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Network News

Forest Health & Biodiversity

Canadian Forest Service

Forest Ecosystems of Canada Project

Forest ecosystem classifications (FECs) are taxonomic systems that organize forest ecology information into consistent nomenclatural structures. The primary value of an FEC lies in the provision of a standardized reference lexicon for a specific range of ecological conditions, including criteria for identifying individual forest ecosystem types. FECs are generally presented in handbook form as a series of dichotomous keys and descriptive fact sheets; they are rarely presented as maps denoting spatial divisions of land or water. Currently, many internally consistent, regionally specific, FECs exist throughout Canada. However, there is often little compatibility of nomenclature between the individual regional classifications.

In recent years, development of a national forest ecosystem classification system has consistently been ranked near the top of Canadian Forest Service (CFS) program priorities. It was one of the four highest priority action items identified by the Blue Ribbon Panel in reviewing the 1992 National Forest Strategy. In the renewed Strategy, forest ecosystem classification was identified during the regional consultations as a priority, particularly in connection with improving Canada's capabilities for reporting on Criteria and Indicators of Sustainable Forest Management and for planning networks of protected areas. In the new CFS Strategic Plan, completion of a national ecosystem-based land classification system is specifically mentioned.

An updated national forest ecosystem classification would provide a systematic ecological reference framework for the extension of scientific results and management strategies across jurisdictional boundaries, which currently isolate existing regional FECs. A national FEC would also provide a critical linkage between detailed forest vegetation information and hierarchical ecological mapping systems (such as the Ecoregions/Ecozones of Canada). Finally, it would clearly define forests in an ecosystem context that is essential for reporting on changes in ecosystem and habitat diversity or for developing conservation strategies.

In January, 1998 a feasibility study was commissioned by the Canadian Forest Service to investigate the possibility of developing a collaborative approach to the development of a national classification of forest ecosystems. The proposed partners were the CFS and provincial and territorial agencies which, by virtue of their own FEC programs, are custodians of significant forest ecology databases. The provincial and territorial representatives were contacted and asked whether they would be willing to make their regional data available for synthesis into a national forest ecology database, with subsequent classification analysis. Following the survey, a two day workshop was held in July, 1998 for provincial ecologists and CFS staff to further discuss the proposal. In particular, it was important for the major collaborators to exchange

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The Canada Yew, A Little-Known Species

The Canada yew *(Taxus canadensis)* is a coniferous species that grows in the understory of the deciduous and mixed forests of eastern North America. In contrast to its western relative - a species that can attain 10 to 15 metres in height - the Canada yew is a shrub rarely exceeding two metres in height.

Canada yew has a low growing form, with branches that tend to 'creep' along the ground (the reason for its common name 'ground hemlock'). It is usually found in clonal 'clumps' or 'colonies'.

The formation of these colonies occurs as follows: A seed may be carried, by birds, from one area to another. Once a seedling becomes established in this new area , over the next few hundred years, it can spread through layering (the horizontally growing branches come into contact with the soil, roots form on those branches and then a 'new' tree is formed).

This 'new' individual, a genetic copy of the original tree, forms with other copies, a clone. Thus over time, these clonal colonies develop. All of the trees , whether they are individuals or colonies within a given area constitute a population.

Canada yew also reproduces sexually, but 'seedlings' are less frequently found than for most other conifers. The Canada yew is unique among yews in that the same plant bears both male and female flowers. Although pollen is spread by wind, the seed is large and spread primarily by birds. This is in contrast to seeds of most other conifers which are smaller and have tiny wings attached to them which aid in their being wind-dispersed over greater distances . Furthermore, the scarcity of yew seedlings can be explained in part because seed germination is often poor. Yew do not produce cones as with most other conifers, so they can be readily identified by the red fleshy berry surrounding the seed.

(Above) Student Sauphie Senneville examines a Canada Yew. Note the distinctive red berries. (Below) A typical Canada Yew clonal colony.

Until recently, the Canada yew did not have any significant economic value. Given its small size, it was mainly used as an ornamental plant. Furthermore, its high toxicity to humans and cattle meant it was treated as a 'weed'. The discovery of paclitaxel, better known as Taxol®, changed everything!

It all started in 1962 when the National Cancer Institute in the United States undertook intensive sampling of natural products likely to contain new active agents for fighting various forms of cancer. The bark of the Pacific yew displayed high cytotoxic activity (toxic to actively growing cells). However, it was 1971 before paclitaxel, the active agent responsible for this cytotoxicity, was isolated. This product seems to be one of the most promising anti-cancer compounds discovered in the last 25 - 30 years.

Large quantities of Pacific yew were harvested in order to extract this product from the bark. Since the only approved source of paclitaxel, up to now, has been the bark of the Pacific yew, harvesting pressure on this

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North American Test of Criteria and Indicators

In June and July 1998, CFS had the opportunity to participate in the field test of several sets of Criteria and Indicators of Sustainable Forest Management (C&I) conducted in Boise, Idaho under the auspices of the Centre for International Forestry Research (CIFOR). CIFOR, located in Indonesia, is one of several international research centres, and is the only one that deals exclusively with forestry. This test was the seventh of its kind and the only one conducted to date in North America by CIFOR.

The significance of this test to Canada was the inclusion of the Canadian Council of Forest Ministers (CCFM) set of Criteria and Indicators, which was developed in Canada and is widely recognized as our national C&I set. It is expected that the results of the test will be valuable in our continued adjustment and application of these C&I. Other C&I tested include the basic set that has been developed by CIFOR through other tests, indicators drawn from the Greater Fundy Ecosystem Biodiversity Guidelines, and the State of Idaho Best Management Practices. Others were examined but not actually tested.

A team of eight from Canada, U.S. and Mexico, with varied backgrounds in forestry, ecology, genetics, social sciences and economics, was assembled to bring a variety of insights and perspectives to the testing process. Three team members, including the leader, Stephen Woodley of Parks Canada, were Canadian. The study area was almost 2 million hectares in size and included a variety of land ownerships: federal land, state land, industrial, and small private holdings. The quantity of data available to the testing team was remarkable. Support from National Forests databases, Forest Service personnel, state employees and Boise Cascade, a commercial forestry company, was excellent.

The process of testing the C&I had several stages. The first assessment involved extensive reading by all team members before meeting in Idaho. Although a given indicator made the "first cut", that did not guarantee that it would be fully assessed in its present form, or at all. Each indicator was defined, often using material from CCFM or CIFOR written specifically for the indicator. If these definitions were inadequate, additional explanation for the indicator was necessary. A series of questions relating to testability, scale, applicability to all landowners, and function were posed for each indicator assessed. Team members briefly described the underlying concepts, drawing from material written about the indicator, when available, in addition to supplemental information. Relevance to sustainable management was judged.

The next part of the assessment involved describing measurement

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Number of Criteria and Indicators in Each of Three Categories for the Two Original C&I Sets (CIFOR and CCFM) and the New Proposed Set (Boise)

Indicator Set Number of Criteria/Elements/ Indicators	Ecological Number of Criteria/Indicators	Socio-Economic Number of Criteria/Indicators	Management Number of Criteria/Indicators	Other Number of Criteria/Indicators
Boise 17/45 (New)	7/17 (3)	5/17 (2)	4/17 (1)	1/3
CIFOR 17/67 (Accepted)	4/16 (7)	8/34 (16)	5/17 (17)	
CCFM 8/22/83 (Accepted)	12/42 (16)	5/20 (6)	5/21 (5)	

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methods, data requirements and availability, and after using available data, assessing the practicality of the indicator. Information value of the indicator was also assessed at that point. It is possible for an indicator to be easily measured, widely applicable to landowners, and relevant to sustainable management, but still to have very low information value. Results of the test were summarized. There was no attempt to actually assess the forestry operations on the study area; i.e. it was not considered relevant whether results were positive or negative.

An over-all assessment was made for each indicator resulting in one of four outcomes. Indicators could be accepted as is; they could be accepted with changes; set aside as having merit but requiring further development; or rejected. No indicator could be rejected or changed without discussion, and all proposals to accept, change or reject indicators were "defended" to the group. In some cases, two indicators were combined to make one. In others, an indicator may have been rejected but one or more new ones were proposed to replace it. In total, the new Boise C&I set consisted of 17 criteria and 45 indicators.

Information used to assess the indicators varied from raw data in the form of inventories to published reports about the area, as well as information gleaned from email, the Internet and university library searches.

During the presentation and "defense" of the indicator assessments, the underlying concepts were explained, data availability and use were described, results were presented as well as final assessment. This component of the testing was thorough, with lengthy and animated discussions among all team members.

The initial set of indicators examined by the team included only one genetics indicator, which was from the CCFM set: "Implementation of genetic conservation strategies for endangered and commercial species". Though many of the components of an adequate strategy for gene conservation were in place in the study area, there were no written strategies as such. Thus the indicator, taken literally would result in a "0". In addition, the tree species of concern in Idaho are not necessarily either listed as endangered or commercial. In the wider context, even if a strategy exists, there is no standard for what constitutes a strategy. For example, a strategy may or may not have research behind it. It may be based on "best guesses", with little critical thought or it may be based on well-thought out, well-researched status reports. Thus in the testing process, this indicator was rejected.

Ideally, an indicator of genetic diversity would measure diversity directly, but such measurement is difficult and costly; the choice of species to monitor and best tools to employ is not always clear. At best, only a few populations of a handful of species could be monitored directly for genetic diversity. In general, developing and monitoring indicators to track ecological processes that maintain genetic diversity is more cost effective and may be more meaningful than monitoring direct genetic diversity measures. Thus, the indicators that were chosen to replace the CCFM one were process based and were stated as directives as follows:

1. Population sizes and reproductive success are adequate to maintain levels of genetic diversity.

2. Use of scientifically-based seed transfer rules and seed orchard zones in planting native species.

3. Harvesting does not significantly change gene frequencies.

Results of the test have been widely presented in each of the three participating countries. In Canada, a presentation was made to the CCFM C&I Task Force, to assist in further developing the definition and application of indicators of sustainable forest management. Following the presentation of the results in the United States, a decision was made to apply the Boise set in six national forests, to further test and refine the indicators. In Mexico, the federal forest management and research agencies intend to carry out further testing and development, to build in greater specificity for the Mexican context.

Development and testing of C&I will continue for some time to come. Each set of results contributes to the greater body of knowledge that is developing around the issue. Significant challenges remain. For example, target levels will have to be defined in order to assess and interpret the indicators. In addition, the definition of "sustainability" needs common agreement in a practical sense. In order to do this, new ways must be found to integrate the three solitudes of economics, ecology, and society.

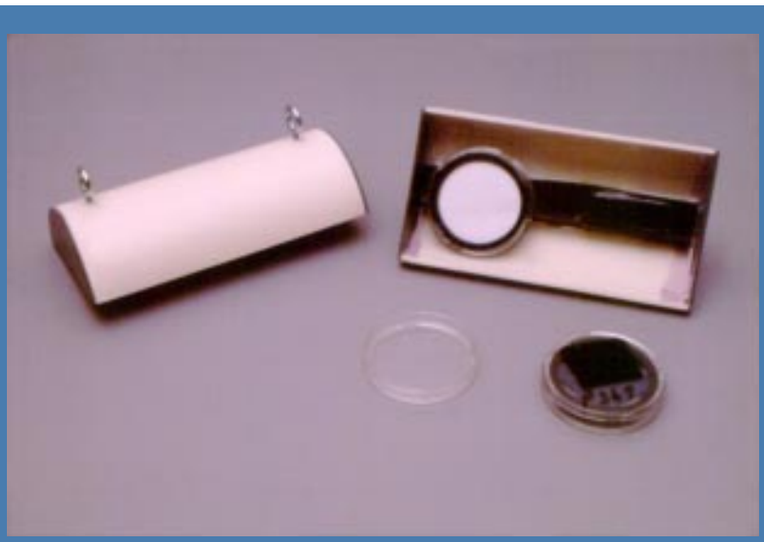
by Dr. Judy Loo
Atlantic Forestry Centre

Forest Health Passive Ozone Monitoring: An update on the CanOxy Plate™

Ground level ozone is an air pollutant known to have damaging effects on tree species. It occurs over wide areas at levels considered harmful to plants. As reported in the Fall 1997 issue of Network News, the Canadian Forest Service has developed and tested an inexpensive passive monitoring device for measuring exposure of forest plots to ozone.

Interest in the CanOxy Plate™ passive ozone sampler continues to grow, with nearly four thousand plates being deployed in nine separate studies since 1993. The passive monitor is composed of a PVC shelter which houses a pair of small plates, each containing a paper impregnated with ozone-sensitive indigo dye. After the plates have been exposed for the sample period, they are sealed and sent to a laboratory for a simple extraction procedure and analysis.

For two years, the Forest Health Network of CFS has combined CanOxy Plate™ field monitoring with visual assessment of foliage for ozone damage, at selected forest health plots across the country. Other studies conducted to date include graduate student research projects, NGO action groups, and provincial, national, and international monitoring networks. Long term monitoring interest has been demonstrated by the Canadian energy sector. Current international commitments include ongoing monitoring projects in Mexico (Mexico City) and Spain (Mijares-Jiloca valley), while a request for plates has been received from government researchers in Finland (Kola Peninsula).



The CanOxy Plate™ passive ozone monitoring system (above) is being used by CFS and other agencies to measure the ozone trees are exposed to, right in the forest canopy (below).

An information fact sheet on the monitor has been produced in English, French and Spanish and is available upon request. Interest in the device has prompted a business plan exercise to aid cost recovery and the ability to license the technology. In addition a CFS Information Report on the monitor and its use is underway.

This monitoring technology is suitable for use in remote areas where there is no access to power. It allows for high-intensity spatial monitoring of ozone where the cost of instrumental monitors would be inhibitory. The relatively low-tech methodology makes it suitable for amateur and school environmental projects, an area where some interest has been generated. The technology would be applicable to projects in developing countries, to identify regions of ozone pollution and in the design of ozone monitoring networks.

For more information, please contact Dr. Roger Cox at (506) 452- 3532 or to obtain a copy of the informational fact sheet, please contact Shirley Pegler at (506) 451-2616.

by Shirley Pegler
Atlantic Forestry Centre

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ideas on classification design and a methodology for developing the project.

The results of both the feasibility survey and the workshop demonstrated overall support for a national FEC that would be complementary to existing provincial and territorial systems. The provincial and territorial representatives indicated a willingness to make their ecological data available for the project, but they stated clearly that it should be the CFS that takes the lead role — both scientifically and financially.

A scientific steering committee consisting of Bill Meades and Ken Baldwin from CFS-Great Lakes Forestry Centre, Ole Hendrickson from CFS-Headquarters, and Richard Sims of Geomatics International has been directing the preliminary phases of the project. Technical expertise for development of the classification will be drawn from CFS researchers, provincial and territorial collaborators, and private sector contractors. The publication development will be coordinated by CFS-Headquarters publication section. Data sharing and scientific collaboration agreements will have to be negotiated with participating provincial and territorial agencies. The final product will be a book that will include dichotomous keys, fact sheets, and reference images. As well, there is the possibility of developing a CD entitled *Forest Ecosystems of Canada*.

Since the July, 1998 workshop, discussions with numerous potential collaborators have ensued in an effort to arrive at a generally acceptable strategy for undertaking the *Forest Ecosystems of Canada* project. A draft strategy document has been circulated to the regional partners for comments. Discussions relating to the design of a national FEC and its linkages to spatial products such as the National Forest Inventory and NatGRID are ongoing under the auspices of the National Forest Information Strategy. CFS Science & Technology funding, to date, has supported the feasibility survey and the July workshop, across 2 fiscal years. A small amount of additional funding has been obtained for the fiscal year 1998-99 from the Canadian Geospatial Data Initiative to conduct preliminary investigations of relative compatibility between existing provincial and territorial FECs and some universal vegetation classification standards. The project is poised to go ahead with a broad base of inter-governmental cooperation pending commitment of sufficient CFS resources in fiscal year 1999-2000.

by Ken Baldwin and Bill Meades
Great Lakes Forestry Centre

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species increased dramatically, to the point that the Pacific yew was proposed as an endangered species in need of protection. Other sources of paclitaxel are therefore being sought. This product is present in the bark, leaves and roots of all species of yew. The leaves of the Canada yew are already being used as a source of paclitaxel in Quebec (and other places in eastern Canada). Before massive harvesting has an impact on the natural populations of Canada yew, it seemed important to gather information on the genetic diversity of the species, in order to implement conservation measures.

A study was conducted by members of the Biodiversity Network at CFS-LFC, in collaboration with Dr. Jean Bousquet of the Centre de recherche en biologie forestière at the Université Laval. Its objectives were the estimation of genetic diversity of Canada yew, the study of its genetic population structure, and the proposal of conservation strategies for these genetic resources.

The results from this study indicated that, when compared with most other conifers, the Canada yew seems to have a relatively low amount of genetic variation. Most of this genetic variation occurs among individuals within a population. More importantly, the study reveals that a greater proportion of this variation is found within populations than is usually observed in other conifers. In the latter, large number of seed is spread by wind and new populations are always geographically and genetically close to the existing ones. For the Canada yew, seed is scattered by birds and each new population originates from a limited number of seed collected in the original population. This phenomenon explains why each Canada yew population presents a particular gene pattern.

However, these results represent only the start of the total work needed in order to fully assess the variability of this species. Work has started on determining the amount of variation that exists in 'adaptive traits' i.e., the traits that relate to the ability of a tree to thrive under, and to respond to, different growing conditions. As the results from this additional work becomes available, only then can reliable, scientifically-based strategies for conservation and management be developed.

By Sauphie Senneville, Jean Beaulieu and Gaëtan Daoust
Laurentian Forestry Centre

Here's What You Said: Network News Survey Summary

The results are in! Included with the last issue of Network News (Volume 2, No.1, Fall 1998) was our first Readership Survey. Thanks go to all 402 respondents who sent us their valuable feedback; their opinions, readership habits, and suggestions to make Network News even better, not to mention a very high approval rating. According to the survey results, 97.8 percent of our readers really enjoy reading the publication, with 88 percent of you reading half or more of each issue. We were thrilled to learn that Network News is reaching even more readers than we expected, since 71.6 percent of you pass your copy on to others for their reading pleasure.

The survey results also offered much valuable information on article content - what our readers have enjoyed in past issues and what you'd like to see more of in the future. Network News represents the efforts of many hard-working contributors doing their best to produce articles that appeal to you, our readers. It was very encouraging to learn that approximately 95 percent of all respondents chose the "Good - Excellent" rating for every mentioned category concerning the quality of Network News' articles - interest/relevance, scientific detail, general information and article mix.

The survey results also provide valuable guidance for upcoming issues of Network News - what better way to discover which topics are of most interest to our readers? The survey respondents inform us that they'd like to see more articles relating Forest Health and Forest Biodiversity Networks to forest management subjects with a stronger regional emphasis. Also rating highly as interesting subjects were items of national interest, partnerships, and articles about the other CFS forest science networks across Canada.

Again, many thanks go to all survey respondents for their valuable comments and suggestions. We welcome feedback from all of our readers at any time - please feel free to send your input to:

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