Monitoring Canada's forests: The National Forest Inventory

M.D. Gillis[1], A.Y. Omule[2] and T. Brierley[3]

ABSTRACT

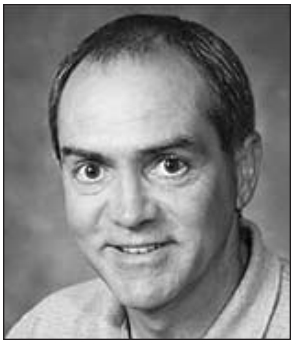
A new national forest inventory is being installed in Canada. For the last 20 years, Canada's forest inventory has been a compilation of inventory data from across the country. Although this method has a number of advantages, it lacks information about the nature and rate of changes to the resource, and does not permit projections or forecasts. To address these limitations a new National Forest Inventory (NFI) was developed to monitor Canada's progress in meeting a commitment towards sustainable forest management, and to satisfy requirements for national and international reporting. The purpose of the new inventory is to "assess and monitor the extent, state and sustainable development of Canada's forests in a timely and accurate manner." The NFI consists of a plot-based system of permanent observational units located on a national grid. A combination of ground plot, photo plot and remote sensing data are used to capture a set of basic attributes that are used to derive indicators of sustainability. To meet the monitoring needs a re-measurement strategy and framework to guide the development of change estimation procedures has been worked out. A plan for implementation has been drafted. The proposed plan is presented and discussed in this paper.

Key words: Canada, forest cover, inventory, monitoring, National Forest Inventory, re-measurement, panel

RÉSUMÉ

Un nouvel inventaire forestier national est en voie d'implantation au Canada. Au cours des 20 dernières années, l'inventaire forestier du Canada découlait de la compilation des données d'inventaire en provenance de tout le pays. Même si cette méthode comportait un certain nombre d'avantages, on dénote l'absence d'information sur la nature et le taux de changement de la ressource ainsi que l'impossibilité de faire des projections ou des prévisions. Afin de corriger ces limites, un nouvel Inventaire forestier national (IFN) a été élaboré pour évaluer les progrès du Canada au niveau de ses engagements en matière d'aménagement forestier durable et pour répondre aux besoins d'élaboration de rapports nationaux et internationaux. L'objectif de ce nouvel inventaire vise à « évaluer et surveiller l'étendue, l'état et le développement durable des forêts du Canada de manière opportune et précise ». L'IFN repose sur un système de parcelles constituées d'unités permanentes d'observation établies au moyen d'un quadrillage national. Une combinaison des données en provenance des parcelles terrestres, des photos et de télédétection sont utilisées pour saisir un ensemble d'attributs fondamentaux desquels sont dérivés les indicateurs de durabilité. Afin de répondre aux besoins en terme de surveillance, une stratégie de re-mesurage et un cadre de référence pour orienter l'élaboration de procédures d'estimation du changement ont été développés. Un plan portant sur l'implantation a été ébauché. Cet article comporte une présentation et une discussion de ce plan.

Mots clés : Canada, couvert forestier, inventaire, surveillance, Inventaire forestier national, re-mesurage, comité



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Introduction

Canada is the steward of one-tenth of the world's forests. Forest and other wooded land cover 401.9 million hectares (992.1 million acres) and occupy more than 40 percent of the total landmass (including inland water) of the country (Gillis *et al.* In Preparation). Canadian forests make significant contributions to the global environment by filtering air and water, contributing to global bio-geochemical cycles, reducing erosion, and providing habitat to wide range of species. Forestry is the largest industry in Canada, supporting over 373 000 direct jobs and contributing over $37 billion to our balance of trade (NRCan 2001).

The protection of Canada's forests is a concern both nationally and internationally, making essential the need for resources and data in support of sustainable forest manage-

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ment (SFM). The capacity to respond to concerns, and to deliver on national and international commitments regarding SFM, is constrained by the existing federal, provincial, territorial, and industrial forest inventories and information systems. As a result Canada requires a forest measurement and monitoring program that can provide accurate, timely and comparable forestry information in response to national and international concerns about the sustainable development of Canada's forests (Wulder *et al.* 2003). Canada's National Forest Inventory[4] is being redesigned, and in combination with other national programs and the cooperation of the provinces and territories, is developing into a new forest measurement and monitoring system for Canada.

The manner in which Canada has gathered, compiled and reported nationally on forest resources has continually improved. Before 1981 it consisted of a compilation of information based on questionnaires that were completed by provincial and federal forest management agencies. In 1981 a computer-based system, known as Canada's Forest Inventory (CanFI) was developed to summarize the data that were obtained from the management agencies. CanFI converts the best available data from provincial/territorial inventories to a national classification scheme. The data are then aggregated to the mapsheet, provincial and national levels for storage, analysis and reporting. The most recent version (CanFI 2001) is derived from 57 inventory sources.

The current approach to national inventory is cost-effective as it is based on existing data. The process is well-established and accepted by the contributing agencies and provides detailed information about Canada's forests that is consistent with forest management information. The inventory also contains location-specific information on the characteristics and quantity of the forest resource, providing mapping and spatial analysis capabilities. While this periodic compilation has many advantages, CanFI data can be up to 2five years old and collected to variable data standards. As a result, CanFI does not provide the capability to monitor the rate and nature of changes to the resource over time, nor does it necessarily reflect the current state of the forests. It also generally lacks information on non-timber attributes and is of unknown precision (Gillis 2001).

CanFI, based on provincial and territorial inventories of varying standards, coverages and ages, cannot adequately address increasingly complex and detailed reporting needs (Barker *et al.* 1996). A new National Forest Inventory (NFI) has been designed and is being implemented to meet demands for additional forest resources information. The new NFI will also address policy, national and international reporting and will provide the framework to monitor Canada's forests to allow reporting on indicators of SFM. This paper outlines the design of the new inventory, presents activities to date and discusses a re-measurement framework and implementation plan to monitor the sustainability of Canada's forests.

[4]Documents describing the inventory including the attributes being collected, the land cover and land use classification systems, the guidelines for data collection, the database dictionaries and the compilation and estimation procedures are available at http://nfi.cfs.nrcan.gc.ca.

Canada's New National Forest Inventory

To address limitations with CanFI and to meet new business demands the Canadian Forest Inventory Committee (CFIC) developed a new approach to produce a national forest inventory. The CFIC is a subcommittee of the Canadian Council of Forest Ministers' National Forest Database Program Steering Committee, and comprised of the managers of forest inventory from federal, provincial and territorial governments. A technical subcommittee of the CFIC discussed a number of design options. The design presented in this paper is derived from the recommendations of this Committee. In 1997, a workshop was held to reach consensus on the technical details of a new inventory. The NFI, which replaces the periodic compilation of existing information from across the country, is a plot-based design consisting of permanent observational units located on a national grid.

The purpose of the NFI is to assess and monitor the extent, state and sustainable development of Canada's forests in a timely and accurate manner. By collecting and reporting information to a set of uniform standards, the NFI allows for consistent reporting across the country to establish a baseline of where the forest resources are and how they are changing over time. More specifically, the NFI will provide data for the Criteria and Indicator processes to monitor sustainable development (The Montreal Process 1995, CCFM 2003) and in support of reporting on climate change and for national and international inquiries (for example, the Global Forest Resources Assessments (FAO 2001)). In addition to providing consistent estimates for traditional forest inventory attributes, the NFI will also provide a framework for collecting additional data relevant to the reporting of progress towards sustainable development (for example, socio-economic indicators), as well as data related to forest health (for example, insect damage and disease infestation), biodiversity and forest productivity.

Sample design

The core design of the NFI has the following essential elements:

- A systematic network (grid) of sampling points across Canada to insure complete coverage;
- Stratification of the sampling points by terrestrial ecozone with varying sampling intensity among the strata so that each ecozone is adequately sampled for statistical reliability;
- Estimation of area and other attributes from remote sensing sources (photo plots) for consistency, timeliness and to reduce cost;
- Estimation of species diversity, wood volumes, and other desired data from ground-based plots located within a sub-sample of the photo plots for attributes not available from remote sensing sources;
- Estimation of changes over time from repeated measurements of all sample plots for monitoring purposes — all plots will be re-measured at regular intervals.

A guiding principle in the development of the NFI was for the NFI design to be sufficiently flexible that the implementing agencies can, over time, integrate the implementation of the NFI into their existing or planned inventories. So, design details can be flexible as long as data consistency

can be assured. For example, plot sizes may vary in shape and size, but the same attributes must be measured to the national compilation standard. Plots must be established in a statistically defensible manner, and must be sufficient in number to achieve an acceptable level of precision. The NFI design and database tools are available to the provinces and territories who would want to develop provincial/territorial inventory, growth and yield monitoring programs, such as that proposed by Huang *et al.* (2004).

The target population is Canada's entire landbase, whether vegetated or not. The target population is assumed to consist of an infinite number of points that are stratified for reporting purposes into 15 terrestrial ecozones[5] (Ecological Stratification Working Group 1995). Ecozones are partitioned into sub-populations (NFI units) for estimation purposes. An NFI unit is defined as an ecozone within the boundaries of a province or territory. The partitioning into NFI units is required because of the variations in sampling schemes and data collection methods among the provinces and territories, provided for in the design.

The overall NFI sampling design is a probability sample of points in Canada, consisting of two components:

1. A single systematic sample of points across Canada, with a photo plot installed at each sample point (remote sensing).
2. A simple random sub-sample of the systematic sample within selected ecozones, with a ground plot established at or adjacent to each sub-sample point (ground sampling).

The photo plots are the primary source of the NFI data, and the ground plots provide additional information. A representation of the NFI photo and ground plot network is illustrated in Fig. 1.

All potential sample locations reside on a 4 x 4 km network. To provide reliable area statistics, the objective is to survey a minimum of 1% of Canada's land mass. The preferred sampling intensity is a 20 x 20 km grid of sampling points (the 20 x 20 km grid is nested within the national 4 x 4 km grid). A 2 x 2 km permanent photo plot is located at each sample location. Photo plots are identified on conventional, mid-scale, aerial photography, and delineated and interpreted in full according to land cover classes and other forest stand attributes (Fig. 2). Satellite imagery is used as a surrogate for aerial photography to provide attribute data for areas otherwise not covered by photo or ground plots (for example, Canada's north). Combinations of attributes are used to describe the range of forest conditions. The attributes estimated from the interpretation of aerial photographs are listed in Table 1, and include land cover, land use, ownership and protection status. The flexibility of the design allows the sampling to be more intense to achieve regional objectives, or less intense for non-forested or remote areas, such as Canada's north. Approximately 18 850 photo plots (approximately 1:53 000 ha) are planned for the country. In the non-treed or non-vegetated Ecozones (for example, the three Arctic Ecozones), only overall area totals will be obtained. There will be no attempt to break the area down by classifier.

The ratio of forested ground plots to photo plots is 1:10, with a minimum of 50 forested ground plots per ecozone. There will be no field samples established in the three non-treed, Arctic ecozones. The ground samples are, in most cases, located at the centre point of the photo plot and consist of nested circular plots, line transects and a soil pit (Fig. 3). Attributes and data collected in ground plots will complement and enhance the attributes and data from the photo plots. Ground plots measurements are taken on large trees, small trees, herbs and shrubs, and down woody debris. Soil and site descriptions are also recorded. Attributes measured on the ground are also listed in Table 1.

Table 1. Summary of NFI attributes

NFI photo-plot attributes	NFI ground-plot attributes
Polygon:	*Site:*
- land-cover classification	- land cover
- forest stand structure	- plot origin
	- plot treatment
	- plot disturbance
Stand layer:	*Large tree list:*
- species composition	- species
- age	- volume
- height	- growth
- crown closure	- biomass
- volume	*Small tree list:*
Origin	- species
Treatment	- biomass
Disturbance	*Shrub and herb:*
Land use	- species
Ownership	- percent cover
Protection status	- biomass
Conversion of land use	*Woody debris:*
Exotics	- volume and biomass by diameter and decay class
- Origin of exotics	*Soil:*
	- soil features
	- soil horizon information
	- carbon content

Ground plots are only established in forested or potentially forested conditions, classified as vegetated treed or potentially vegetated treed (for example, areas that have been harvested or disturbed by fires that are expected to return to vegetated treed class). Whenever a random location happens to fall on a non-treed area, another sample location will be chosen, again at random. The initial locations will maintain their status as NFI ground plots, and although no measurements are taken, the locations will be retained in the analysis. Plots are being established on non-treed locations when they become forested. Inaccessible plots are replaced with suitable subjectively selected matches and difficult-to-access plots are subsampled. There are approximately 1150 ground plots in the forested and other wooded land of the country (approximately 1:350 000 ha).

Remote sensing data will be used to enhance the NFI, to assess whether the location of plots are skewed in any fashion, to assess the extent of change and the need to revisit plots, to extend the inventory beyond the 1%, and to provide other area-based parameters such as forest condition. Other national projects, such as Earth Observation for Sustainable Development of Forests[6] (EOSD) will provide

[5] http://sis.agr.gc.ca/cansis/publications/ecostrat/intro.html

[6] www.eosd.nrcan.gc.ca/

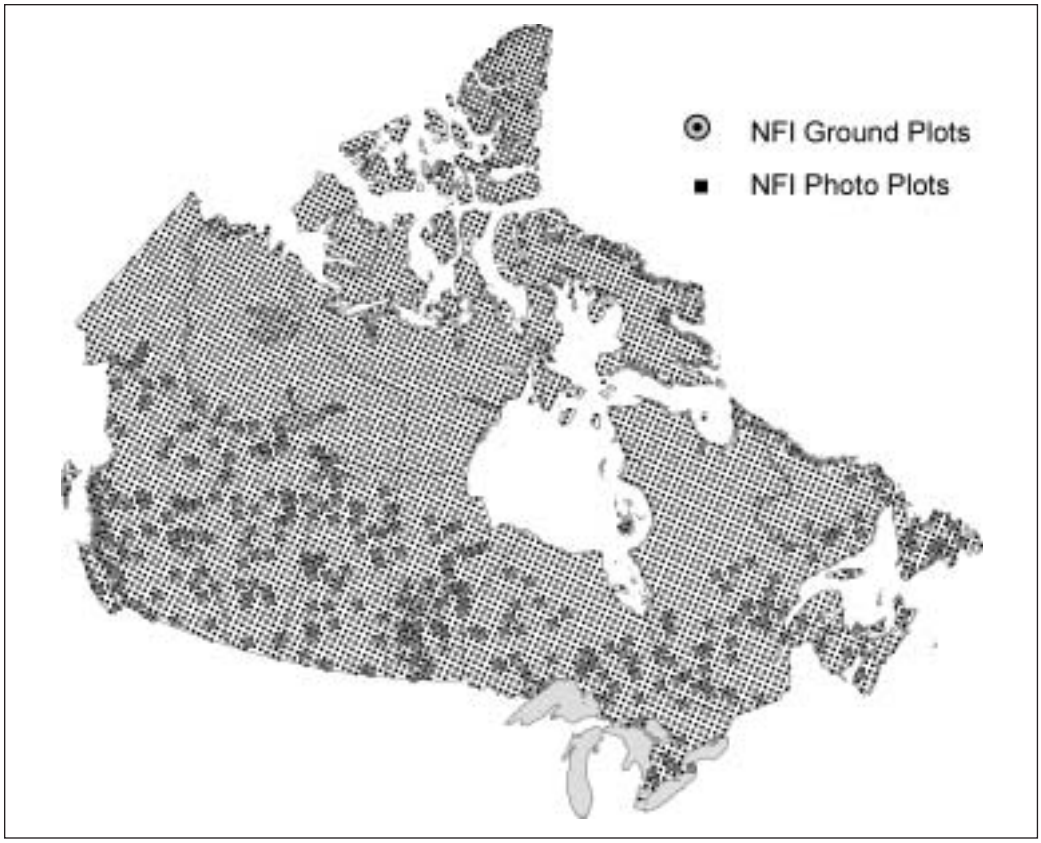

Fig. 1. Representation of National Forest Inventory photo and ground plot network across Canada.

remote sensing products to assist in the monitoring of the sustainable development of Canada's forests (Wulder *et al.* 2003). EOSD is designed to provide, at regular intervals, complete (wall-to-wall) satellite coverage of Canada's forested areas. The image data will be used to generate land cover and biomass information and as a basis for generating change products required to enhance the plot-based NFI design.

Data management

Validated photo and ground plot attribute and spatial data are stored in the NFI Development Database. Periodically, the records in the database will be compiled to estimate NFI unit totals (and averages) to produce reports.

The compilation involves:

1. Adding indirect attributes (for example, tree volume) to the database, using existing relationships (for example, provincial/territorial tree volume equations).
2. Aggregating the raw layer-level photo plot data and individual tree or woody debris piece-level ground plot data (Table 1) into polygon-level and plot-level attributes, respectively.

The estimation involves calculating point and interval estimates for attribute totals of the target population (for example, total area, volume, biomass or carbon). The estimation approach considers the sampling design and any available auxiliary information, and includes:

1. Estimating the totals for each NFI unit by classifier class (domain) using the photo or ground plot observations falling in the NFI unit, the ratio-of-means (ROM) estimator, and the known NFI unit area. Classifiers are defined by categorical variables including land cover, land use, ownership, and protection status. The ROM is calculated as the ratio of the sum of the attribute totals in a classifier class to the sum of the plot attribute totals for all classifier classes in the NFI unit. The estimated area, tree or other attribute total is obtained by multiplying the ROM estimate in a classifier class by the NFI unit total area. NFI units with very few plots (less than 30) or no plots are pooled with adjacent units within an ecozone prior to analysis. Small area estimation techniques (Rao 2003) are being explored to address situations where the pooling is undesirable or impossible.
2. Summing the individual NFI unit totals and their associated variances to the ecozone level,
3. Producing internally consistent tabulations of ecozone attribute totals and their associated variances by classifier class.

The reporting involves producing standard tabular, chart and thematic-map statistics by national terrestrial ecozones and classifiers. The initial focus of the reporting will be on the key NFI attributes (Table 2). Eventually, the reporting will be expanded to other attributes and to user-defined domains. web-based internet access is being developed to allow users to query the database and generate reports.

Implementation

The NFI is an interagency partnership project. Natural Resources Canada, under the guidance of the CFIC, coordinates NFI activities. Through the interagency arrangement the provincial and territorial partners define the sampling intensity (i.e., the number and distribution of plots within the jurisdiction), collect and subsequently provide data. The

Fig. 2. Illustration of 2 km x 2 km NFI photo plot located on a mid-scale aerial photograph (extraneous lines outside the photo plot boundary delineate the effective area of the photo for interpretation).

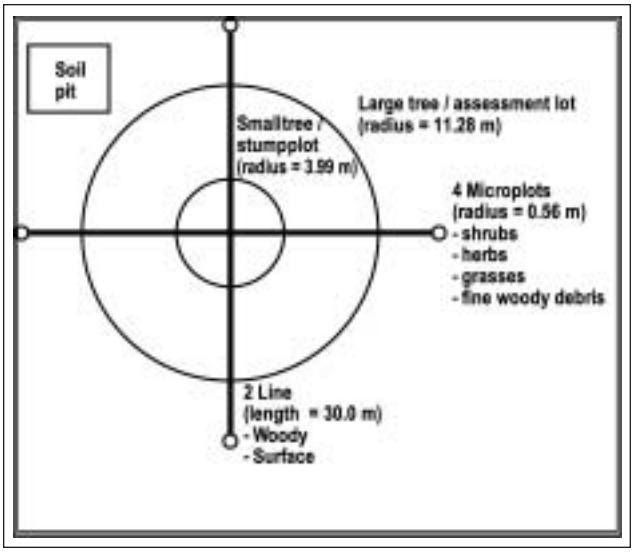

Fig. 3. Illustration of NFI ground plot layout.

Table 2. The 25 key attributes reported in Canada's National Forest Inventory

NFI attributes
Total forest area
Area by forest type
Area of forest type by age class
Area of forest types by protection status
Area of other wooded land by protection status and type
Area of age classes by protection status
Area and percent of forest land managed primarily for protective functions (watersheds, flood protection, avalanche protection, riparian zones)
Regeneration and afforestation area by type
Area of surface water in forests
Area of forests undisturbed by man
Area of other wooded land undisturbed by man
Number of forest dependent species
Number of native and exotic species in forests
Origin (local/non-local) of seedlings in regenerating areas
Area available for timber production
Area converted to non-forest use
Area and severity of insect attack
Area and severity of disease infestation
Area and severity of fire damage
Area of forest disturbance
Area and percent of forest land with significant soil erosion
Total biomass by forest type, age, succession stage
Total volume of all species on timber productive land
Area/volume of plantations (native/exotic)
Current volume growth (annual) of forest (gross, net)

federal government's role is to develop and maintain standards, procedures and infrastructure and to conduct the data analysis and reporting. The NFI is implemented through bilateral agreements between the federal government and the provincial and territorial governments. Currently, the inventory is being established in eight of the ten provinces and two of the three territories. Planning activities are underway in the remaining provinces and territory. Table 3 shows the progress to date. Approximately 40% of the photo plots and 35% of the ground plots have been established. The cost to-date for the design, development and implementation of the NFI has been approximately $5.6 million. An additional $10.5 million is required to complete the establishment of the inventory. Plans are to complete the establishment by 2006.

Monitoring Canada's Forests

To enable monitoring of Canada's forests, the NFI will be on-going. Canada's forest will be monitored using the NFI, supplemented with earth observation data from remote sensing programs, and change will be estimated from repeated sampling of photo and ground plots. The intent is to initiate the re-measurement program the year following the establishment of the inventory.

Re-measurement framework

An inventory workshop was organized in Victoria, March 2 to 3, 2004 to develop a framework to guide the development of change estimation procedures for the NFI. Invited partci-pants at the workshop included NFI clients and stake-holders, and biometricians from the United States Department of Agriculture (Forest Service) involved in the Enhanced Forest Inventory and Analysis (FIA) program, and Comisión Nacional Forestal (CONAFOR). The workshop endorsed the following recommendations:

Table 3. Canada's National Forest Inventory progress as of March 31, 2004

	Ground plots (#)		Photo plots (#)			
			(from photography)		(from satellite data)	
Jurisdiction	Design total	Outstanding	Design	Outstanding	Design	Outstanding
BC	268	50	2414	100	0	0
AB	166	166	1656	1656	0	0
SK	45	30	561	219	1067	600
MB	96	28	950	698	665	482
ON	203	193	1848	1448	637	0
QC	150	150	1494	1494	1781	1781
NB	19	0	194	0	0	0
NS	14	4	141	0	0	0
PE	2	0	12	0	0	0
NL	40	23	432	275	631	441
YT	0	0	0	0	1225	225
NT	136	104	0	0	2945	1500
NU	0	0	0	0	287	287
Total	**1139**	**748**	**9702**	**5890**	**9238**	**5316**

1. Re-measurement sampling strategy: The strategy includes implementing a 10-year cycle and grouping the photo plots into 10 national panels[7] representative of Canada's landmass and measuring one panel per year, and for ground plots, grouping the ground plots into 10 ecozone panels representative of each ecozone and measuring one panel per year. The plots that are not measured will be updated for catastrophic changes using event maps from inventory update and monitoring programs.
2. Re-measurement methods: No formal recommendation was proposed, but a number of inventory guidelines were suggested. These guidelines include conducting an ongoing review of the list of attributes collected in the inventory, assessing the need for each attribute for re-measurement, and when techniques are introduced or changed, do the measurements using both the new and old techniques.
3. Statistical estimation and projection of change: Initially all estimates from all panels should be combined into one estimator weighted by the number of plots. Research should be conducted on the use of auxiliary information to improve the precision of the estimator and on models to impute annual change estimates, and in the longer term to switch to a more precise statistical estimator.
4. Reporting of NFI statistics: Calculate change estimates annually, but publish reports of change estimates only periodically (five years).

No recommendation was proposed for implementation. A number of follow-up steps were suggested and a preliminary implementation plan has been devised following the workshop as outlined in the next section.

Re-measurement plan

The plan is distinct for photo plots for which NFI attributes are provided through a classification of satellite data (Northern Canada) and for photo plots for which NFI attributes are obtained through interpretation of aerial photography (Southern Canada). A clear delineation between Northern and Southern Canada is required.

The re-measurement plan proposed for Northern Canada does not follow the sampling strategy recommendations of the workshop because it is not possible to guarantee the availability of satellite imagery for a given location within a given year. The re-measurement plan in Northern Canada proposes to follow a periodic continuous forest inventory design where the re-measurement will be guided by the availability of satellite image data. The re-measurement will be conducted over a short period (five years) within a 10-year cycle.

The re-measurement plan proposed for Southern Canada follows the recommendations of the workshop. The re-measurement plan proposes a periodic continuous forest inventory with annual reporting. Southern Canada will be divided into ten national panels of photo plots with one panel will be measured every year. The re-measurement cycle is over 10 years.

The plan proposes that all plots that are not measured within a given year will be updated to capture catastrophic changes (i.e., harvest, fire and insect and other disturbances where possible) within the year. Provincial/territorial inventory update/monitoring programs will be relied on to provide the data.

The plan proposes to accept the workshop recommendations for the ground plots. Ground plots will be grouped into 10 ecozone panels representative of each ecozone and one panel will be measured each year.

Earth observation data from existing and new remote sensing programs will be used to supplement the remeasurement plan. Earth observation data will be used for the initial capture of disturbance information, to check the data provided from inventory update/monitoring programs, or to evaluate the plot re-measurements and updates on a periodic (five-year) basis to ensure that significant disturbances have been captured. Satellite image data from high-resolution sensors such as Ikonos or Quickbird, medium-resolution sensors such as Landsat or low-resolution sensors such as MODIS will be

[7]A panel is a sample in which the same elements are measured on two or more occasions, to independently sample a population.

Table 4. National Forest Inventory re-measurement activities[1]

Year	Plot measurement (NFI and RS)[2]	Update (RS and NFI modeling)	Evaluation (RS and NFI reporting)	Reporting (NFI)
1	- National Panel 1 Photo plots - Regional Panel 1 Ground plots	- Monitor disturbance, detect and label changes		No
2	- National Panel 2 Photo plots - Regional Panel 2 Ground plots	- Monitor disturbance, detect and label changes - Grow attributes		Yes
3	- National Panel 3 Photo plots - Regional Panel 3 Ground plots	- Monitor disturbance, detect and label changes - Grow attributes		Yes
4	- National Panel 4 Photo plots - Regional Panel 4 Ground plots	Ongoing		Yes
5	- National Panel 5 Photo plots - Regional Panel 5 Ground plots	Ongoing	- Monitor and label changes - Produce efficiency reports	Yes (Publish)

[1]Remeasurement activities refer to the first five years of a 10-year cycle. The second five years would be a repetition of the first five years.
[2]RS: Remote sensing activities include EOSD land cover, land cover update, change and biomass, Deforestation change assessment programs, Canada Centre for Remote Sensing change monitoring programs (for example, Fire M3), and provincial and territorial inventory update programs and land cover activities.
NFI: Includes provincial, territorial and other federal government department partners in the implementation of the NFI, as well as the NFI Project Office.

used as appropriate to detect changes as a result of disturbance, to attribute the changes and to characterize the land cover.

The aim is to estimate area totals and attribute totals annually and to report them periodically. The photo and ground plot re-measurements will be used to estimate annual changes in area totals and attribute totals by classifier class and NFI unit, and to report these changes periodically at the ecozone and national levels. Data from all the photo plots will be used to estimate changes in area totals for disturbance and treatment classifiers. For now, data from only the re-measured panel plots will be used to estimate changes in area totals for other classifiers, and changes in attribute totals; methods, such as model-based estimators that incorporate projected plot data, will be considered in the future.

The estimation will involve at each year of measurement:

1. Estimating annual change in the area totals and attribute totals for each photo or ground plot. (Annual change is estimated as the difference between the area or attribute total at year of measurement and the total when it was last measured, divided by the number of years that have elapsed since the last measurement.)
2. Averaging the annual change estimates for each area classifier and attribute from the appropriate plots within an NFI unit, to give average annual change estimates at the NFI unit level.
3. Summing the NFI unit annual change estimates to the ecozone level.

Standard reports on area and attribute total periodic change statistics by ecozone and classifier will be published after every five years of measurement.

Table 4 provides an illustration of the activities by year for five years of a 10-year cycle. The flowchart presents the plot re-measurement plan, how earth observation data from remote sensing are used to supplement the re-measurement, and the integration with other programs (primarily remote sensing). Contingency plans are being discussed to deal with issues such as organizational options for the selection of panels, and the inability to re-measure or update plots within a given time period.

Summary

The new NFI and its associated re-measurement strategy form a forest measurement and monitoring program that will provide data for the Criteria and Indicators processes to monitor sustainable development, data to support policy, national and international inquiries and for reports on climate change. The integration of these projects with satellite-based programs such as EOSD will also provide a framework for collecting data on factors affecting forest health and productivity. As steward of one-tenth of the world's forests, Canada requires a measurement and monitoring program that can provide accurate and timely data to respond to national and international concerns about the sustainability of Canada's forests. CanFI, based on provincial and territorial inventories of varying standards, coverages and ages, cannot adequately meet the current demands for additional forest resource attributes for policy, national and international reporting and for reports on indicators of SFM. A new national forest inventory, NFI, has been designed and is being implemented to address current information needs. The new NFI will assess and monitor the extent, state and sustainable development of Canada's forests in a timely and accurate manner. The NFI is also designed to be responsive to future information needs. The establishment of the NFI provides a baseline inventory of Canada's forest. The NFI is a continuous forest inventory design, and change in Canada's forest will be monitored through repeated sampling. The NFI will be supplemented with earth observation data from remote sensing programs. Earth observation data from remote sensing platforms will be used to enhance the inventory, to assess the extent and nature of change. The establishment of the NFI will be completed in 2006, with the first report on the inventory in 2007. The first estimates of change following the re-measurement strategy proposed will arrive following the first re-measurement year. The first

monitoring report on how Canada's forests are changing over time will be presented following five years of plot re-measurements. In addition to the NFI monitoring reports, the NFI design and database tools are also available to the provinces and territories to develop their provincial/territorial inventory, growth and yield monitoring programs. These monitoring programs are becoming increasingly important given the changing role of the provincial/territorial governments in conducting management-unit inventories.

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