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Network News

Forest Health & Biodiversity

Canadian Forest Service

Exotic Pests: A Going Concern

In last fall's issue, Network News included an article on exotic pests finding their way into Canada and posing a serious threat to our nation's forest and agricultural industries.

In 1997, science detective work by the Canadian Forest Service (CFS) on the west coast yielded worrisome results: 16 different exotic insects, both dead and alive, were recovered from wooden packing materials associated with trade imports. CFS staff examined 92 wooden wire spools from China, Korea, and Malaysia and more than 80 percent contained insect galleries, some even housing live insects. These numbers alarm CFS researchers across the Forest Health Network. An action plan for detecting, examining, and trapping insects is being developed in response to these initial survey statistics.

In July 1998, the Canadian Food Inspection Agency (CFIA) and CFS signed a Memorandum of Understanding (MOU) and Agreement annexes that clarify the direct activities and operations of our organizations with respect to exotic pests. The MOU and Agreements outline how we work together and identify joint responsibilities. For example, CFS will take the lead in research support, while CFIA will lead in monitoring activities, with CFS assisting where possible. The MOU also hints at the development of a coordinated, national response team involving CFS Forest Health Network scientists, and CFIA Plant Protection Division inspectors and officials. The ultimate goal of the project is to reduce the risk of exotic pests being introduced into Canada.

Tony Bourgoin, a CFS summer student, is emptying a specialized trap designed to catch insects, including exotics.

Currently, CFIA inspects 1 to 2 percent of all containers imported into Canada. By learning more about the scope of the potential problem, new regulations and directives can be put into place, in conjunction with the planned Forest Pest Emergency Response Team. Through these joint efforts, it is hoped that strict compliance with the directives and an active response unit should reduce the frequency of improper or unacceptable wooden packing materials being used in imports.

The Forest Health Network has undertaken key research activities for exotic pests in 1998-1999. The goal is to obtain more information on the various species entering Canada, how they enter and move within the country, the effect they have on forest productivity and ecosystem function, and most importantly, what can be done to prevent introduction and establishment in Canada.

On the west coast, Dr. Eric Allen of the Pacific Forestry Centre, continues to be shocked by what he's finding. This spring, the European spruce bark beetle and other pests arrived in Vancouver with a shipment of Norwegian granite. Allen happened to be driving by a stone supplier in the Lower Mainland area when he noticed the new shipment and stopped by for a quick visit. To his surprise, more than 1,500 arthropods, mainly beetles crawled out of two pieces of green wood bracing material, less than half-a-metre long. Federal trade officials contacted Norwegian authorities to urge them to stop using raw, fresh wood with bark as bracing material.

At other CFS centres across Canada, CFS Forest Health Network team members are also doing their share of sleuthing. Specialized traps are set up in warehouses or high risk

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Development of Conservation Strategies for Tree Species at Risk

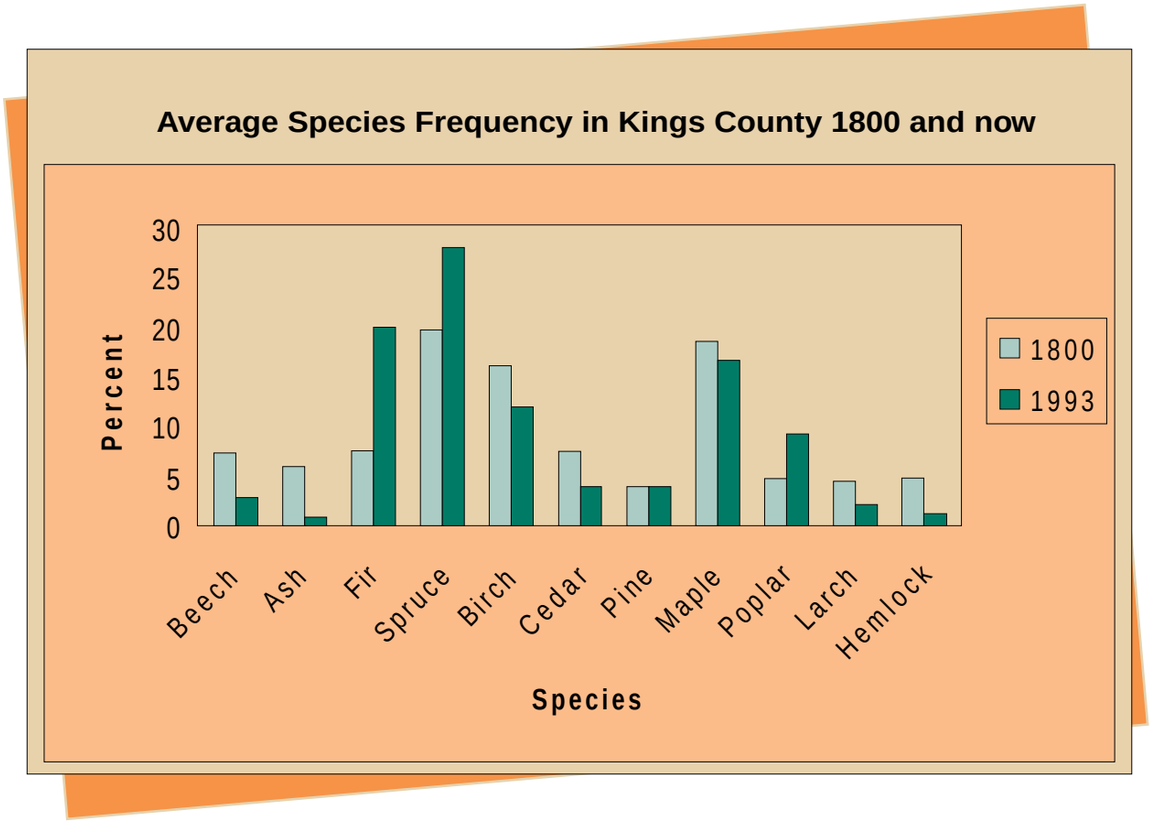
Scientists within the Forest Biodiversity Network at the Atlantic Forestry Centre, in collaboration with provincial government, industry and universities, have initiated a process to develop gene conservation strategies for forest tree species deemed to be at risk,.

A recent impetus for this work is the emphasis in the Fundy Model Forest on "Criteria and Indicators". The Fundy Model Forest is one of ten sites across Canada that has been designated as a research and demonstration area where sustainable forestry practices will be developed and implemented. "Criteria and Indicators" refer to sustainable forest management and constitute Canada's centerpiece on the international forestry scene. The underlying philosophy is that we cannot know whether or not we are practising sustainable forest management if we do not have defined criteria and if we do not have measurable indicators to tell us how close we are to meeting the criteria. Each model forest has been given the mandate to make the national set of criteria and indicators workable at the model forest scale, at a practical level.

To make a long story short, one of the six criteria concerns conservation of biodiversity and an indicator by which to measure our success is implementation of in situ/ex situ gene conservation strategies. However, implementation must necessarily follow development of strategies. None of the Atlantic provinces of Canada has an elaborated set of gene conservation strategies for forest trees with the exception of a few specific cases (see Mosseler, this issue). The idea of working at the level of genes tends to scare many foresters, forestry practitioners, and even scientists who do not normally work at that level. In the case of trees, we really must focus conservation measures at the level of species and populations within the species, but we cannot conserve a species without conserving its genes.

To this end, we have initiated a project to develop gene conservation strategies for forest tree species "at risk" by bringing together interested people in each of the Maritime provinces to lay the foundation for strategy development. Ultimately, we would like to see a similar process undertaken in each province, resulting in a unified set of strategies for the country.

I will outline steps in developing and implementing gene conservation strategies for forest trees, as has been initiated in the Atlantic provinces. First, species "at risk" must be identified. A set of criteria has been developed and used in the three Maritime provinces to identify species requiring conservation measures. A rating system has been applied to define, at a gross scale, the type of attention required. The ratings go from 0 - "no problem", to 3 - "specific conservation measures required".



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Newfoundland's Declining Native Pines

Geographically isolated tree populations such as those on islands or otherwise separated from the centre of their geographic range are of interest because of their potentially unique genetic composition. Because Newfoundland (NF) is an island which remained partially ice-free during the last glacial period, its flora and fauna may be of special genetic interest relative to the ancestral populations on the mainland from which they have been separated for many thousands of years.

The recent decline of Newfoundland's two native pines, eastern white pine, Pinus strobus, and red pine, Pinus resinosa, has raised concerns about their future as naturally occurring species. These pines constitute a major component of the island's terrestrial biological diversity and represent important aspects of Newfoundland's cultural and historical development. The former national anthem of NF refers to "pine-clad hills" that no longer exist. Recently, a conservation strategy aimed at the ecological restoration of these native pines and the habitat that they represent has been developed by the Newfoundland Department of Forest Resources and Agrifoods, based on research by Canadian Forest Service (CFS) scientists.

One of the main objectives of the CFS research on pines was to characterize the genetic diversity and reproductive success of the island's declining white pine and red pine. Biochemical (enzyme) and molecular (DNA) gene markers were used to compare island populations with those at the centre of the geographic range and reciprocal field tests have been established both in NF and in Ontario (ON) to compare growth performance and other adaptively significant traits in common environments.

Once common and widespread throughout northeastern North America, white pine has undergone fundamental changes in population structure as a result of human interference on the landscape. Harvesting pressures have reduced populations to small, isolated groups of trees over large portions of its former geographic range. The rapidly declining numbers and sizes of eastern white pine populations in NF have become an urgent conservation issue because of threats to its survival as a naturally occurring species on the island. In NF, this decline was exacerbated by the liquidation harvesting for sawlogs at the turn of this century and the subsequent introduction from Europe of the devastating white pine blister rust disease, caused by the fungal pathogen Cronartium ribicola.

The oldest documented Red Pine in North America from Newfoundland at 360 years old.

Prior to these events, white pine was widespread, albeit diffusely, across central and western NF as a minor component of a mixed wood, fire-origin forest dominated by species such as aspen (Populus tremuloides), black spruce (Picea mariana), balsam fir (Abies balsamea), tamarack (Larix laricina) and white spruce (Picea glauca). The healthy 'old growth' white pine described in the "Ode to Newfoundland" no longer exist as a prominent feature of the island's landscape. The extant white pine population consists of a few small surviving patches of younger trees ranging in age from 40 to 70 years. This creates a situation where inbreeding and loss of genetic diversity could begin to threaten population viability. While genetic diversity and structure have been characterized for other parts of the geographic range of white pine, no such information was available for developing the necessary conservation and restoration strategies for the NF population.

Initial research results reveal that, contrary to our expectations, and despite 8,000 years of post-glacial geographic isolation, NF white pine populations are as genetically diverse as those from central ON, based on standard genetic diversity parameters from enzyme (gene) analyses. These results are consistent with those reported by CFS scientists from Quebec which also show that genetic diversity levels in marginal populations are comparable with those of central populations. However, the ON populations generally had more rare alleles. This fact could be important in adapting to new or changing environments. Our estimates of genetic variation are consistent with those for other wind-pollinated, primarily outcrossed conifers and are comparable to estimates calculated for other North American pine species.

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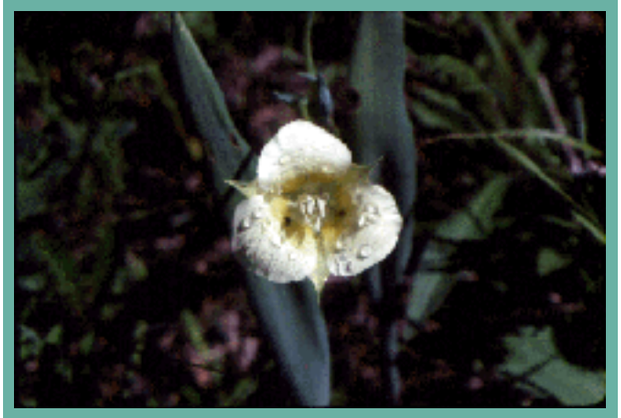
Inventory of Rare Vascular Plants in the Prairie Provinces

Conservation of biological diversity (biodiversity) is the cornerstone of many international, national, and provincial initiatives (e.g., United Nations Convention on Biodiversity, Alberta Forest Conservation Strategy, Special Places 2000) and land management decisions (e.g., protected areas). A major challenge to biodiversity conservation is ready access to information on species, sites, and communities. Currently in the prairie region, information is widely scattered in a variety of forms. Comparison of data can be difficult and time consuming. Efficiently and quickly gathering information for large areas is almost impossible. Canadian Forest Service (CFS) staff at the Northern Forestry Centre in Edmonton, notably Derek Johnson, have been addressing the biological methods and conservation components of the CFS Forest Biodiversity Network Program from a plant perspective. This article summarizes two initiatives related to the inventory of rare plants in Alberta and Manitoba.

Alberta Parks Management Support Division, Parks Canada, and The Nature Conservancy have combined forces on a biodiversity information project called The Alberta Natural Heritage Information Centre (ANHIC). Information is being accumulated and standardized for all of Alberta's Natural Regions on selected plant and animal species and plant communities. Report categories include: confirmed locations; conservation status and management needs; and managed areas such as national and provincial parks, natural areas, wilderness areas, and ecological reserves. Information is housed in a series of linked computerized databases, the structure of which is modeled on the system used in the Conservation Data Centres (CDCs) of The Nature Conservancy. These CDCs form an international network encompassing most of the western hemisphere and parts of eastern Asia. Alberta is working with neighbouring CDCs in British Columbia, Saskatchewan, and Montana on species and communities of common interest. Information is also linked to a Geographical Information System (GIS).



Calochortus apiculatus, South Castle River, Alberta 21/6/91

Castilleja hispida, South Castle River, Alberta 21/6/91

The goal of the Conservation Data Centre project and related publications is to develop a comprehensive, efficient information management system that will benefit land-use management planning, including ecological reserve selection and design, and the conservation of Alberta's biodiversity.

Preliminary tracking lists for vascular plants and mosses have been compiled and reviewed. A tracking list for macrolichens is being developed at the University of Alberta. The tracking lists include species identified as high priority because they are rare, endemic, disjunct, in peril, or special in some other way. Currently, species with 20 or fewer known occurrences in the province are being tracked and the occurrences of these species are being mapped within an overlay of managed areas. The degree of threat in the province for these species is being ranked, and sources of information on rare species and communities are being compiled and updated.

The Alberta Parks Management Support Division as a partner in ANHIC is providing information and maps for the Alberta Native Plant Council's planned publication, "A Field Guide to the Rare Vascular Plants of Alberta." The information was compiled from numerous sources, including a survey of rare plants in all Alberta herbaria.

Derek Johnson of the CFS in Edmonton is involved in several aspects of the work with rare plants. He works on maintenance of collections in regional herbaria (vasculars, bryophytes, and lichens) to keep records of rare plant species current for input into ANHIC database. He contributes to developing and re-

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The Fungal Herbarium: A Key Research Tool in Forest Biodiversity and Forest Health

To most people in forestry, tree disease fungi are something to be avoided. But to mycologists Brenda Callan, Chuck Davis, Gaston Laflamme, and Ken Harrison fungi are their proverbial "bread and butter". They curate herbaria situated across Canada, housing specialty collections and focus on keeping biological records of forest plants and their diseases, and forest fungi. The Canadian Forest Service (CFS) maintains similar collections for insects, living cultures, and mites. Mycological herbaria document which fungi were present in the past and which currently occur in particular regions and habitats across the country. Herbaria can provide verifiable baseline data on a fungus at a particular place and time to contribute to studies of change on biodiversity, climate change, and forest health.

The Pacific Forestry Centre's Forest Pathology Herbarium, located in Victoria, BC and curated by Brenda Callan, is an internationally recognized collection with over 35,300 preserved and catalogued forest fungi and disease specimens. Representing over 3000 different fungal species in BC, the collection is the largest of its kind in western Canada.

"The herbarium is known as DAVFP in the Index Herbariorum, the catalogue of the world's herbaria," says Callan, who works in the Forest Biodiversity Network of the CFS. "That stands for the Department of Agriculture, Victoria, Forest Pathology. Although it obviously switched departments a few times, the herbarium collection has been preserved and expanded since its establishment in 1940."

Although the herbarium itself is almost 60 years old, some of the mycology and forest pathology specimens date back to the 1800s. Such a collection provides a tangible record of the natural history in the province.

"As well, there are over 140 type specimens at DAVFP; collections which are the basis for new species descriptions," explains Callan. "The herbarium is invaluable to researchers in confirming published host-fungus distribution records and for re-examining specimens in the context of new taxonomic information and research techniques. It provides the physical evidence that a fungus species is present in the province." Most of the DAVFP specimens were collected by CFS field technicians and research scientists over the years. In the past, field technicians of the Forest Insect and Disease Survey contributed thousands of records to the database with specimen and data processing carried out by CFS herbarium technicians Daphyne Lowe, Fiona Ring and Analie Fernando. The Pacific Forestry Centre (PFC) continues to maintain, expand, and modernize the collection.

Specimens on permanent display at the PFC herbarium.

Part of the modernization includes a new herbarium website http:/www.pfc.cfs.nrcan.gc.ca/biodiversity/herbarium. The website hosts the DAVFP Collections Database, listing over 20,000 of the specimens stored in the herbarium. The database can be searched by fungus, host, determiner, collector, locality, DAVFP number, or year of collection. A map of a single collection location, or a distribution map of all specimens on record can be created with a click of the mouse.

You can also access the BC Host/Fungus Index Database at the PFC web site. It has been designed to assist in the identification and formal documentation of fungi occurring on native plants in BC (except for most agricultural crops and horticultural or ornamental (non-native) plant species). The Host-Fungus Database consists of an extensively revised and modernized database compiled from 60 years of CFS records, partially based on a checklist published by Daphyne Lowe in 1977 as well as published literature and data generously provided by Agriculture and Agri-Food Canada. This section can be searched by genus or specific epithet of both host plants and fungi, and also includes a smaller list of fungi associated with other substrates including non-plant hosts. The format of the Host/Fungus Index and taxonomic modernization were designed by Brenda Callan and are loosely based on the 1989 reference by D.F. Farr, G.F. Bills, G.P. Chamuris, and A.Y. Rossman, Fungi on Plants and Plant Products in the United States, published by the American Phytopathological Society.

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sites in cities such as Vancouver, Edmonton, Sault Ste. Marie, and Saint John. Staff at these sites are supporting the initiative and have been trained to bait and empty the traps every two weeks. The contents collected from the traps are then analysed at regional CFS science laboratories. Each species is identified by an entomologist; the biology and behaviour of each insect relative to the region's forests becomes the foundation of the analysis.

In Halifax this fall, at the annual meeting of the North American Plant Protection Agency, Canadian officials, including CFS Forest Health Network representatives, will discuss implications of implementing a standard which would regulate the use of raw and infested wood packing material. Last year, a proposal was tabled to ban the use of raw and infested wood as packing material. This proposal will receive further attention at this year's conference with the hope that agreement can be reached. The ban would also require Canadian industry to comply in their exports to ensure that the wood packing material is free of insects.

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For more information on exotic pests, visit the web sites:
• http://www.pfc.cfs.nrcan.gc.ca/health/exotics.htm
• http://www.pfc.cfs.nrcan.gc.ca/biodiversity/exotics/

Or contact:

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The other two are: 1 - "insufficient information" and 2 - "attention required at the level of forestry practices".

Meetings have been held in three of the Atlantic provinces to start the process of collecting and compiling information about those species for which our knowledge is inadequate. Such information regarding location and condition of species occurrences, will be used to produce preliminary status reports. The reports will then be used to decide whether the species needs attention, and if so, how to proceed.

For other species, sufficient information exists to proceed with developing recommendations, either in terms of best management practices or specific gene conservation measures. This may be as simple as recommending a particular harvesting and regeneration regime, or it may involve defining specific needs for protection of populations "on the ground" as well as collection and storage of seed from specified populations for use in restoration plantings. In either case, it will be important to monitor populations over time to evaluate the success of the strategies.

Intertwined throughout this approach to strategy development are opportunities for research projects and for collaboration with a broad array of stakeholders. There is, and will continue to be, a need for research on a variety of questions, including genetic variability of populations, gene flow mechanisms, factors influencing reproductive success, species-specific definitions of viable population size, modes of genetic resistance to disease or insects, germplasm storage, and restoration protocols.

Establishing a broad collaborative framework is essential in this work. Implementation of a conservation strategy will fall to those managing the land. Research organizations can do the background studies, make recommendations, and perhaps even guide the progress of implementation, but they do not have management control over the land. Therefore, it is crucial that land managers are included from the beginning in developing strategies. The provincial governments cannot successfully pursue a conservation strategy, even on Crown land, without assistance of licensees, and in an area with a high number of private woodlots, woodlot owner cooperation is essential. In addition, conservation agencies can help to negotiate protected area deals and subsequently manage the areas. Thus, the involvement of a variety of agencies, companies, and organizations must be sought, in order to implement the strategies.

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Nfld's Declining Native Pines

Recognizing that these pines were at risk of disappearing as naturally occurring species on the island, the NF government proposed a conservation strategy aimed at ecological restoration. However, implementation of this strategy has been hindered by a succession of poor seed crops in NF white pine that may be related either to a deterioration in climate or to inbreeding effects related to small population size. Results of our research suggest that seed introduced from mainland seed sources as far away as the center of the range in ON may be acceptable for restoring white pine and red pine in NF. However, this assumption needs to be tested by further assessments of growth performance of introduced seed sources. Such tests have been established in central NF.

One of the more controversial recommendations in the proposed conservation strategy is a proposal to ban harvesting of white pine until the recovery of the species is assured. Surprisingly, the recommended harvesting ban has received widespread support within the forestry community and now appears to be receiving political support within the provincial government; the proposed harvesting moratorium awaits cabinet approval. The recent collapse of the NF cod and salmon fisheries has raised public awareness of the ecological and commercial consequences of the loss of native species. A conservation ethic is emerging. Hopefully, one day, Newfoundlanders will again enjoy those "pine-clad hills" that inspired the author of their anthem.

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Rare Vascular Plants

viewing lists of vascular plant, bryophyte, and macrolichen species at risk in Alberta in cooperation with ANHIC, Parks Canada, and the University of Alberta. In addition, he is editing text for the ANPC's "Field Guide to the Rare Vascular Plants of Alberta".

On a related front, the CFS supports the work of the Manitoba CDC, in conjunction with the Manitoba Museum, documenting occurrences of rare vascular plants in Manitoba. The objective is to obtain data on rare vascular plant occurrences from herbaria; and to compile and incorporate these data into the Manitoba CDC's Biological and Conservation Data System and GIS system.

The products from this collaboration will include a list of rare vascular plants occurring in each of the Forest Management Units within the Pineland, Lake Winnipeg East, Interlake, Mountain, Saskatchewan River, Hayes River, Nelson River, Highrock and Churchill River Forest Sections of Manitoba, and a GIS thematic layer of occurrences of rare vascular plants within the above-listed Forest Sections of Manitoba.

These two projects in Alberta and Manitoba have obvious links. The next step, and one where CFS's Forest Biodiversity Network could play an important role, is to assist in integrating this rare plant species inventory information for the Prairie provinces as a whole.

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The Fungal Herbarium

The databases were programmed by Dr. Alan Thomson and co-op student Jonathan Bahl at PFC.

There is also a section on the website called "Forest Mushrooms", which provide colour illustrations and simple explanations of the various ecological roles that common mushrooms play in our forests.

The Canadian Forest Service has similar mycological herbaria at the Atlantic Forestry Centre in Fredericton, N.B. and in Corner Brook, Newfoundland, the Laurentian Forestry Centre in Ste. Foy, Quebec, the Great Lakes Forestry Centre in Sault Ste. Marie, Ontario and the Northern Forestry Centre in Edmonton, Alberta. Each herbarium preserves unique voucher specimens that confirm the existence of many indigenous and introduced forest fungi in their respective areas. Experts who are studying a particular fungus can examine the specimens and confirm its presence at a particular time.

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For more information on the CFS Biodiversity Network, please visit our national web site at: http://www.fcmr.forestry.ca/fbn/biodiv_e.html .

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