Newfoundland and Labrador National Forest Inventory Pilot Program

WNMF Component

Summary Report
November 2000 to October 2001

Department of Forest Resources and Agrifoods
Canadian Forest Service
Western Newfoundland Model Forest

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1. OVERVIEW OF CANADIAN NATIONAL INVENTORY SYSTEMS

The management of forest resources in Canada is the primary responsibility of provincial and territorial agencies, with the exclusion of national parks or other federally administered lands (e.g., military and airport properties). Hence, the forest inventories conducted by each province focuses on data necessary to develop management plans and vary according to regional needs.

Prior to the 1980's, national inventories were compiled based upon survey forms that were sent to and completed by the appropriate provincial, territorial and federal agencies. However, the level of detail wasn't capable of addressing new concerns that developed in the early 1980's regarding existing forest management practices with respect to increased demands on forest resources. A need arose for the compilation of all provincial/territorial/federal inventory data into a national database to provide information on forest health, forest sustainability, and forestry practices.

The Canadian Forest Inventory Committee (CFIC), originally established in 1975 to assist in the implementation of the metric system in forest inventories, had its duties extended to the improvement of forest inventory practices and statistics. The committee, consisting of representatives from each province/territory and related federal agencies, assisted in the development of a revised system. In 1981, the first compilation of Canada's National Inventory,

CanFI, was completed and presented by the Canadian Forest Service (CFS).

The Can-FI database incorporated GIS technology to store, process, analyze, and report on the forest inventory data; hence, Can-FI provided a detailed spatial database for all inventoried forest areas within Canada (Lowe *et. al.*, 1994). It also ensured that the database was compiled using the latest data available from the source (provincial, territorial, federal) inventories. Can-FI focussed on 12 core attributes to classify land. These attributes were limited to basic forest management descriptors (ownership, age class, cover type, density, productivity) but had the ability to incorporate additional information to meet regional needs (regeneration, stocking, growth, and access).

2. A NEED FOR CHANGE

In recent years, there have been increasing demands for a new national forest inventory design that is capable of providing additional information on forest resource attributes and for policy, national and international reporting. Specifically, Canada's support of and commitments to sustainable forest management as per national (e.g., the Canadian Council of Forest Minister' Criteria and Indicators - CCFM Process) and global (e.g., Kyoto Protocol and Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests - The Montreal Process) processes, spurred a noticeable change in forest resource information requirements. Canada's ability to meet these commitments is hampered by its lack of a **standardized forest inventory design that provides essential and reliable assessments of current forest state and change through time.**

CFIC set up a technical sub-committee to discuss and analyze other inventory methods to develop a system that would provide:

- data that are timely, reflecting a state of the resource at a defined time.
- data types with uniform definitions and collected to the same quality standards nation-wide.
- data that reflect consistent and complete area coverage.
- the ability to derive accurate trend assessments from successive inventories.

In October 1997, the sub-committee convened a workshop during which attendees agreed to the technical specifications and methodology of a new national forest inventory – the NFI.

3. THE NATIONAL FOREST INVENTORY (NFI)

The new national inventory is a plot-based system of permanent plots applied systematically across Canada that could provide information at the provincial and national levels. More specifically, it will provide monitoring information for climate change, criteria and indicators, biodiversity, and sustainable development. The NFI design will collect accurate and timely information about the extent and state of Canada's landbase to establish the baseline of where the forest is and how it is changing over time. The initial implementation of the new design is expected over the next five years. The first report based on data collected according to the new design is expected in 2005.

The guiding principles in the development of the NFI were:

i. the design must be flexible,
ii. the data resulting from the provincial inventories must also be consistent: the same attributes must be measured, using the same standards in a statistically defensible manner, at an acceptable level of precision.

The required data consistency and design flexibility are achieved by developing a simple core design and permitting variations in implementing the design. The core design has the following essential elements: (Boudewyn *et. al.*, 1999)

- a network of sampling points across the population.
- stratification of the sampling points, with varying sampling intensity among strata.
- estimation of some attributes from remote sensing sources (air photo and satellite imagery) on a primary (large sample).
- estimation of species diversity, wood volumes and other detailed data from a small ground-based sub-sample.
- estimation of changes from repeated measurements.

Considerable flexibility is permitted in the implementation of the core design: existing inventories and inventory data may be used or modified as long as the required data are obtained in a timely and statistically defensible manner.
The Newfoundland and Labrador approach for implementing the inventory is described below.

4. PROVINCIAL – NATIONAL INVENTORY APPROACHES

The Department of Forest Resources and Agrifoods (DFRA) currently conducts detailed forest inventories on a continuous 10-yr cycle within the **forested** areas of the province. Temporary sample plots (TSP's) are established by stratum to estimate volume; whereas, permanent sample plots (PSP's) monitor growth estimates in selected stand conditions.

4.1 Previous Can-FI Reporting System

In addition to provincial reporting needs, the provincial inventory information was "rolled-up" every five-years to meet Can-FI requirements for national and international reporting. Essentially, Can-FI attributes were extracted by cross-reference with the provincial dataset.

Even so, this information for the Province was incomplete or non-existent for the unforested areas of the province. The last inventory within the unforested areas, the Global Forest Inventory, was conducted in 1975 and provided only reconnaissance-level information. The 1994 vegetation inventory conducted in southern Labrador using Landsat TM was of benefit. The bottom line was that there was still a need for detailed and timely provincial inventory information for national reporting purposes.

4.2 NFI Reporting System:

The national approach for the implementation of the new plot-based National Forest Inventory in the Province is to acquire the data from "drilling" of the provincial inventory database and/or the interpretation of existing or new photography. A network grid of plots will be superimposed within the provincial boundary to define the sampling locations. The minimum sampling intensity of 1% will be met. At each sampling location, a "photo plot" is defined and new or recent aerial photography interpreted to attain the required data. The status of 25 key NFI attributes in each plot polygon will be compiled and reported by ecozones in the NFI compilation. Other attributes required at the provincial level and Model Forest levels, will also be measured and reported. Auxiliary attributes related to land-use, ownership, protection status, access, human influence, conversion of forest land and information on exotics are to be added from management records, other data sources, and maps. Where the province has not been covered by inventory, the photo plot locations will be sampled using satellite imagery. The auxiliary attributes available for these plots are also to be added.
At a subset of the sample locations/photo plots (minimum of 10% with at least 50 plots for each of the forested ecozones), new field plots are to be established for the acquisition of additional detailed data such as wood volume, species diversity and understory vegetation. Ground plots will be established as a sub-set of the photo plots and selected randomly until the required number of **treed** plots are attained; non-treed plots that are selected will not be measured but retained in the appropriate analysis. These non-treed plots are to be monitored and if they became treed, plots will be established on the ground.
The plot-based National Forest Inventory is a continuous forest inventory design. All plots are

considered permanent. A remeasurement cycle of 5 to 10 years will be agreed upon and a joint plan of remeasurement will be established prior to March 31, 2004. At the end of the first remeasurement period, after the attributes have been measured twice, the difference in estimates between the two measurements will be compiled along with relevant change statistics. Remeasurements are not required where pre-assessments reveal that no significant changes have occurred. In this way changes to the land-base will be monitored by the NFI.

4.2.1 Guideline Documentation for NFI Implementation

As noted before, the guiding principle in the development of the new plot-based National Forest Inventory was that the design could be flexible as long as data resulting from the inventory was consistent. The same attributes must be measured, using the same standards in a statistically defensible manner at an acceptable level of precision.

The Canadian Forest Inventory Committee approves the national compilation standards for photo and ground plots. The Committee also has the authority to make modifications to the compilation standards through a change management process.

Supporting documentation from the NFI Design Document includes:

- National Forest Inventory Definitions
- Land Cover Classification
- Land Use Classification
- NFI Tree List

In addition, guidelines for the collection of both ground plot and photo plot attributes are available.

It is recognized that the province will require more detailed information (attributes and models) to derive the NFI attributes and once obtained it is expected that the province will maintain this basic information.

5. PROVINCIAL NFI IMPLEMENTATION STRATEGY: WNMF PILOT PROJECT

Implementation of the NFI in the province of Newfoundland and Labrador is a cooperative approach between provincial Department of Forest Resources and Agrifoods (DFRA) and the Canadian Forest Service (CFS). Both groups had agreed to involve the Western Newfoundland Model Forest (WNMF) to facilitate implementation. This involvement of the WNMF effectively ended in October 2001. During that timeframe, some progress had been made with the testing of the NFI design and its implementation in Newfoundland and Labrador.

5.1. Testing Phase

This initial phase suggested that the Province could supply the required NFI data by a combination of database "drilling" and photo interpretation. It was also suggested that a 10km x 10km network grid with 1km x 1km plots should be superimposed on the island portion and a 20km x 20km grid with 2km x 2km plots applied in Labrador to define the sampling locations. The grid could be wider in Labrador since its forest structure is more homogenous; however, this scenario still provided the required sampling intensity of 1% (Oke and Harris, 1999).

5.2. Design and Implementation Phase

Creation of the Newfoundland and Labrador boundary coverage, overlaying of the network grid and photo plots within the island portion, and drilling of DFRA's digital database were the next steps required in the NFI development process. The previous provincial boundary used by Oke had a scale of 1:1,000,000, which was considered to be substandard. Priority was placed on the creation of a larger-scaled provincial boundary derived from DFRA (1:12,500) and NTS (1:50,000 and 1:250,000) coverages. Table 1 provides specifics on achievements, revisions, delays and problems encountered during this phase of the project.

Table 1. Details of NFI Design and Implementation Phase.

Date Comments

November 2000 Contract between the Department of Forest Resources and Agrifoods (DFRA) and Western Newfoundland Model Forest re-initiated to develop National Forest Inventory (NFI) Program at the provincial level. NFI Pilot Project had been conducted but not completed by Brian Oke in the previous year. The new contract involved:

i. a training component in which the candidate became familiar with ARC-INFO, ARC VIEW, and UNIX,

ii. and the development and assessment of photo plots (grid system and plot size to be determined) by a combination of "drilling" DFRA's digital forestry database and aerial photo interpretation.

- November 2000 to January 2001 Self-study of ARC-INFO and ARC VIEW software.
- Familiarization with DFRA's digital database and libraries.
- Ongoing consultation with DFRA personnel on ARC-INFO, ARC VIEW, and UNIX.

Review of Brian Oke's notes, files, coverages, and AMLs.

February 2001 Complete revision of provincial NFI strategy based on meetings with Mark Gillis – Pacific Forest Centre, CFS. Main revisions to project are:

i. Photo plots will no longer be assessed through drilling of the DFRA database but entirely by aerial photograph interpretation.

ii. Photo plots for insular Newfoundland will be based on a 10km x 10km grid system with a 1km x 1 km plot size; whereas, Labrador will be assessed by 2km x 2km plots based on a 20km x 20km grid system.

iii. Existing NFI provincial boundary prepared by Brian is inadequate since it does not include Labrador and is based on 1:1,000,000 scale sources. Need to add Labrador to NFI boundary coverage and use larger-scaled sources for boundary delineation where available.

Began extraction of coastline and boundary arcs from National Topographic Service (NTS) 1:50,000 digital coverages for **island**.

March 2001 to October 2001 Continuation of NFI provincial boundary composition for the **island** and **Labrador** from NTS 1:50,000 , NTS 1:250,000, and DFRA 1:12,500 digital coverages.

- DFRA 1:12,500 coverage only covers forested regions of island and some of District 19; there are huge gaps on the south coast and Northern and Avalon Peninsula's that have to be filled-in by other sources.
- Encountered problems with arc coding in all digital formats that had to be corrected.
- Encountered computer problems that eventually required replacement of computer.
- DFRA did not have complete NTS library, so encountered delays in obtaining remainder from Surveys and Lands.
- Encountered problem in obtaining digital coverage for the Labrador-Quebec boundary. After contacting many agencies best that could be obtained was a 1:1,000,000 scale coverage.
- Weeklong Public Service Strike in first week of April prevented access to DFRA's digital database.
- DFRA in process of updating Avalon Peninsula coverages; this process would not be complete until February 2002

NFI plot grid and photo plot coverages developed for province. This exercise could only provide estimates for the number of plots within the province since the NFI provincial boundary could not

be finalized until February 2002.

NFI – Pacific Forest Centre experiences delays in the definition/confirmation of the attributes will be extracted from the photo plots. Definition and confirmation requires consultation with all other provinces.
October 12, 2001 Contract between DFRA and WNMF ends.

As indicated above, a number of revisions and problems were encountered during the second phase that hindered progress towards the designation of actual photo plots within the provincial boundary. Chief among these, were the availability of NTS coverages, digital arc coding problems, and scheduling delays. There was also a decision to eliminate the "drilling" component from the provincial NFI strategy. This decision was based upon the age of the source information, the NFI requirement for data no older than 1995, and the lack of data for areas on Avalon and Northern Peninsulas and the south coast of the island. As of October 2001, the provincial NFI coverage still hadn't been finalized due to ongoing departmental updates being made to the Avalon Peninsula digital database. Also, there were problems with the grid, plot, and ecozone coverages provided by CFS-Pacific. Since October, the provincial boundary coverage has been finalized but errors with the plot and ecozone overlays remain unresolved thus far.

6. SUMMARY

The pilot project conducted from November 2000 through to October 2001 revealed a number of problems with the proposed NFI implementation strategy. From this, a number of revisions were made to the provincial NFI design to strengthen the overall program and its ability to meet all of the National reporting requirements. Considerable progress had also been made on the creation of the NFI boundary coverages for both the island and Labrador. Though full implementation of the NFI design had not been achieved within the province, it did permit the resolution of a number of concerns that arose during its development.

References

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