WESTERN NEWFOUNDLAND MODEL FOREST

First Report on Criteria and Indicators of Sustainable Forest Management

DATA ACQUISITION STRATEGY

SECTION 1: CRITERIA 1-4

DRAFT

Prepared for: Criteria and Indicators Steering Committee

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January 13, 1999

Report # 0-901-001

EXPLANATORY NOTE

Each indicator is described according to the following categories:

Measure: Where the indicator does not include an explicit unit of measurement, that information is provided here.
Lead: The person or people who will help to assemble the relevant data and provide it to the WNMF.
Source: Agency, department that has the information; or how it will be gathered.
Scale: At what scale can this indicator be measured?
Measurement interval: How often will the information be updated?
Data reliability: An estimate of how reliable or accurate the information on the particular indicator or measure is.
Interpretation: What does this indicator tell us (or what does it *not* tell us)?
Comments: Assorted observations. Included here is an initial assessment of whether this indicator has the potential to be included in scenarios that involve forecasting the values of indicators into the future based on different forest management scenarios ("forecasting"), as well as whether there is sufficient information to reconstruct historical data and/or to develop trend lines

In some instances we will be reporting on **"Case Studies"** that illustrate some aspect of SFM. Case studies are used where there is inadequate data or no systematic process for compiling data on an ongoing basis, but there are nevertheless relevant initiatives that can be reported on. In some cases the "case study" approach will be used to report on preliminary findings. Case studies are indicated in this data strategy by being set within text boxes. In the final report they will likely be reported in sidebars.

At the end of each criterion there is a small section on **"Future Efforts**." These sections list indicators or measures that we agree are crucially , but for which accurate information is not readily available. These notes should serve to guide future efforts. They will not be reported on in the First C&I Report

1. Biodiversity

1.1 Protected areas

Measures:

- **Proportion of each ecosystem sub-region that is in a protected status**
- **Proportion of each sub-region that is barren, bog, forest and water**
- **Proportion of each protected area that is barren, bog, forest and water**

Lead: Darrell Harris, Stephen Flemming

Source: NFS forest inventory, GMNP data

Scale: This indicator will be applied to the full area of all ecosystem sub-regions found within the WNMF boundaries.

Measurement interval: Information for this indicator should be updated each time a protected area is established or removed from protected status.

Data reliability: excellent

Interpretation: This indicator will show the extent to which it has been possible to address the goal of establishing a representative network of protected areas. It will show not only the area of protected lands relative to the entire area, but will also show if the protected areas are generally representative of the landscape types present in that eco-region.

Comments: The definition of "protected area" used in the WNMF's C&I work is "Any area with legislated restrictions to limit human impact, including prohibitions on logging, hydroelectric developments and mineral and hydrocarbon exploration and development." It does not include riparian buffers (which are regulated, not legislated) or special management zones where logging or mineral activities are restricted, but not prohibited. Included as "protected" in WNMF area: GMNP (except see below), provincial parks (Blow-Me-Down, Richard Squires, Barachois), any Wilderness or Ecological Reserves (including provisional reserves; currently none exist). Not included: domestic cutting blocks within GMNP, any de-gazetted provincial parks (Blue Ponds, Stag Lake). May or may not be included, depending on the specific regulations: Wildlife Reserves (although the proposed Wildlife Reserve in the Little Grand Lake area would not be included, based on the activities that are likely to be permitted). It will be possible to provide this data for 1992 (the first year of the WNMF) and the present.

1.2 Forest fragmentation

Measures:

- **Area of forest that is more than 1 km from a road**

Lead: Darrell Harris

Source: NFS forest inventory

Scale: Model Forest area

Measurement interval: five years

Data reliability: There is a certain amount of subjectivity involved in determining what is or is not a passable road. For the first report we will check NFS data against work carried

out for the Stream Crossing Inventory.

Interpretation: Roads have a number of potential direct and indirect impacts on forest ecosystems. They can limit the range of interior forest-dwelling species, especially those that are particularly sensitive to human intervention. For some animals, they may present obstacles that limit or discourage dispersal and/or genetic mixing. Perhaps most importantly, however, is that roads provide access for humans and a wide range of activities (logging, hunting, fishing, cabin developments, etc) that have the potential to alter the structure, dynamics and overall integrity of forest ecosystem components.

Comments: A map will show the road network within the WNMF (using NFS data, corrected by deleting roads that are deemed to be inaccessible to normal truck traffic), and a GIS-based calculation will determine the overall area (broken down by forest, bog, water, barrens, etc) that lies outside an imaginary 1km buffer zone alongside every road. This data can be used in forecasting, by predicting the change to this indicator with the construction of new forest access roads and/or the decommissioning of old roads.

1.3 Area of each forest type by age class

Lead: Darrell Harris, Stephen Flemming

Source: NFS forest inventory, GMNP data

Scale: Across the entire WNMF area

Measurement Interval: Five years

Data reliability: Generally good, although there are some gaps (that will show up as "unknown").

Interpretation: This indicator will show if logging activities or large-scale natural disturbance events are resulting in an increasing percentage of forests in younger age classes, thus lessening the ecosystem (or habitat) diversity of the forest.

Comments: Good opportunities for forecasting. Some efforts will be needed to come up with a simplified set of categories to be used for this indicator. It will be possible to group together many of the codes used in the NFS Inventory, and some simplification of the forest type codes will be needed if we hope to effectively communicate the overall picture to a typical reader of the First C&I Report. In grouping and simplifying these codes, care will be needed to ensure that there is consistency between the definitions used in the NFS inventory and the GMNP inventory, and to ensure that critical detail is not missing.

1.4 Population levels of selected species

Measures:

- **Trend lines for caribou on the Island (number of caribou seen per day by hunters, supplemented by the number of days hunted, the number of licenses issued each year, and the adjusted success rate)**
- **Census data for the Corner Brook Lake herd**

Lead: Shane Mahoney

Source: Wildlife Division

Measurement interval: annual, for the trend lines; irregular for the Corner Brook Lake herd

Data reliability: Trend lines are not based on firm census data, but on a variety of secondary sources (sightings, hunter success rates, etc). In other words, the information is more useful in spotting overall trends than in pinning down absolute numbers.

Interpretation: There is increasing interest in woodland caribou, which has shown an overall decline in population figures worldwide. This may be due at least in part to human-caused factors. The caribou on the Island are a bit of an anomaly, since they do not show the same trend. The Corner Brook Lakes herd is a further anomaly, since it is one of the few stationary herds, meaning that it does not migrate significant distances but stays more or less in the same general area throughout the year. Because they are non-migratory, it is thought that they may be particularly sensitive to human-induced changes to their habitat.

Comments: Island-wide trend data is continuous back to 1966. The Corner Brook Lake herd was counted twice, in ca. 1993 and 1995.

1.5 Known forest-dependent species classified as at risk, including changes in risk status and distribution

Measures:

- **Number of forest-dependent species in each COSEWIC risk category**
- **Distribution for each at-risk species**

Lead: Joe Brazil

Source: COSEWIC, Wildlife data

Scale: Island-wide

Measurement interval: COSEWIC lists are updated annually; distribution estimates may or may not be updated that frequently.

Data Reliability: Distribution estimates are considered reasonably accurate; more so than population estimates, which are based on distribution estimates but subject to greater error.

Interpretation: It is not possible to draw firm conclusions from any additions to the COSEWIC list, since the addition may be due to new information rather than some deficit in forest management. However, once a species is listed it should be the objective of forest managers to move the species to a less vulnerable category, or at least ensure that it remains stable. The chief factors influencing the populations of the Newfoundland pine marten include habitat loss due to logging, limitations and fluctuations in the availability of prey and accidental snaring and trapping.

Comments:

- "At risk" categories include Vulnerable, Threatened, Endangered and Extirpated. Extinct species are not "at risk."
- At this time the only COSEWIC-listed at-risk species with significant habitat within the Model Forest area is the Newfoundland marten.
- The scale for this indicator will have to be Island-wide, because that's the finest scale for which there is a systematic listing of species at risk.
- Historical data exists for this indicator, going back at least fifteen years and potentially

much further.

- This indicator has high potential for use in forecasting various management scenarios.

Future efforts:

- **Indicators related to special places**

2. Forest Health

2.1 Area of insect, disease, fire and logging disturbance

Measures:

- **average area affected annually by insects, disease, fire and logging over a five-year period**

Lead: Darrell Harris, Stephen Flemming

Source: NFS inventory, GMNP

Scale: Across the entire Model Forest area

Measurement Interval: annual, but averaged out over five-year periods

Data reliability: Good on productive forest lands; will be incomplete for scrub forests. We will not attempt to report on the severity of disturbance, since the information bases has too many gaps to be able to provide comprehensive summary statistics.

Interpretation: This indicator will show some of the stresses that the forest is under, and indicate periods where the stresses are particularly high. Because year-to-year fluctuations are sometimes simply due to time lags in getting the inventory up to date, the data will be reported by aggregating information over a period of five years and then determining an annual average during that period.

Comments: For our first report we'll report on data from 1985-90 and 1990-95.

2.2 Species interrelationships

Measures:

- **number of lynx hunted**
- **number of snowshoe hares taken**

Lead: Leah Soper

Source: Wildlife Division data, using fur sales figures (lynx) and license returns (hares).

Scale: To be determined. We will seek an area that is as close as possible to the area of the WNMF, but this may not be possible, since hare and lynx are reported for differing geographical districts and it will be necessary for the regions to more or less overlap for the indicator to be meaningful. This may mean reporting on Island-wide figures.

Measurement interval: annual

Data reliability: The numbers of lynx and hare taken each year are only very crude and unreliable measures of the population levels of those species. Any year-to-year changes to these figures *may* be related to changes in the overall population levels of those species, but there are many other factors (market conditions, reporting accuracy,

etc) that come into play. Nonetheless, these numbers provide us with the best available information, and it can be used to spot general trends, but it will not be possible to draw firm conclusions without considerably more information.

Interpretation: Snowshoe hare populations go through cyclic fluctuations, for reasons that are poorly understood. Lynx are highly (but by no means exclusively) dependent on hare, so that when snowshoe hare levels increase a "classic" wildlife model would show lynx numbers increasing shortly thereafter, "shadowing" the hare trends. If this does not occur - if, for instance, lynx numbers stay low even though hare numbers rise sharply - wildlife managers may seek further information to determine the cause, which could be due to either natural causes or human intervention.

Comments: It will be possible to reconstruct figures for these measures, going back [HOW MANY?] years.

CASE STUDY: SETTING UP A COMPREHENSIVE MONITORING PROGRAM

Indicator: Ecosystem health

Measures:

- **area of forest converted to other uses**
- **succession pattern following disturbance**
- **mean annual increment**

Lead: Darrell Harris

Source: National Forest Inventory random plots

Scale: Island wide, but with information gathered in sufficient detail that it will be possible to isolate date for specific regions, such as the WNMF area.

Data Reliability: The importance of each of the above measures has long been recognized, but until now the relevant information has not been collected in a way that makes it possible to monitor and report on overall trends relating to Sustainable Forest Management. Each indicator has its own problems:

- There has been no systematic record kept of areas of forest that have been converted to other uses.
- The Newfoundland Forest Service monitors succession patterns following logging, but has devoted less attention to succession patterns following natural disturbances, especially when they take place in non-commercial (scrub) forests.
- Mean Annual Increment is monitored in commercial forests, but not in non-commercial forests.

Planning for SFM and ecosystem health means taking into consideration the entire forest, and not just the so-called "productive" forests where commercial logging takes place. Current inventories were developed mainly for timber management, and therefore aren't fully adequate to meet the expanded challenge of monitoring overall ecosystem health.

Description of the case study: The Newfoundland Forest Service hopes to participate in an ambitious project that will see dramatic improvements made in the quality of the National Forest Inventory. A new series of sample plots will be established across the country. Based on a predetermined grid, they will randomly sample all types of forests, including forests where logging does and does not occur. Initial data will be obtained by means of remote sensing, with field work taking place in a random sub-set of these plots.

3. Soil and Water

3.1 Water quality

Measures:

- **nitrogen levels**
- **total suspended sediments**

Lead: Ian Bell

Source: City of Corner Brook

Scale: Three sample points within the Corner Brook Stream watershed. For each sample point, the measure will indicate those periods when harvesting has been taking place close to or upstream from the sampling point.

Measurement Interval: monthly

Data Reliability: excellent

Interpretation: Logging activity is one of several factors that may cause changes in nitrogen levels and total suspended sediments. If logging is resulting in a depletion of soil nutrients, including nitrogen, one place that these nutrients might show up is in the water. As well, logging or road building (especially when improperly carried out) may flush soil into the water, resulting in an increase in total suspended solids.

Comments: Data goes back to 1989. At least one of the sample points (Eastern Lakes) has had no harvesting to date in the vicinity or upstream.

3.2 Drinking water quality

Measures:

- **Reported cases of *giardia.***

Lead: Ike Anderson

Source: Public Health data

Scale: WNMF area

Measurement interval: annual

Data reliability: good

Interpretation: *Giardia* is carried by mammals, and transmitted through feces and feces-contaminated water. It is sometimes called "beaver fever" because it is typically beavers that will pollute a water supply and thereby infect people. However, beavers aren't usually responsible for bringing the disease into a particular watershed; this is generally done by mammals that range over broader distances; in particular humans and/or their pets. Often municipal watershed have a high degree of human activity taking place in them, including recreational activity and logging. This means that if there is a sudden increase in instances of *giardia* within a particular community, it may be caused or exacerbated by human activities.

CASE STUDY

Indicator: Percentage of harvested area having significant soil compaction, displacement, erosion, puddling, loss or organic matter, etc

Lead: Eric Young

Source: NFS study

Measurement Interval: For the first C&I Report we will simply be reporting the findings of a study, so there is no measurement interval, since this data is not being gathered systematically on a regular basis.

Interpretation: Logging activity - in particular the use of heavy machinery - can have a number of damaging impacts, especially when it is carried out carelessly or with the wrong equipment. Heavy equipment can cause soil compaction, which can increase water runoff and the loss of nutrients, and can make it difficult for new trees to get properly established. There are several practical ways to mitigate these impacts, including the use of wide-flotation tires and the use of slash or snow to help protect the soil layer from direct contact with heavy equipment. There is always some soil displacement required in building roads and landings, but proper care can be taken to minimize these impacts, especially in minimizing the size of landings and limiting soil erosion on the harvest site and in skid trails.

3.3 Forest policy and enforcement

Measure:

- **A list of current Five-Year Management Plans (and addenda or modifications) that have been registered under Environmental Assessment**
- **A list of current Five-Year Management Plans (and addenda and modifications) that have been released from the Environmental Assessment process**
- **A list of gaps**

Lead: Alan Masters

Source: Newfoundland Forest Service

Scale: Forest Management Districts 14 and 15 (Crown, Kruger and Abitibi-Consolidated)

Measurement interval: irregular, whenever a change in status occurs

Interpretation: This indicator simply records whether or not forest management agencies are fulfilling their commitment to have their management plans developed through a public process, and submitted for registration under the Environmental Assessment Act. It does not measure the extent to which forest management agencies are actually in compliance with the commitments made in the plans.

4. Global Impacts

CASE STUDY

Indicator: Carbon storage in forests

Measures:

- **Tons of carbon stored in above-ground biomass on forested lands**
- **Tons of carbon stored in soils on forested lands**

Lead: Joan Luther

Source: CFS pilot study

Scale: Approximately 6 50,000-scale map sheets in western Newfoundland

Interpretation: Forests play a vital role in helping to regulate the earth's climate. They do this by storing vast amounts of carbon; in trees, other plants and in the soil. They sequester carbon as the trees grow, and release carbon as the trees decompose, are burnt or are logged and get made into products that themselves decompose and decay at a later point in time. The carbon that is released into the atmosphere is a "greenhouse gas," and is the most significant of the gases to which global climate change has been attributed.

Comment: When Canada signed and ratified the 1992 Framework Convention on Climate Change, it agreed to measure how much carbon is being stored in the forests across the country, and to monitor and report on changes over time. The Canadian Forest Service has developed a Carbon Budget Model which shows that in the mid 1980s Canada's forests changed from being a carbon "sink" (meaning that they were absorbing more carbon than they were releasing) to becoming a net source of carbon (primarily due to a dramatic increase in fires and insect attacks). The challenge is to generate more refined measurements, and to provide for accurate reporting by each province.

Case study description: An area in western Newfoundland is one of three areas in Canada (the others are in Québec and Saskatchewan) that is part of an innovative pilot project aimed at improving and refining our ability to measure the amount of carbon on forested lands, as well as to improve our ability to estimate the amount of carbon stored in forest soils. There are two main stages to this research project. The first step will be to improve our estimates of forest biomass through use of existing forest inventory data (age class, height class, density, etc). The next step will be to refine these estimates through the use of remote sensing (satellite imagery) and other tools (digital elevation models). The accuracy of these tools will be checked against field measurements on permanent sample plots. (The researchers expect to have an initial presentation ready in early March 1999 for a conference. We will use elements from this presentation as part of a case study for the first C&I Report.)

Future efforts:

- **tracking information on forest product life cycles**
- **reporting on greenhouse gases released through forest sector manufacturing and transportation**