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Newfoundland Marten: Developing conservation guidelines for a species at risk

The island of Newfoundland, like most other island communities, has a unique ecological assemblage with fewer species when compared to mainland areas of similar size. For example, Newfoundland has only 13 species of terrestrial mammals, almost all of which are classified taxonomically as distinct subspecies. By comparison, mainland Nova Scotia has over 30 species of terrestrial mammals. Over the last 150 years, however, historical and human interactions have resulted in radical changes to the native flora and fauna. At least 11 additional terrestrial mammals have been either intentionally or accidentally introduced and one species, the Newfoundland wolf, (*Canis lupus beothucus*) has been extirpated.

One of the native mammals, the Newfoundland marten, is of special concern to natural resource managers. A forest-dwelling carnivore and member of the weasel family, the Newfoundland marten is classified as a distinct subspecies of the American marten, *Martes americana atrata*. Not surprisingly, results of genetic analysis of American marten populations, published in 2003 by Kyle and Strobeck in the Canadian Journal of Zoology, have confirmed the genetic uniqueness of marten in Newfoundland when compared to all other populations across Canada.

CFS researcher Brian Hearn and a Newfoundland Marten

Historically, marten were distributed throughout most forested areas of Newfoundland. By the early 1900s, concern was being raised as marten started to decline both in population and in distribution. By 1934, worry over the welfare of the population resulted in a ban on all commercial trapping. However, despite this protection, marten populations continued to decline. In 1986, the Newfoundland marten was listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as Threatened, thereby designating this subspecies as one of the most vulnerable forest-dependent mammals in Canada. Ten years later, COSEWIC revised the status of the Newfoundland marten to Endangered based on the continued decline of the population over the previous decade.

Marten and Forestry Practices

The historical decline of marten in Newfoundland was attributed to excessive trapping and habitat loss due to logging and fire. Recently, wildlife managers and researchers have concluded that habitat loss via timber harvesting of mature (60–80 years) and overmature (81+ years) softwood forests was the most significant problem impeding recovery of the subspecies. This conclusion was consistent with results from elsewhere in North America where marten have traditionally been described as reliant on landscapes dominated by patches of mature and overmature conifer-dominated forests.

Accordingly, marten have been used as an indicator species for environmental assessment of sustainable forestry practices and certification of industrial practices in many jurisdictions across Canada. Obviously, the importance of managing forest harvesting for this endangered subspecies is heightened in Newfoundland.

Consequently, over the last eight years, researchers of the Canadian Forest Service – Atlantic Forestry Centre (CFS-AFC) have been involved in a series of multi-agency projects involving the federal and provincial governments, the Model Forest Program, universities, and forest industry partners. These projects have concentrated on improving our understanding of the

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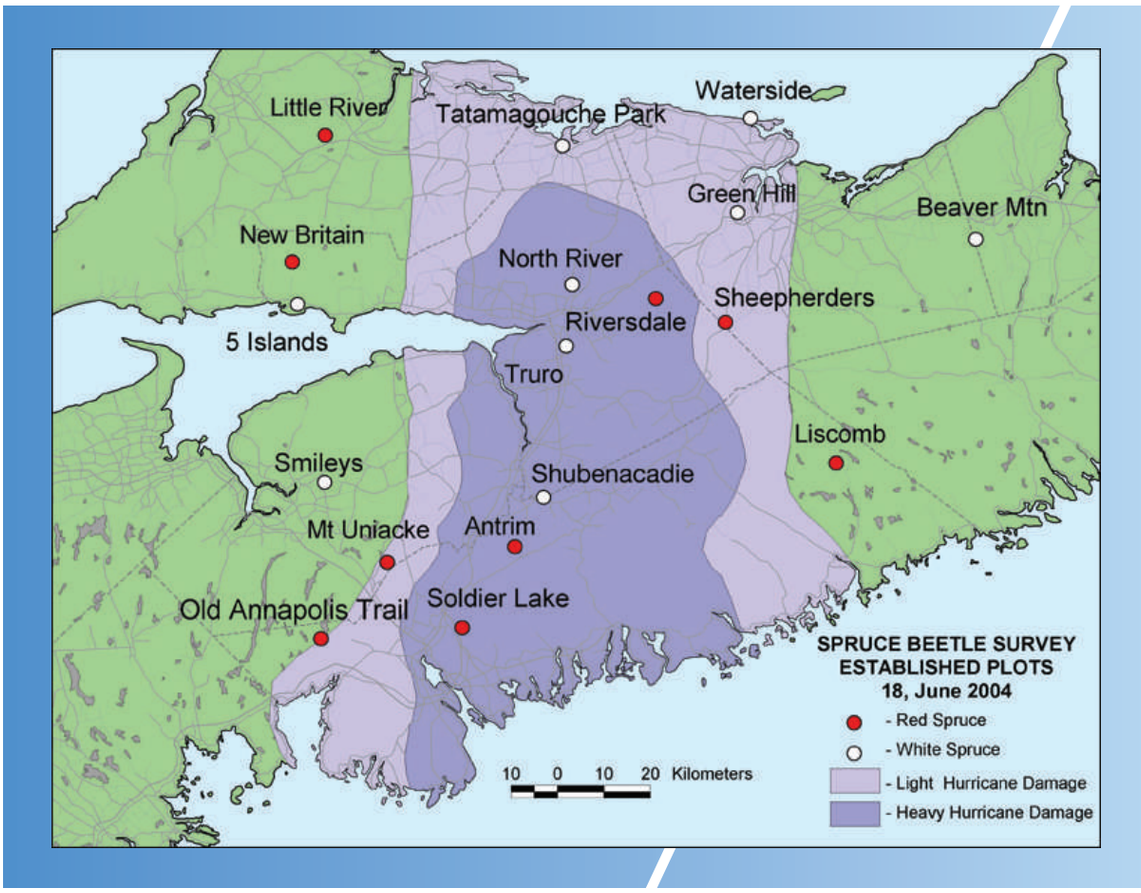
Will Hurricane Juan spark a spruce beetle attack?



Hurricane Juan ripped through Nova Scotia on the night of September 28/29, 2003 wreaking havoc over an estimated land base area of more than one million hectares. The area of forest blowdown occurs within a swath of damage from the Halifax Regional Municipality to the Northumberland Strait coastline (see map insert).

Forest pest managers understand that disturbance events of this type may trigger other unwanted natural events that in turn exacerbate forest health. Dead and dying trees provide opportunities for insects and diseases, and the spruce beetle is one such forest insect pest that takes advantage of blowdowns. The abundance of blowdowns in the Halifax area may propel this insect to population levels capable of significant harm to healthy spruce forests.

The native spruce beetle (*Dendroctonus rufipennis Kirby*) is an important mortality agent of mature spruce. Spruce beetle activity in Nova Scotia has been both chronic and widespread. The Canadian Forest Service (CFS), in a 1981 study in Nova Scotia, found that spruce beetle infestations in white spruce stands had killed 18% of the merchantable volume (nearly 1.6 million m^3) and infested an additional 9% (0.8 million m^3). Only 5% of the red spruce stands examined were infested. Aerial surveys conducted by the Nova Scotia Department of Natural Resources (NSDNR) in 1995 mapped 4463 ha of damaged spruce stands on mainland Nova Scotia and, in 2001, 428 ha of damage along the Fundy shore of Cumberland and Colchester counties.

Most of the current literature on the forest impact of the spruce beetle has been generated in the western areas of North America. Blowdown events there have been linked to spruce beetle outbreaks and large scale spruce mortality events. What are the implications of this large scale blowdown event in the Acadian forest of central Nova Scotia?

The literature states that windthrow is a primary cause of spruce beetle population buildup. Thus, the endemic population of spruce beetle in and around Hurricane Juan's damage swath may rise, increasing the vulnerability of nearby healthy spruce stands. Given the extent of hurricane damaged forests, we consider it prudent, from a forest management perspective and in light of the broader implications for disturbance impacts on forest health, to set up a study to assess the impact. Specifically, we will monitor for anticipated spruce beetle population response, research the impacts on healthy spruce stands and discern the attack potential for white and red spruce.

NSDNR and CFS have teamed up for a multi-year study, with financial support from the Nova Forest Alliance, in an effort to document answers to such questions as:

- How will the spruce beetle respond to rarely occurring, high intensity, large-scale blowdown?
- Will the risk for damage on red spruce increase, as compared to white spruce, the favored host species, given the scale and intensity of this wind damage event?

If the spruce beetle population begins to rise substantially, the project proponents will report the information as an early warning system. The project is currently underway. Research plots have been established (see map) and data assessment in ongoing through the fall and winter 2004/05.

J. Edward Hurley,
Atlantic Forestry Centre
Bob Guscott,
Nova Scotia Department of Natural Resources

Genetic Diversity – our future forests depend on it!

The Conservation of Forest Genetic Resources Workshop in Montebello, Quebec

Genetic diversity, the variation among individuals that is inherited, is the essential ingredient in species adaptation to environmental change. Conserving a rich pool of genetic diversity also provides the potential for the discovery and development of new products of high economic value for the forest, agricultural, horticultural, pharmaceutical, or other industries. Conservation of forest genetic resources is carried out by identifying the threats to genetic diversity, understanding species biology and ecology, and developing management strategies and objectives for populations, usually with a combination of methods, such as *ex situ* (in facilities, including germplasm collections) and *in situ* (in place, including protected areas and altered forestry practices). Climate change and invasive alien species are two emerging challenges to Canada's forest genetic resources.

Canada has made international commitments to conservation and sustainable use of biological diversity through the Convention on Biological Diversity, the Santiago Declaration Statement on Criteria and Indicators for the Conservation, Sustainable Management of Temperate and Boreal Forests, and the Convention on Trade in Endangered Species of Wild Flora and Fauna.

One of the most serious national issues on Canada's horizon is climate change. Warming climates and on-going globalization are expected to worsen the impacts of invasive alien species, many of which already pose serious threats to a number of native tree and shrub species in Canada.

Both the Atlantic and Laurentian Forestry Centres have active research programs that support conservation of forest genetic resources. Activities include evaluation of genetic diversity patterns of several species for which conservation issues have been identified, development of novel storage techniques for species that produce seed that is hard to store, and development of vegetative propagation techniques for species under threat from alien pathogens. The CFS has excellent *ex situ* storage facilities at both centres where germplasm, including seed, is stored for research and conservation. The CFS Peer Review process, completed in 2002, provided guidance for giving biodiversity research more national focus and cohesion. Suggested recommendations from the Peer Review included increasing CFS investment in genetic conservation, strengthening collaboration, and placing more emphasis on non-timber forest values.

Beech seed collected by Donnie McPhee.

Bernie Daigle checks seed storage at the Atlantic Forestry Centre.

In February 2004, with these issues at the forefront, and in consideration of the economic benefits to Canada, associated with the maintenance of options for future product development and access to overseas markets, CFS hosted the conservation of Forest Genetic Resources Workshop in Montebello, Quebec.

The workshop dovetailed with another national workshop on Ecosystem Effects of Novel Living Organisms to take advantage of synergies and common interests of some of the participants. The goal of the workshop was to evaluate the national landscape and explore a potential role for CFS in conserving genetic resources of forest trees and shrubs. The list of invitees consisted of key individuals working with forest genetic resources from all parts of Canada, including representatives from the forest industry, academia, the agriculture sector, and environmental non-governmental organizations (NGOs).

Workshop Objectives

- Identify priorities and gaps in existing forest genetic resources activities across Canada.
- Define the role of the federal government and CFS in particular in the conservation of forest genetic resources in collaboration with provinces, Aboriginals, industry, and NGOs.
- Identify elements of a cohesive S&T initiative to support conservation and sustainable use of Canada's forest genetic resources.
- Identify how molecular genetic tools can help to address key questions in conservation of forest genetic resources.

Workshop Outcomes

The most important outcome of the workshop was the development of a vision and mission for the CFS in a program to support conservation of forest genetic resources. Participants agreed that there is a need for a national program on the conservation of forest genetic resources and that the CFS is the most appropriate federal agency for coordinating the formation of such a program. Active programs exist in some jurisdictions, but species ranges extend across provincial and territorial borders and gaps remain in some jurisdictions for species that are receiving attention in other areas. The federal government is seen as being best positioned to coordinate research to address such gaps.

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Addressing forest invasive alien species: Developing a policy framework

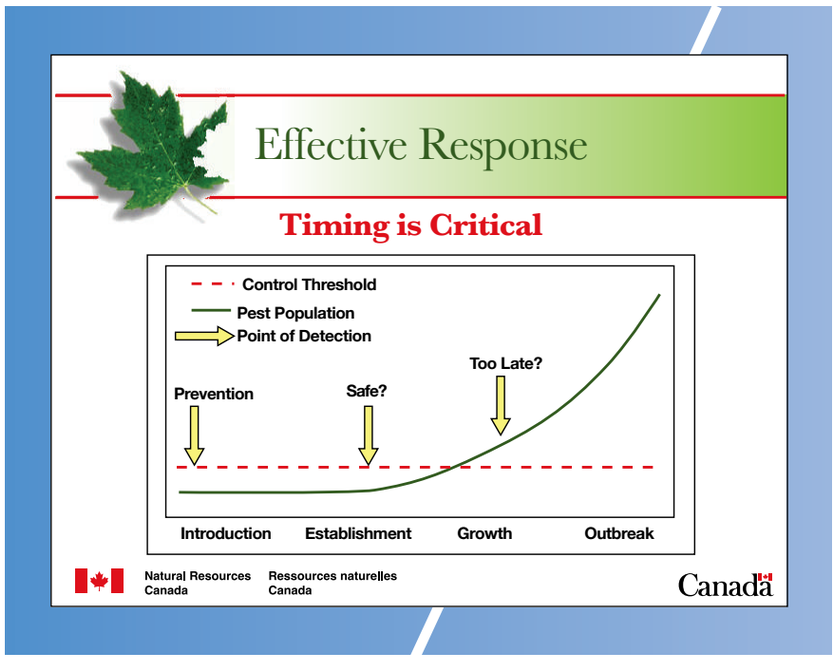
In the past several years, the presence in Canada's forests of forest invasive alien species (FIAS) has increased steadily. Canada's forest industries and forest-based communities are currently facing problems and considering risks that they have never before had to consider. Canadians are being forced to alter the way they perceive their forests and the goods and services those forests provide. Gaining a better on-the-ground understanding of FIAS is critical to ensuring a healthy forest and a strong forest sector, and dedicated research programs are up and running. Creation of a cohesive, inclusive national policy that addresses the FIAS threat at multiple stakeholder and action levels is also ongoing, inside and outside of the federal government.

In the Beginning

The start of the FIAS strategy dates back to September 2001, when federal, provincial and territorial Ministers for wildlife, forests, fisheries and aquaculture jointly called for a plan that would specifically address the growing threat of invasive alien pests. Over the next three years, officials in many organizations worked together, developing what became a national approach. That work was finalized after a series of cross-country consultations in the first half of 2004. In September 2004, at a meeting in Whitehorse in the Yukon, federal, provincial and territorial Ministers approved the Alien Invasives Strategy, requesting that action plans be created and presented to them in autumn 2005.

The Framework

The FIAS strategy's management scope is broad, addressing aquatic and terrestrial ecosystems and the plant and animal organisms associated with them. The Strategy follows a step-wise approach to prevention and control of FIAS, focusing on prevention of new introductions, provision of early detection capacity to combat new introductions, establishment of a rapid response to new invasions and management of established and spreading organisms through containment, eradication and control. The terrestrial component of the action plan addresses agriculture and forest ecosystems, and has been developed through a multi-agency team co-chaired by the Canadian Food Inspection Agency (CFIA) and the Ontario Ministry of Agriculture and Food. The Canadian Forest Service of Natural Resources Canada is providing forest-related expertise, and is currently developing a strategic plan specifically for the Canadian forest sector. Issues such as fungal and insect species and issues of trade importance that could threaten the health of Canadian forests and the strength of our forest sector.



An effective FIAS strategy has been tailored to Canada's natural and social realities. Canada's trading partners, trade competitors and the many international policy agreements and legal instruments to which Canada is committed all require consideration. This array of international and domestic policy drivers, though complicated, provides a good platform for a comprehensive FIAS strategy, ensuring that Canada's forest sector is strategically placed to reduce risks and to maximize its national and international advantages.

The policy addresses many needs and it's the public interest, which is directly served by investments made to combat FIAS. It favours partnerships, as the challenges FIAS pose go well beyond the ability of any one organisation to handle. The policy also offers value for money, since control of FIAS before they arrive in Canada should reduce costs and thus the greater negative consequences of battling pests once they are established. The key point is that we must focus on the earliest possible FIAS detection and prevention as a means to avoid unpredictable and unmanageable costs down the road.

The Bottom Line

Fundamentally, the strategy rests on three broad, but interdependent policy considerations, each of which reflects the unique Canadian forestry context and the wide range of FIAS impacts possible in Canadian forests. First, Canadian efforts to combat alien species must be consolidated. The CFIA is the lead agency on invasives, and is mandated with prevention, detection, response and management responsibilities. However, the expertise and critical resources to fulfil those responsibilities exist within many organizations, inside and outside of governments. A policy that enables synergies and partnerships in provision of science and policy advice, creation of awareness, operational activities, communications and technology transfer is crucial to overall success.

Second, Canada requires access to global forest product markets. The Canadian forest industry conducts trade with more than 100 countries around the world, which accounts for one-fifth of global forest products exports. In 2002, Canada exported almost $43 billion in forest products. Given the increase in the use of non-tariff barriers that restrict or distort international trade in global markets, including technical and scientific barriers related to plant health, addressing FIAS risks

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factors and mechanisms endangering marten populations in Newfoundland. Initially, restricted distribution was the issue, and the following questions were considered:

- Is Newfoundland marten distribution restricted to areas of overmature timber because of the species' specific habitat requirements?
- Is the excessive mortality of marten in younger second-growth forest due to forest harvesting activities that provide trappers with road access?

The first phase of our work (1995–2000), based on results from over 160 radio-collared marten, yielded some significant results. Adult resident marten (n = 92; 44 males and 48 females) established home ranges encompassing a variety of forest stand types and across a range of forested landscapes. This demonstrates that at least at the forest stand scale, marten were not restricted to areas dominated by only overmature coniferous forests. Additional research is ongoing to define the threshold values for various habitat types, i.e., immature, mature, and overmature forest, within areas suitable for occupancy by Newfoundland marten.

Furthermore, territory size for marten in Newfoundland was exceptionally large (15–30 km^2) when compared to mainland marten (2–5 km^2). It may be that Newfoundland marten are less specific in their habitat requirements than their mainland counterparts because they had to be. Their life history reflects their distinctive ecological setting where this mammal has evolved over the last 10,000 years.

Our field results also indicated that many marten were accidentally killed in traps and snares set for other furbearers. Not surprisingly, it appears that habitat for Newfoundland marten is defined in part by landcover composition and structure and in part by factors relating to individual security, i.e., human access and over-exploitation by trappers. To protect marten from accidental harvest, additional forested reserves that are closed to traditional snaring and trapping methods, are being established by the provincial government for protection of the marten.

Predictive Models and Habitat Assessment

Our field data are now being used to help refine provincial forestry and wildlife management strategies and habitat management tools. Towards this end, several other cooperative projects are being conducted in collaboration with CFS. Using the empirical results generated during the first phase of our marten work, Angela Fuller is completing her PhD at the University of Maine under the direction of Dr. Dan Harrison. Ultimately, Fuller's work will produce a predictive habitat model for Newfoundland marten that will evaluate threshold responses of marten to landscape change and will build predictive models of marten occurrence based on landscape characteristics. These models will allow natural resource managers to reliably predict the response of marten to alternative forest management scenarios; identify areas of potentially suitable habitat requiring forest harvesting planning; and to prioritize areas of likely marten occurrence for conducting future detection surveys. Finally, we are also developing a base habitat (landcover) map relevant to Newfoundland marten for the island of Newfoundland — a requirement for the application of the predictive habitat model in development. The latter project is a collaborative effort with remote-sensing and spatial analysis staff at CFS-AFC (J. Luther, G. Strickland, and D. Piercey). The project leverages funding provided by the Canadian Space Agency's Earth Observation for Sustainable Development and Environment Canada's Interdepartmental Recovery Fund for Species at Risk.

For further information on these projects, or the Newfoundland marten in general, visit Environment Canada's Species at Risk website (http:// www.speciesatrisk.gc.ca).

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at the policy level is critical to maintaining and enhancing the market access of Canadian forest products.

Third, the policy has to ensure that the environmental, economic and social benefits that rural and urban Canadians derive from forest resources are not reduced as a result of FIAS. The Canadian forest sector is a fundamental element of Canada's economy and culture. It must remain biologically and economically sustainable, in spite of challenges that arise from FIAS. A policy that considers innovative solutions, including site restoration or novel use of affected areas, is required.

Next Steps

In the near future, stakeholders across the forest community will be asked to comment on the strategy. Reaction and suggestions on the approach proposed will be sought, as well as input on potential roles and involvement of forest sector players.

For further information on the development and next phases of the FIAS strategy, please contact Jacques Gagnon, CFS, Science Branch (613) 947-9043 or by email jgagnon@nrcan.gc.ca.

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Vision

The CFS will develop and disseminate knowledge and protocols to facilitate and promote the management and conservation of forest genetic resources in Canada.

Mission

The CFS will achieve the vision, in partnership with a variety of collaborators, by:

- Developing and broadly disseminating the knowledge required for the conservation and management of forest genetic resources.
- Maintaining CFS germplasm storage facilities for long-term *ex situ* collections for conservation and research.
- Developing a national gene conservation initiative, including a national strategy to identify threats and mitigation measures in collaboration with provincial and federal government departments and other partners.
- Using selected species as examples for developing strategies and designing forestry practices, including in situ (in place) and *ex situ* (germplasm storage) protocols, to address gene conservation issues pertaining to invasive alien species, climate change, and land use (urbanization, resource development).
- Establishing *ex situ* collections for high priority species that are vulnerable to climate change, invasive alien species, or forestry practices.
- Promoting gene conservation methodologies through technology transfer nationally and internationally.
- Developing methodologies for understanding and mitigating gene flow from exotic species and genetically modified species.
- Providing relevant and timely information on threats to genetic resources and mitigation protocols associated with major national issues such as climate change, invasive alien species, and impacts of forestry practices to aid in developing Canada's forest policies.

Finally, the benefits of a high-profile CFS program to conserve forest genetic resources were considered. As custodian of a significant percentage of the world's forests, Canada is internationally responsible for demonstrating its stewardship of these forest resources. Implementing this vision and mission will better position Canada to meet commitments under the Convention of Biological Diversity and as an international leader in the conservation of forest genetic resources. As a leader, Canada will share information and transfer knowledge and resources to support sustainable economic development and environmental protection. These efforts will help forest communities thrive in Canada and around the world. To do this, a national strategy on conserving forest genetic resources would benefit and sustain our forest resources, including non-conventional products (i.e., medicinal plants and other non-timber forest products), and ensure a strong forest sector. Ultimately, the long-term benefit of any genetic conservation strategy is to maintain the capacity of forest species to adapt to climate change, invasive alien species, and the cumulative effects of these and other threats.

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