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Atlas of long-term forest research experimental sites of the Canadian Forest Service, Laurentian Forestry Centre

Claude Delisle and Louis Archambault

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ABSTRACT

This report presents a compendium of 535 long-term forest research experimental sites grouped together into 34 research projects. Twenty of these projects are still active and 14 are completed. Most of the sites are located in Quebec, while a few are located in Newfoundland and New Brunswick. Although a number of projects are completed, many sites are still easy to find, while others require a bit more effort.

The following selection criteria were used to include a project in the database:

1. It was initiated or supervised by a research scientist working at the Laurentian Forestry Centre;

2. It includes silvicultural treatments, regeneration measurements, growth measurements, genetic progeny tests, entomological studies or pathology studies;

3. It includes data collected from one or more periods; and

4. The experimental sites can be located in the field, regardless of whether or not the sites have been logged.

The following metadata were provided for each of the 34 projects: project title; abstract, objectives and comments; project status (active or completed); a description of the experimental design; names and contact information of the person in charge of the project and collaborators; main species studied; type of treatment implemented; data activity and stability; type of measurement; experimental site establishment, measurement and treatment years; a description of the place where the data are located; names of those who contributed to the creation of the metadata; metadata creation and modification dates; name of the experimental site; nearest town or city; longitude, latitude, altitude and surface area of the site; Canadian ecozone, Quebec bioclimatic subdomain and administrative region of which the experimental site is part; status of the measurement device; integrity and type of sample plots; comments regarding the measurement device; and list of project-related publications.

The database does not contain any field, laboratory or analysis data. Users wishing to obtain additional information or data relative to a project are asked to contact the person in charge of the project.

RÉSUMÉ

Ce rapport présente un compendium de 535 dispositifs expérimentaux de recherche forestière à long terme regroupés dans 34 projets de recherche. Vingt de ces projets sont encore actifs et quatorze sont complétés. Les dispositifs sont situés en majorité sur le territoire du Québec alors que quelques-uns sont localisés à Terre-Neuve et au Nouveau-Brunswick. Bien que plusieurs projets soient complétés, plusieurs dispositifs demeurent facilement retrouvables alors que d'autres exigeraient un peu plus d'effort.

Les critères de sélection pour qu'un projet s'inscrive dans cette base de données étaient :

1- qu'il ait été initié ou qu'il soit sous la supervision d'un chercheur travaillant au Centre de foresterie des Laurentides;

2- qu'il inclut, entre autres, des traitements sylvicoles, des mesures de régénération, des mesures de croissance, des tests de descendances génétiques, des études entomologiques ou des études pathologiques;

3- qu'il dispose de données prises à une ou plusieurs périodes; et

4- que l'emplacement des dispositifs expérimentaux soit localisable sur le terrain, que les dispositifs aient été coupés ou non.

Pour chacun des 34 projets, la métadonnée suivante est fournie : le titre du projet; un résumé, les objectifs et les remarques concernant le projet; son statut (actif ou complété); une description du dispositif expérimental; les noms du responsable et des collaborateurs au projet ainsi que les coordonnées pour les rejoindre; les principales espèces étudiées; le type de traitement appliqué; l'activité et la stabilité des données; le type de mesure; les années d'établissement, de mesure et de traitement du dispositif expérimental; une description de l'endroit où les données sont localisées; le nom des collaborateurs ayant participé à la création de la métadonnée; les dates de création et de modification de la métadonnée; le nom du dispositif expérimental; la ville la plus près; la longitude, la latitude, l'altitude et la superficie du dispositif; l'écozone canadienne, le sous-domaine bioclimatique et la région administrative du Québec dont fait partie le dispositif expérimental; le statut du dispositif de mesures; l'intégrité et le type de parcelles-échantillons; des remarques concernant le dispositif de mesures; la liste des publications reliées au projet.

La base de données ne contient aucune donnée de terrain, de laboratoire ou d'analyses. Si un utilisateur désire des informations supplémentaires ou des données relatives à un projet, il est invité à contacter le responsable du projet.

INTRODUCTION

This report was prepared in response to a request submitted by research scientists of the Canadian Forest Service, Laurentian Forestry Centre (CFS-LFC), to have a database created to store information on the LFC's forest research experimental sites. Since substantial amounts of money and work were invested to set up and monitor these sites, it became imperative to store this information to guarantee its availability over the long term. Given that it takes many years to obtain the expected results in forest research, these sites will provide other research scientists and graduate students with opportunities to study the long-term effects of various silvicultural treatments.

PROJECT OVERVIEW

The compilation of the Atlas of long-term forest research experimental sites of the Canadian Forest Service, Laurentian Forestry Centre, began in the fall of 2006 with the gathering of descriptive information, or metadata, on the CFS-LFC forest research sites. Some of these sites were established over 60 years ago. The objective of this work was to store information about these sites in a centralized database before the information was forgotten or lost forever. A total of 535 sites, grouped into 34 research projects, were compiled in an inventory (Appendices 1 and 2).

The metadata associated with a project can be used for several purposes, especially when it is collected, organized and presented in a unique information source such as a relational database in which searches can be done (Cole et al., 2005). First, research scientists can use the information to identify and locate studies and data that may be useful for answering specific scientific questions. A previous study may help to refine or launch a new study by providing supporting information or findings. In addition, by obtaining data and analyses from published studies and/or findings, it becomes less necessary to launch new studies. Research scientists can use the data from a previous or current study, either in its present form or in a reassessed or recompiled form, to meet the objectives of a research project. Research managers can also use the metadata to determine the merits of providing funding for proposed studies.

Second, easily accessible metadata can help practitioners, such as foresters, to quickly and efficiently determine whether experimental sites focusing on specific silvicultural issues are available that may suit their needs.

The third major way in which metadata can be used is to provide a larger segment of the population with information on long-term forest research experimental sites in Quebec, including highly valuable descriptive and geographical information pertaining to those sites.

ABOUT THE DATABASE

Presentation of the research projects

The research projects in this report are listed in alphabetical order.

Information selected for each project

In collaboration with the scientific staff of the LFC, we selected the following information, most of it based on Cole et al. (2005), for inclusion in the metadata:

- project title;
- summary;
- objectives;
- comments;
- project status (active or completed);
- a description of the experimental site;
- names and contact information of the person in charge of the project and of collaborators;
- main species studied;
- type of treatment implemented;
- data activity and stability;
- type of measurement;
- experimental site establishment, measurement and treatment years;
- a description of the place where the data are located;
- names of those who contributed to the creation of the metadata;
- metadata creation date;
- metadata modification date;
- name of the experimental site;
- name of nearest town or city;
- longitude, latitude, altitude and surface area of the site;
- Canadian ecozone, Quebec bioclimatic subdomain and Quebec administrative region of which the experimental site is part;
- status of the measurement device(s) included in the project;
- integrity and type of sample plots;
- comments about the measurement device(s); and
- partial list of project-related publications and internal reports.

All of the criteria concerning data activity and stability were assessed by the staff responsible for the experimental sites and are subdivided into several categories.

Data activity indicates the frequency with which the data are updated. Data that are regularly updated are assumed to be of higher value and more easily accessible than a set of inactive data. Data activity was coded according to one of the five following categories:

1. Active regular: data set is updated regularly.
2. Active irregular: data set is updated on an irregular basis.
3. Inactive available: data set is static but available.
4. Inactive unavailable: data set is static and completely or partially lost.
5. Unknown.

Data stability indicates the storage format used to preserve the data. Data stability was coded according to one of the five following categories:

1. Very stable: data digitized recently; available in hard copy; well documented.
2. Moderately stable: data digitized recently; available in hard copy.
3. Moderately unstable: data in a digital format that is relatively old or obsolete; quality of hard copies is poor.
4. Very unstable: data in a digital format that is relatively old or obsolete; hard copies are missing or damaged.
5. Unknown.

Sample plot integrity is an assessment of the condition of field sample plots, including whether or not the forest stand in which the study was carried out is intact, whether or not the sample plots are sufficiently marked with paint, whether or not the trees are labelled, whether or not there are stakes at the corners or in the centre of the plot, and whether or not other permanent markers and archived records would enable a skilled technician to reliably locate most of the plots. This assessment was made either based on information obtained from field workers or based on the most recent documentation available on data collection in the plots. Sample plot integrity was coded according to one of the five following categories:

1. Good: plots are intact and well marked.
2. Average: plots are intact and well marked, except for a few unmarked plots.
3. Poor: plots are not intact or not well marked, and there is little likelihood of recovery.
4. Logged: plots have been logged since they were last measured.
5. Unknown.

No attempt was made to gather, store, organize or distribute the data for the purposes of this report. Our objective is to provide descriptive information about the research projects and an assessment of the research project data. Anyone wishing to obtain data on a research project should contact the person in charge of the project. In addition, an authorization request should be submitted to the person in charge of the project to be allowed to access and use the study sites in order to avoid any possible disruption or damage to the experimental site.

Please note that Latin names do not appear in italics in the database due to technical constraints.

Publications

As much as possible, we have identified publications and/or other communications products that were developed for the purposes of a project. For each project, the bibliographical references are included in the list of publications.

CONTACT US

To submit comments, corrections, additions or questions concerning the Atlas of long-term forest research experimental sites of the Canadian Forest Service, Laurentian Forestry Centre, or request copies or information on the data presented in this report, please contact us by e-mail at the following address:

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The authors thank all LFC research scientists and technicians for their assistance in locating the experimental sites and providing access to their information. Their contributions made it possible to produce this report, which will undoubtedly prevent a large number of experimental sites from being forgotten and thus help them become more useful over time.

Special thanks are extended to Dr. Sylvie Gauthier, Dr. Louis De Grandpré and Dr. Jean-Martin Lussier for proposing the compilation of such a document, and to Dr. Pierre DesRochers who reviewed the manuscript.

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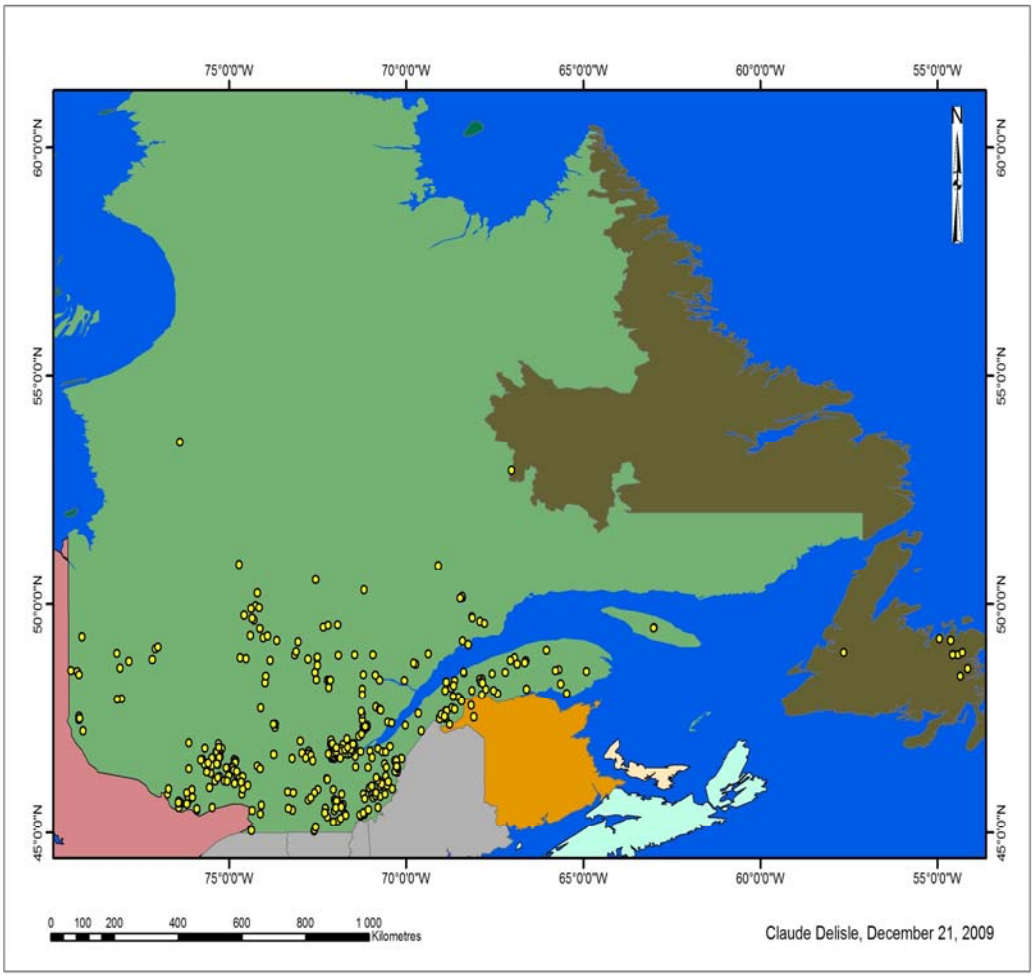

Figure 1. Location of the 535 LFC long-term forest research experimental sites

APPENDIX 1

APPENDIX 1
Alphabetical list of research projects

APPENDIX 2
Metadata for the research projects[1]

[1] The content of each description is entirely the responsibility of the person in charge of the project.

Acid Rain National Early Warning System (ARNEWS)

Abstract: Established in 1984, the acid rain national early warning system (ARNEWS) aimed to identify early signs of damage in Canada's forests and to monitor the evolution of vegetation and soil. In 1993, the number of parcels network ARNEWS was increased and the methods to assess the condition of the crowns were revised.

Objective(s): Detect early signs of damage from acid rain in Canada's forests and to monitor the evolution of vegetation and soil.

Comment(s):

Project status: Completed

Layout/design: Several plots in Quebec have been cut.

The methodology can be found in the following publications:

Magasi, L.P. 1988. Acid rain national early warning system: manual on plot establishment and monitoring. Canadian Forestry Service, Headquarters, Forest Science Directorate, Ottawa. Information Report DPC-X-25. 59 p.

Magasi, L.P. 1988. Dispositif national d'alerte rapide pour les pluies acides : guide pour l'établissement et la surveillance des parcelles. 1988. Service canadien des forêts, Administration centrale, Ottawa (Ontario). Rapport d'information DPC-X-25F. 59 p.

D'Eon, S.P., Magasi, L.P., Lachance, D. and DesRochers, P. 1993. ARNEWS: Canada's National Forest Health Monitoring Plot Network. Manual on Plot Establishment and Monitoring (Revised). Information Report Pi-X-117, Chalk River, Ontario, 95 pages.

D'Eon, S.P., Magasi, L.P., Lachance, D. and DesRochers, P. 1995. DNARPA, Réseau national de surveillance de l'état de santé des forêts au Canada : Guide d'établissement et de surveillance des parcelles (version revue). Rapport d'information Pi-X-117F, Chalk River, Ontario, 99 pages.

Study leader(s)

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Collaborator(s)

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- Hébert, Christian - Canadian Forest Service, Laurentian Forestry Centre
  - E-Mail: chhebert@rncan.gc.ca - Tel. (418) 648-5896 Ext.
- Lachance, Denis - Canadian Forest Service, Laurentian Forestry Centre
  - E-Mail: - Tel. Ext.

Species	• Conifers • Hardwoods
Treatment(s)	
Data activity	Inactive available - data set is static but available
Data stability	Very stable - data digitized recently; available in hard copy; well documented
Measurement(s)	• Age • Diameter at breast height (dbh) • Stem height • Soil measurement • Stem quality • Crown condition • Defoliation • Abiotic symptoms • Plant cover
Establishment year(s)	1985; 1993
Measurement year(s)	1985 - 1999
Treatment year(s)	
Data location	Virtual: pidesroc on s2-que-nas\perso$'\AnalyseDNARPA\données\ and Oracle database housed at AFC, Database National Forest Health (AFC).
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre
Metadata creation date	2008-02-05

Metadata
modification date

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administra-tive region	Design status	Plot integrity	Plot type	Comments
DNARPA - Parcelle 301 - Lac Misérable, Réserve faunique de Papineau-Labelle	Ripon	-75.39	46.14	360		Boreal Shield	Western sugar maple-yellow birch	15	Completed but watched			
DNARPA - Parcelle 302 - Lac des Sept Frères, Réserve faunique de Papineau-Labelle	Ripon	-75.26	46.24	305		Boreal Shield	Western sugar maple-yellow birch	15	Completed but watched			
DNARPA - Parcelle 303 - Lac des Sept Frères, Réserve faunique de Papineau-Labelle	Ripon	-75.26	46.24	300		Boreal Shield	Western sugar maple-yellow birch	15	Completed but watched			
DNARPA - Parcelle 304 - Lac aux Castors, Réserve faunique de Papineau-Labelle	Ripon	-75.13	46.15	275		Boreal Shield	Western sugar maple-yellow birch	07	Completed but watched			
DNARPA - Parcelle 305 - Lac Tremblant, Parc Provincial du Mont-Tremblant	Saint-Jovite	-74.61	46.23	305		Boreal Shield	Eastern sugar maple-yellow birch	15	Completed but watched			

DNARPA - Parcelle 306 - Lac du Chat, Parc Provincial du Mont-Tremblant	Saint-Jovite	-74.61	46.23	366	Boreal Shield	Eastern sugar maple-yellow birch	15	Completed but watched
DNARPA - Parcelle 307 - C.E.F. des Laurentides, Saint-Faus	Barkmere	-74.61	45.96	366	Boreal Shield	Western sugar maple-yellow birch	15	Completed but watched
DNARPA - Parcelle 308 - Oka, Parc Paul-Sauvé	Vaudreuil-Dorion	-74.11	45.42	120	Mixedwood Plains	Sugar maple-bitternut hickory	16	Completed but watched
DNARPA - Parcelle 312 - Mont St-Hilaire	Richelieu	-73.21	45.50	270	Mixedwood Plains	Sugar maple-bitternut hickory	16	Completed but watched
DNARPA - Parcelle 313 - Mont Sutton	Abercorn	-72.59	45.04	455	Atlantic Maritime	Eastern sugar maple-basswood	16	Completed but watched
DNARPA - Parcelle 314 - Perthuis	Saint-Raymond	-72.11	46.92	275	Boreal Shield	Eastern sugar maple-yellow birch	03	Completed but watched
DNARPA - Parcelle 315 - Dudswell	East Angus	-71.82	45.57	310	Atlantic Maritime	Eastern sugar maple-basswood	05	Completed but watched
DNARPA - Parcelle 316 - Rivière Pikauba	Stoneham	-71.26	47.65	790	Boreal Shield	Eastern balsam fir-white birch	03	Completed but watched

DNARPA - Parcelle 317 - Rivière Pikauba	Stoneham	-71.26	47.65	850	Boreal Shield	Eastern balsam fir-white birch	03	Completed but watched
DNARPA - Parcelle 319 - Mont Mégantic	Scotstown	-71.30	45.40	500	Atlantic Maritime	Eastern sugar maple-yellow birch	05	Completed but watched
DNARPA - Parcelle 320 - Mont Mégantic	Scotstown	-71.30	45.40	550	Atlantic Maritime	Eastern sugar maple-yellow birch	05	Completed but watched
DNARPA - Parcelle 321 - Mont Mégantic	Scotstown	-71.17	45.40	900	Atlantic Maritime	Eastern sugar maple-yellow birch	05	Completed but watched
DNARPA - Parcelle 322 - St-Hilaire-de-Dorset	La Guadeloupe	-70.93	45.77	520	Atlantic Maritime	Eastern sugar maple-yellow birch	05	Completed but watched
DNARPA - Parcelle 323 - Armagh	Montmagny	-70.57	46.76	335	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Completed but watched
DNARPA - Parcelle 324 - Parc du Bic	Le Bic	-68.87	48.31	170	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Completed but watched
DNARPA - Parcelle 325 - Rivière Patapédia	Rivière-Patapédia-Est	-67.86	48.02	425	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Completed but watched
DNARPA - Parcelle 326 - Albertville	Rivière-Patapédia-Est	-67.52	48.12	300	Atlantic Maritime	Eastern balsam fir-yellow birch	11	Completed but watched

DNARPA - Parcelle 327 - Parc de la Gatineau, Belvédère Huron	Heyworth	-75.91	45.50	330	Boreal Shield	Western sugar maple-basswood	07	Completed but watched
DNARPA - Parcelle 328 - Parc de la Gatineau, Lac la Pêche	North Onslow	-76.19	45.64	243	Boreal Shield	Western sugar maple-basswood	07	Completed but watched
DNARPA - Parcelle 329 - Maniwaki, Kitigan Zibi	Brodeur	-76.13	46.40	208	Boreal Shield	Western sugar maple-yellow birch	07	Completed but watched
DNARPA - Parcelle 330 - Saint-Félicien	Saint-Félicien	-72.58	48.51	366	Boreal Shield	Western balsam fir-white birch	02	Completed but watched
DNARPA - Parcelle 331 - Lac de la Loutre, Réserve faunique Ashuapmushuan	Girardville	-73.14	48.90	380	Boreal Shield	Western balsam fir-white birch	02	Completed but watched
DNARPA - Parcelle 332 - Lac Bluteau, Réserve faunique Ashuapmushuan	Girardville	-73.10	48.96	360	Boreal Shield	Western balsam fir-white birch	02	Completed but watched
DNARPA - Parcelle 333 - Lac Aigremont, Réserve faunique Ashuapmushuan	Roberval	-73.91	49.31	400	Boreal Shield	Western spruce-moss	02	Completed but watched
DNARPA - Parcelle 334 - Chibougamau	Chibougamau	-74.15	49.92	400	Boreal Shield	Western spruce-moss	10	Completed but watched

DNARPA - Parcelle 335 - Seigneurie Nicolas-Rioux, Lac Blanc	Saint-Valérien	-68.66	48.22	230		Atlantic Maritime	Eastern balsam fir-yellow birch	01	Completed but watched
DNARPA - Parcelle 336 - Seigneurie de Mitis, Lac des Quatre-Pattes	Les Hauteurs-de-Rimouski	-67.84	48.29	350		Atlantic Maritime	Eastern balsam fir-yellow birch	01	Completed but watched

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Canadian Carbon Program (FLUXNET)

Abstract

The major deliverable of the Canadian Carbon Program (CCP) is the development of a scientific network to reduce the uncertainty in estimating the carbon budget of Canada and North America at monthly to multi-annual time scales through a coordinated program of measurements and modelling. By evaluating the sensitivity of Canadian forests to climate and disturbances, we will also analyze and suggest ways to integrate the effects of climate variability into Canada's forest carbon accounting system and help develop a predictive capability for analyzing the effects of different climate scenarios on future carbon stocks. Working in close collaboration with our government partners (Natural Resource Canada's Canadian Forest Service, Environment Canada's Atmospheric Sciences and Technology Directorate, NOAA's Global Monitoring Division), we will measure ecosystem fluxes, atmospheric trace gas concentrations, and ecosystem component processes by using existing data of land surface properties from remote sensing and from forest inventories. We also expect to work in close collaboration with the US and Mexico within the framework of the North American Carbon Program (NACP). The combination of high-quality measurements and coordinated modelling within the CCP is essential to the development of a scientific network for an integrated carbon-cycle monitoring and prediction system for Canada.

Objective(s)

General objectives

The Canadian Carbon Program (CCP) is a national research network following in the footsteps of Fluxnet-Canada that brings together university and government scientists. The CCP aims to improve estimations of the carbon budget of Canada at monthly to multi-annual time scales through a coordinated program of measurements and modelling.

There are four major components to the CCP network:
- High-Precision Atmospheric Greenhouse Gas Concentration and Related Isotope Measurements
The CPP, in collaboration with Environment Canada, will measure carbon monoxide (CO), carbon dioxide (CO2) and methane (CH4) concentrations in three different ecosystems: Chibougamau (Quebec) in Eastern Canada, Prince Albert (Saskatchewan) in Central Canada, and Lac Labiche (Alberta) in Western Canada. These measurements will help reduce the uncertainty in the modelling of carbon budgets at regional, national and continental scales.

- Ecosystem Fluxes
The CCP will measure carbon, water and energy exchange in over 20 sites located in forest and peatland ecosystems in six different provinces so as to cover Canada's major vegetation types. These measurements will lead to a better understanding of a) the effects of climate on carbon sources and sinks; and b) the dynamics of carbon cycling in young and intermediate-aged forests as well as peatlands.

- Regional, National and Continental Scale Modelling of Carbon Sources and Sinks
The CCP will develop a modelling framework that will serve as the scientific foundation for an integrated carbon monitoring and prediction system for Canada and North America.

- Process Modelling to Support Forest Carbon Accounting and Management
The CCP will provide information on the impact of disturbances and climate on the carbon budget for integration into the CBM-CFS3 model, which forms the core module of Canada's National Forest Carbon Monitoring, Accounting and Reporting System (NFCMARS).

Specific objectives

Use the tower-based Eddy Covariance Technique to make continuous, multi-year measurements of CO2, water and sensible heat fluxes, and in some cases other GHGs, for mature and disturbed forest and peatland ecosystems along an east-west national transect that encompasses some of Canada's important ecoregions. We will examine the relationship between the interannual variability of carbon fluxes and climate; analyze the contribution of different ecosystem components to the net flux, particularly gross ecosystem production, total ecosystem respiration and soil respiration (microbes and roots); explore the relationship between net primary productivity and net ecosystem productivity; parameterize and evaluate ecosystem and land surface climate models.

Characterize relationships between climate variables (e.g. mean monthly temperature) and net ecosystem productivity on both disturbed and undisturbed sites.

Evaluate the relationship between the measurements of net ecosystem productivity from towers and the changes in carbon stocks measured by inventory and other biometric techniques over several years.

Use the knowledge gained in attaining the above objectives, combined with existing land-use data, to provide better first-order approximations of the total potential for carbon uptake, emission and sequestration by Canadian forests and peatlands at regional and national scales.

Train highly-qualified personnel, inform policy-makers and increase public understanding of carbon cycling sciences and issues.

Comment(s) The Canadian Carbon Program (2007-...) continues where the Fluxnet-Canada project (2000-2007) left off. Website: http://www.fluxnet-canada.ca/

Project status Active

Layout/design Background information for the Quebec flux station

Within eastern Canada's boreal forest, black spruce-feathermoss stands dominate much of the landscape. These stands sometimes include a significant quantity of jack pine. Located in a cool and humid climatic region, this flux station provides an interesting contrast to the stations located in black spruce stands in Saskatchewan and Manitoba. Until recently, the principal natural disturbance in black spruce - feathermoss stands was wildfire with return intervals ranging between 50 and 150 years. However, forest harvest activities in the boreal forest of eastern Canada have increased steadily over the past 30 years and are now a more common disturbance than fire for a significant portion of Quebec's boreal forest. This forest is a very important economic resource, supporting large industries based on the production of both construction lumber and pulp and paper products. In Quebec, the majority of forestry activities take place on crown lands. The provincial government provides a long-term lease to one or more forest companies who are then responsible for managing a given area on a sustained yield basis. With time, increasingly larger percentages of these areas become impacted by management activities and over the next 50 years, this percentage is expected to reach nearly 100%. Thus, developing a scientific foundation for the management of carbon in Canada's forests requires that we better understand how management activities influence the cycling and sequestration of carbon.

The forests in this region are undergoing constant changes due to silvicultural and harvesting strategies. Since 1990, cutting with protection of regeneration and soils (CPRS) has become the most common harvesting system. In a classic CPRS, logging equipment is

restricted to about 30% of the surface area so that the organic layer on the remaining 70% of the area is not disturbed. The skid trails are usually planted with seedlings that are smaller than the natural regeneration. When the amount of natural regeneration is not adequate, sites are either partially or totally scarified, then planted. While the impacts of these treatments on carbon cycling are not known, they are likely significant. A large challenge to understanding and predicting the overall effects of silvicultural treatments on carbon cycling in this region is that the effects are highly local, and are the result of the interaction among stand properties, site properties, climate and the type of silvicultural strategy used. Since the operational forestry procedures change with time, understanding how a specific treatment influences carbon exchange is not sufficient. Rather, there is a critical need to understand how harvesting treatments influence environmental variables in the region, and how these, in turn, influence photosynthesis, respiration, productivity and net carbon exchange.

The Quebec flux station will make long-term measurements of carbon exchange in a mature stand and a recent CPRS site (disturbed). Measurements of ecosystem components will allow us to understand and model the effects of harvest and climate. Eddy covariance measurements on the CPRS site began in August 2001 and measurements at the mature site (undisturbed) will begin in June 2003.

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Collaborator(s)

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Species

- Black spruce
- Jack pine

	• Spruce stand
Treatment(s)	
Data activity	Active regular - data set is updated regularly
Data stability	Very stable - data digitized recently; available in hard copy; well documented
Measurement(s)	• Forest inventory (National Forest Inventory) • Forest inventory (Permanent sample plot) • Forest inventory (Temporary sample plot) • Soil measurement • Photosynthesis • Soil properties • Micrometeorology • Root productivity • Soil respiration • Stem and branch respiration
Establishment year(s)	2000; 2003; 2007
Measurement year(s)	2000; 2003; 2006; 2007
Treatment year(s)	
Data location	U:\Ecosystemes Forestiers\Ecoleap\Fluxnet and P:\FLUXNET (S. Dagnault's personal disk on the LFC server)
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre
Metadata creation date	2008-01-14
Metadata modification date	2008-01-31

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administrative region	Design status	Plot integrity	Plot type	Comments
FLUXNET - Bloc 1 - HBS00	Chibougamau	-74.04	49.27	418	28	Boreal Shield	Western spruce-moss	02	Actively Managed	Good	Round (400 m²: 11.28 m radius)	Site: CPRS (cutting with protection of regeneration and soils, black spruce / pine) 7 plots Tower type: fixed telescopic tower Average air temperature: 0.0°C
FLUXNET - Bloc 2 - EOBS	Chibougamau	-74.34	49.69	402	78	Boreal Shield	Western spruce-moss	10	Actively Managed	Good	Round (400 m²: 11.28 m radius)	Site: mature forest of black spruce 12 plots Tower type: fixed scaffold Average temperature of the air: 0.0°C Annual precipitation averages 961.3 mm Type of vegetation: black spruce
FLUXNET - Bloc 3 - HBS75	Chibougamau	-74.57	49.76	395	50	Boreal Shield	Western spruce-moss	10	Actively Managed	Good	Round (400 m²: 11.28 m radius)	Site: black spruce harvested in 1975 10 plots Tower type: fixed scaffold

Publication(s) •

Comparison of Coleoptera assemblages from recently burned and unburned black spruce forests of northeastern North America

Abstract

Several insect groups have adapted to fire cycles in boreal forests and can efficiently use new habitats created by fire. Our study aimed at producing a first characterization of post-fire Coleoptera assemblages in black spruce forests of eastern North America. For two years, we sampled Coleoptera using flight-interception traps located in burned stands of contrasting ages and structures in a 5097-ha wildfire and in neighbouring unburned mature stands. More than 40 species were exclusively captured in burned stands. Time elapsed since fire and proximity of unburned forests were the most significant parameters affecting Coleoptera assemblages. Stand age and structure had limited effects on assemblage structure; the scolytid Polygraphus rufipennis Kirby was the only common species to clearly favour older stands. The fire-associated Coleoptera assemblages found in our study area were clearly distinct from those found in similar unburned stands; we should thus be conservative in our management approach concerning recently burned stands.

Objective(s) Produce a first characterization of post-fire Coleoptera assemblages in black spruce forests of eastern North America.

Comment(s) Keywords: Habitat selection; Fire-associated Coleoptera; Salvage logging

Project status Active

Layout/design Sampling was conducted in the Grands-Jardins Provincial Park (47°41' N, 70°43' W). It harbors the southernmost lichen woodland of eastern Canada, a legacy of its peculiar disturbance history (Payette et al., 2000a). This territory is especially fire-prone; recent fires have occurred within the park's boundaries or in its immediate vicinity in 1991 (2x), 1995, 1997 and 1999. Pure black spruce stands [Picea mariana (Mill.)] dominate the landscape, with the occasional presence of balsam fir [Abies balsamea (L.)], and tamarack [Larix laricina (Du Roi)], mostly in damp sites. We sampled insects in the 1999 burn during the summers of 2000 and 2001.

Study leader(s)

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- Saint-Germain, Michel -
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Collaborator(s)

Species

Treatment(s)

Data activity

Data stability

Measurement(s)	• Age • Diameter at breast height (dbh) • Stem height • Biomass
Establishment year(s)	1999
Measurement year(s)	1999; 2000; 2001; 2002; 2003; 2004
Treatment year(s)	
Data location	Room 1.24 at the LFC
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre
Metadata creation date	2009-02-10
Metadata modification date	

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administra-tive region	Design status	Plot integrity	Plot type	Comments
	Baie-Saint-Paul	-70.40	47.40	800		Boreal Shield	Eastern balsam fir-yellow birch	03	Actively Managed			

Publication(s)

• Saint-Germain, M. 2004. Comparison of Coleoptera assemblages from a recently burned and unburned black spruce forests of northeastern North America. Biological Conservation 118:583-592.

Developing a predictive model of the progression of damage caused by larvae of longhorned beetles in the wood after fire in the boreal forest

Abstract

In a situation where resource timber is increasingly rare, recovery of burned wood in recently burned areas would permit substantial harvesting to help maintain an adequate volume of wood for the forest industry. However, several species of pine sawyers are quickly attracted by the sudden availability of food and cause extensive damage to the wood by hollowing out many tunnels inside the stems. The lumber quality is strongly affected by the actions of these sawyers.

Objective(s)

To maximize salvaging of burned wood in the boreal forest, a forecasting model of the progression of damage caused by longhorn beetle larvae after the fire has passed will be developed. To achieve this, two objectives will be pursued.

Objective 1. Determine the attack periods of various species of longhorn beetles on trees burned vs. species (black spruce and jack pine) and fire severity (mild, moderate and severe).

Objective 2. Determine the growth rate of whitespotted sawyer larvae in wood burned at different temperatures.

Comment(s)

Project status

Active

Layout/design

Work in stands of black spruce and jack pine located in the regions most affected by fires will be completed in 2008, namely in the regions of Abitibi-Témiscamingue, Baie-James and north of Lac Saint-Jean.

Study leader(s)

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Species

Treatment(s)

Data activity

Data stability

Measurement(s) •

Establishment year(s)

Measurement year(s) 2008

Treatment year(s)

Data location

Contributor(s) to the creation of the metadata • Canadian Forest Service, Laurentian Forestry Centre

Metadata creation date 2009-02-04

Metadata modification date

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administra-tive region	Design status	Plot integrity	Plot type	Comments
Lac Peribonka, Feu 117 en 2008	Dolbeau	-71.18	50.32	430		Boreal Shield	Eastern spruce-moss	02	Actively Managed			

Publication(s)

Effect of site selection on white pine blister rust incidence

Abstract: This study began in 1994 by establishing the first plantation of white pine in the history of Newfoundland. In 1995, another 7 plantations followed in the Gander area, which is naturally conducive to white pine in this province. Surveys were conducted in 2000 and 2002 to monitor the incidence of blister rust. After 7 years, the incidence ranged from 6 to 100%, with an average of 54%, demonstrating that the type of terrain affected the rate of rust. Poor sites dominated by Kalmia had low rates of rust (but also a low growth rate for pine).

Objective(s): Determine the impact of the selection of terrain types on the incidence of white pine blister rust: composition of soil, surrounding vegetation, wealth, drainage, slope, orientation, elevation

Comment(s): New samples will be made in 2010 and 2015 to assess the rate of rust and the survival rate in a mature plantation. This should serve as an index of success of white pine plantation in Newfoundland. Note that almost all the fatal infections of rust occur before the age of 10 years.

Project status: Active

Layout/design: The plots are square. A random sampling of 100 trees was done on each site to assess the incidence of blister rust.

Study leader(s):
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Collaborator(s):

Species:
- Eastern white pine

Treatment(s):

Data activity: Active irregular - data set is updated on an irregular basis

Data stability: Very stable - data digitized recently; available in hard copy; well documented

Measurement(s):
- Stem mortality
- Infected stem incidence

Establishment year(s): 1994; 1995

Measurement year(s)	2000; 2002
Treatment year(s)	
Data location	Paper archives are located in room 2.21at the LFC
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre
Metadata creation date	2009-03-11
Metadata modification date	

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administra-tive region	Design status	Plot integrity	Plot type	Comments
Rouille - Soulis Pond	Campbellton	-54.28	48.95	60	1	Boreal Shield			Actively Managed	Average	Square (100 x 100 m)	
Rouille - Benton	Gander	-54.41	48.90	26	1	Boreal Shield			Actively Managed	Average	Square (100 x 100 m)	
Rouille - Burnt Lake	Gander	-54.62	49.22	58	1	Boreal Shield			Abandoned	Poor	Square (100 x 100 m)	
Rouille - Dildo Pond	Campbellton	-54.93	49.25	44	1	Boreal Shield			Actively Managed	Average	Square (100 x 100 m)	

Rouille - Gander 1	Gander	-54.56	48.91	100	1	Boreal Shield	Actively Managed	Average	Square (100 x 100 m)
Rouille - Gander 2	Gander Island Indian Reserve 14	-54.57	48.90	97	1	Boreal Shield	Actively Managed	Average	Square (100 x 100 m)
Rouille - Maccles Lake	Maccles	-54.13	48.60	126	1	Boreal Shield	Actively Managed	Average	Square (100 x 100 m)
Rouille - Terra Nova river	Walsh	-54.35	48.43	144	1	Boreal Shield	Abandoned	Poor	Square (100 x 100 m)

Publication(s)

Estimation of Northern Quebec's forest biomass using satellite imagery

Abstract	The objective of this project is to estimate the above-ground biomass at the northern limit of the merchantable forest. This project is connected to the EOSD (Earth Observation for Sustainable Development of Forests) and to the BIOMASS component. This project covers all of Canada and each research centre is responsible for part of the territory. The LFC was therefore given the mandate of developing estimating methods for the subarctic forest located in Northern Quebec. This forest is characterized mainly by black spruce stands with varying degrees of openness. The purpose of the series of plots is to represent the various types of stands found in the subarctic forest and a good variation in biomass. There is therefore a large degree of variation in the density, height and types of undergrowth. The research territories are in the areas of Fermont, Mistassini, LG3 (near Radisson) and Chibougamau.
Objective(s)	Estimation of the subarctic forest biomass using satellite data.
Comment(s)	
Project status	Completed
Layout/design	These are inventory plots similar to those of the MRNF, with some differences pertaining to minimum dbh. Plots have 400 m² (11.28 m radius) and include an inventory of all trees with a dbh greater than 5 cm. In small plots (4 m radius), all trees are inventoried. Some plots include study trees (approx. six per plot) for which dbh and height are measured. Plots have been indentified in a non-permanent manner.
Study leader(s)	• Guindon, Luc - Canadian Forest Service, Laurentian Forestry Centre - E-Mail: lguindon@nrcan.gc.ca - Tel. (418) 649-6131 Ext.
Collaborator(s)	• Beaudoin, André - Canadian Forest Service, Laurentian Forestry Centre - E-Mail: abeaudoin@rncan.gc.ca - Tel. (418) 648-3440 Ext.
Species	
Treatment(s)	
Data activity	Active irregular - data set is updated on an irregular basis
Data stability	Very stable - data digitized recently; available in hard copy; well documented
Measurement(s)	• Diameter at breast height (dbh)
Establishment year(s)	2002; 2008

Measurement year(s)	2002; 2008
Treatment year(s)	
Data location	Data can be found on the LFC's network. The first DB on data specific to the telegroup is entitled s-que-nas1:\\#archives\#archive_Terrain\ALL\Fusion_all_v6.mdb The second DB on inventory data (dbh, etc.) can be found in the common file U:\Ecosystemes Forestiers\Ecoleap\Biomasse_Subarctique\BD\BiomasseSubarctiqueEstCanada2004_v1.mdb
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre
Metadata creation date	2007-08-22
Metadata modification date	

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administrative region	Design status	Plot integrity	Plot type	Comments
Biomasse - Bloc 1 - Fermont	Fermont	-67.02	52.92			Boreal Shield	Forest-tundra	10	Completed but watched	Good	Round (400 m²: 11.28 m radius)	
Biomasse - Bloc 2 - LG3	Grande-Trois, La	-76.38	53.55			Taiga Shield	Forest-tundra	10	Completed but watched	Good	Round (400 m²: 11.28 m radius)	
Biomasse - Bloc 3 - Mine Troylus	Mistassini	-74.71	50.88			Boreal Shield	Western spruce-moss	10	Completed but watched	Good	Round (400 m²: 11.28 m radius)	

Biomasse - Bloc 4 - Chibougamau	Chibougamau	-74.29	49.66		Boreal Shield	Western spruce-moss	10	Completed but watched	Good	Round (400 m²: 11.28 m radius)	
Biomasse - Bloc 5 - Villebois	Villebois	-79.15	49.29	2	Boreal Shield	Western spruce-moss	08	Completed but watched	Good	Round (400 m²: 11.28 m radius)	These 50 plots are a temporary dbh inventory and some thickness measurements of organic matter. Connected to a radar project A. Beaudoin.

Publication(s)

- Leboeuf, A.; Beaudoin, A.; Fournier, R. A.; Guindon, L.; Luther, J. E.; Lambert, M.-C. 2007. A shadow fraction method for mapping biomass of northern boreal black spruce forests using QuickBird imagery. Remote Sensing of Environment. Volume 110, Issue 4. Pages 488-500.

Experiment on the eradication of the white pine weevil in Norway spruce and white pine plantations

Abstract

Several plantations were treated and others were used as controls. For the most part, these were private plantations. In the treated plantations, the leading shoots affected by the weevil were systematically eliminated and removed from the site. Two treatments were applied during the summer. The control plantations were not treated at all. The results clearly revealed that the method used was effective in limiting weevil populations in the treated plantations. Other plantations composed of known clones were monitored in order to test their resistance to weevils. These plantations were established by the CFS.

Objective(s)

Determine the effectiveness of plantation treatments against the white pine weevil.

Comment(s)

Leaflets were produced for external communications. See publications.

Project status

Completed

Layout/design

These are private plantations, the majority of which are monospecific. The main species studied are Norway spruce and white pine. Several Quebec sub-regions are being studied, the majority of which are located in the Beauce regions while others can be found in the Lower St. Lawrence region. There are seven treated and seven control plantations. A map makes it possible to locate all the plantations. For the resistance tests, an R is added at the end of the site's name.

Study leader(s)

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Collaborator(s)

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Species

- Eastern white pine
- Norway spruce
- White spruce

Treatment(s)

- Stems or affected branches elimination

Data activity

Inactive available - data set is static but available

Data stability

Moderately stable - data digitized recently; available in hard copy

Measurement(s)	• White Pine and Norway Spruce terminal leader affected by pine weevil
Establishment year(s)	1995
Measurement year(s)	1995 - 2002
Treatment year(s)	1996 - 2002
Data location	Paper archives are located in room 1.58 at the LFC and kept by Robert Lavallée. Electronic files can be found in the common file U:\Ecosystemes Forestiers\Charancon\CharlesCoulombe
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre
Metadata creation date	2008-02-11
Metadata modification date	

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administra-tive region	Design status	Plot integrity	Plot type	Comments
Charançon - 1 - La mignonne	Beauceville-Ouest	-70.83	46.21		0.44	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Abandoned	Unknown		Plantation of Norway spruce (1 200 plants). Control plantation. Plantation treated in 2001. There is a site map.
Charançon - 2 - EpO- Pib	Saint-Alfred	-70.80	46.15		3.4	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Abandoned	Unknown		Plantation of Norway spruce (4 800 plants) and white pine (1 200 plants) in rows. Plantation treated. There is a site map.

Charançon - 3 - Fleurie	Notre-Dame-des-Pins	-70.76	46.15	4.6	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Abandoned	Unknown	Plantation of Norway spruce (13 600 plants). Control treatment. There is a site map.
Charançon - 4 - Le petit Café	Saint-Côme--Linière	-70.69	46.08	2.3	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Abandoned	Unknown	Plantation of Norway spruce (4 500 plants). Control plantation, but treated in 2001 There is a site map.
Charançon - 5 - Ferme Poulin	Saint-Philibert	-70.50	46.13	2.5	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Abandoned	Unknown	Plantation of Norway spruce (4 900 plants). Plantation untreated, except in 2001. There is a site map.
Charançon - 6 - Groupement forestier Saint-Prospère	Saint-Cyprien	-70.24	46.33	2.5	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Abandoned	Unknown	Mixed plantations: Norway spruce, red spruce and white spruce, in block. 3900 seedlings of Norway spruce. Control plantation. There is a site map.
Charançon - 7 - Blaireau	Saint-Léon	-70.60	46.51	0.6	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Abandoned	Unknown	Plantation of Norway spruce (1 400 plants). Control plantation. There is a site map.
Charançon - 8 - L'érablière	Standon	-70.60	46.51	1.7	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Abandoned	Unknown	Plantation of Norway spruce (3 700 plants). Plantation treated. There is a site map.
Charançon - 9 - Ancien bûché, framboise	Saint-Elzéar	-71.07	46.44	2	Mixedwood Plains	Eastern sugar maple-yellow birch	12	Abandoned	Unknown	Plantation of Norway spruce (3 600 plants). Control plantation. There is a site map.
Charançon - 10 - Maison abandonnée	Saint-Cyprien	-70.31	46.34	2.3	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Abandoned	Unknown	Plantation of Norway spruce (5 000 plants). Plantation treated. There is a site map.

Charançon - 11 - Douche de rosée	Saint-Cyprien	-70.31	46.34	2.8	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Abandoned	Unknown	Plantation of Norway spruce (6 000 plants). Control plantation. There is a site map.
Charançon - 12 - Petits Chalets	Saint-Camille-de-Lellis	-70.23	46.42	2.2	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Abandoned	Unknown	Plantation of Norway spruce (5 600 plants). Control plantation. There is a site map.
Charançon - 13 - Groupement forestier Kamouraska	Sainte-Hélène-de-Kamouraska	-69.65	47.62	2.3	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Abandoned	Unknown	Plantation of Norway spruce (4 500 plants) Plantation treated. Some red spruce seedlings.
Charançon - 14 - La jumelle	Saint-Alfred	-70.80	46.15	3	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Abandoned	Unknown	Mixed plantation of Norway spruce (7 100 plants) and white spruce (2 700 plants). Plantation treated. There is a site map.
Charançon - E 407-TEC R	Saint-Gabriel-de-Valcartier	-71.50	46.93		Boreal Shield	Eastern sugar maple-basswood	03	Abandoned	Logged	Plantation of Norway spruce. 120 plants. Detailed map of the clonal park and sketches.
Charançon - E-767 R	Saint-Gabriel-de-Valcartier	-71.50	46.93	0.03	Boreal Shield	Eastern sugar maple-basswood	03	Abandoned		White pine plantation established in 1998. 270 seedlings at a spacing of 1 x 1 m Detailed map of the clonal park and sketches.
Charançon - Lac Biencourt Tc-407-I-1 R	Biencourt	-68.67	47.98		Atlantic Maritime	Eastern balsam fir-yellow birch	01	Abandoned		Plantation of Norway spruce established in 2001. Detailed map of the clonal park and sketches.

Publication(s)

- Archambault, L.; Morissette, J.; Lavallée, R.; Comtois, B. 1993. Susceptibility of Norway spruce plantations to white pine weevil attacks in southern Québec. Can. J. For. Res. 23: 2362-2369.
- Comtois, B.; Lavallée, R.; Morissette, J. 1989. Le charançon du pin blanc : un insecte à surveiller. L'Aubelle 69 : 10-15.
- Coulombe, C.; Bélanger, G.; Lavallée, R.; Laflamme, G.; Daoust, G. 2004. Un outil de contrôle simple et efficace contre le charançon et la rouille vésiculeuse du pin blanc. Développement économique Canada.
- Drouin, L.; Lavallée., R. 1989. La lutte contre le charançon : une leçon d'aménagement. La foresterie sans détour, Feuillet no 3. Ministère de l'Énergie et des Ressources. 4 p.

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- Lavallée, R.; Bonneau, G.; Coulombe, C. 1997. Mechanical and biological control of the white pine weevil. Natural Resources Canada, Laurentian Forestry Centre, Information Leaflet LFC 28.
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- Lavallée, R.; Morissette, J. 1989. Le contrôle mécanique du charançon du pin blanc. Forêts Canada. Feuillet d'information CFL 25. 9p.; 1989. Mechanical control of the white pine weevil. Forestry Canada, Information Leaflet LFC-25E. 9 p.

Extended COllaboration for Linking Ecophysiology and Forest Productivity (ECOLEAP)

Abstract

ECOLEAP (Extended Collaboration to Link Ecophysiology and Forest Productivity) is a multidisciplinary project that was launched by the Canadian Forest Service (CFS) in April 1996 with the aim of partially addressing these needs. Remote sensing, ecophysiology and modelling are among the disciplines used by the project research team.

Objective(s)

The goal of the ECOLEAP project is to identify the action of environmental factors (temperature, fertility, etc.) on the operating of physiological processes (photosynthesis, respiration, etc.) and to bind these factors to forestry productivity. The goal of the ECOLEAP (Extended COllaboration for Linking Ecophysiology And forest Productivity) project, initiated at the Canadian Forest Service's Laurentian Forestry Centre in 1996, is to develop new tools for estimating forest productivity, even for sites where routine calculations cannot be done.

Comment(s)

The ECOLEAP project initially included seven experimental sites. There are now only four active sites.The sites that have been excluded are Saint-Gilles, Duchesnay and Acadia. Websites: http://cfs.nrcan.gc.ca/news/173 and http://cfs.nrcan.gc.ca/subsite/ecoleap/home

Project status

Active

Layout/design

There are three types of plots in the ECOLEAP sites: "A" plots, "B" plots and "TRAME" plots.

"A" plots: these plots are rectangular and measure more or less 1000 m². Equipments such as a tower and scaffolding are located at the centre of the plot.

"B" plots: these plots are circular and measure 400 m² for conifer stands and 1000 m² for hardwood stands. In these plots, we harvest sample trees, we study crown architecture and measure foliar surface.

"TRAME" plots: these plots are rectangular and at their centre there is a structure called "Trame" that allows us to take LAI measurements. Dimensions vary according to stand height and slope.

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Species
- Fir forest
- Maple forest
- Spruce stand

Treatment(s)

Data activity: Active regular - data set is updated regularly

Data stability: Very stable - data digitized recently; available in hard copy; well documented

Measurement(s)
- Micrometeorology measurment tower
- Forest inventory (Permanent sample plot)
- Forest inventory (National Forest Inventory)
- Forest inventory (Temporary sample plot)
- Soil properties
- Photosynthesis

Establishment year(s): 1996 - 1998

Measurement year(s)	1996; 1997; 1999; 2001; 2002; 2006; 2007
Treatment year(s)	
Data location	U:\Ecosystemes Forestiers\Ecoleap\MÉTADONNÉES and Sébastien Dagnault's P disk P:\ECOLEAP\All Sites
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre
Metadata creation date	2008-01-14
Metadata modification date	2008-01-31

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administra-tive region	Design status	Plot integrity	Plot type	Comments
ECOLEAP - Bloc 1 - Forêt Montmorency	L'Étape	-71.10	47.31	834	5.5	Boreal Shield	Eastern balsam fir-white birch	03	Actively Managed	Good	Rectangular (1 000 m²)	- The plot of type "A" are rectangular plots of more or less 1 000 m². The parcels are intact and well marked. - The plot of type "FRAME" are rectangular from 1 to 5 hectares. They are well marked except for some plots.
ECOLEAP - Bloc 2 - Duchesnay	Sainte-Catherine-de-la-Jacques-Cartier	-71.67	46.94	278	7	Boreal Shield	Eastern balsam fir-yellow birch	03	Abandoned	Good	Rectangular (1 000 m²)	- The plot of type "A" are rectangular plots of more or less 1 000 m². The parcels are intact and well marked. - The plot of type "FRAME" are rectangular from 1 to 5 hectares. They are well marked except for some plots.

ECOLEAP - Bloc 3 - Lac de la Tirasse	Chibougamau	-73.65	49.21	434	4.5	Boreal Shield	Western spruce-moss	02	Actively Managed	Good	Rectangular (1 000 m²)	- The plot of type "A" are rectangular plots of more or less 1 000 m². The parcels are intact and well marked. - The plot of type "FRAME" are rectangular from 1 to 5 hectares. They are well marked except for some plots.
ECOLEAP - Bloc 4 - Green-River	Edmundston	-68.15	47.79	454	5.5	Atlantic Maritime			Actively Managed	Good	Rectangular (1 000 m²)	- The plot of type "A" are rectangular plots of more or less 1 000 m². The parcels are intact and well marked. - The plot of type "FRAME" are rectangular from 1 to 5 hectares. They are well marked except for some plots.
ECOLEAP - Bloc 5 - St-Gilles	Saint-Gilles	-71.42	46.44	171	20	Mixedwood Plains	Eastern sugar maple-basswood	12	Abandoned	Good	Rectangular (1 000 m²)	- The plot of type "A" are rectangular plots of more or less 1 000 m². The parcels are intact and well marked. - The plot of type "FRAME" are rectangular from 1 to 5 hectares. They are well marked except for some plots.

Publication(s)

- Affiches <http://scf.rncan.gc.ca/soussite/Ecoleap/affiches>
- Laroche, G.; Dagnault, S. 2000. Rapport d'inventaire des sites ECOLEAP. Rapport interne.
- Publications <http://scf.rncan.gc.ca/soussite/Ecoleap/publications>

Forest 2020: study of 50 hybrid poplar plantations

Abstract

Between August and December of 2004, a total of 50 hybrid poplar plantations, between the ages of 1 and 22 years, located on 32 different sites in Quebec were inventoried. This network of plantations and sample plots will eventually make it possible to monitor changes in carbon stocks. This report describes the sites studied, the methods used and presents the main results.

The results show the capacity of a fast-growing species, such as poplar, to quickly accumulate carbon (stems and roots), particularly between the ages of 10 and 20 years.

Carbon stocks in the first 40 cm of the soil do not show any significant trend based on age or type of cover (plantation vs. wildland), the average stock being 85 t C/ha in both cases. Coarse organic materials, living or dead, account for an average stock of 8 to 9 t C/ha, with higher values in the older plantations and in associated wildlands (~13 t C/ha).

After 3 years, carbon stocks in plantations reach values that are systematically higher than in wildlands. The difference is particularly significant starting at age 14-15 when the carbon contained in the tree biomass reaches values exceeding the threshold of 40 t C/ha.

Objective(s)

The purpose of the study conducted by the CFS-LFC was to characterize the changes in carbon stocks in hybrid poplar plantations established on old, non-regenerated agricultural land in Quebec. More specifically, the study first made it possible to evaluate the carbon content of the woody vegetation on reforested sites, and, for each plantation and wildland studied, the carbon content of the litter and soil was then evaluated and compared with similar land (wildland) that did not undergo any site preparation and that was not reforested.

Comment(s)

Project status

Completed

Layout/design

A total of 32 sites spread out in several regions of Quebec were selected for the needs of the study. Several of these sites presented a series of plantations varying in age and a total of 50 plantations were inventoried. The sites are located in 10 geographic regions in Quebec (see below). Nineteen of the sites (60%) are located in the southernmost regions of Quebec, representing 28 inventoried plantations out of 50 (56%). In fact, at the time of our study, the vast majority of the hybrid poplar plantations in Quebec were located in southern Quebec. However, it should be pointed out that this situation tends to change as adapted clones are being developed and also due to the greater availability of wildlands in the other regions. Given that we wanted to cover as much of Quebec as possible and obtain a variety of age groups, the proportion of the sampling per region is not exactly representative of the distribution of the plantations in these same regions.

Name of the region	Number of sites	Number of plantations inventoried
Montérégie	4	7
Lanaudière	1	1
Central Quebec	3	3
Eastern Townships	5	10
Quebec City	1	2
Chaudière-Appalaches	5	5
Charlevoix	1	1

Lower St. Lawrence	4	10
Saguenay	6	8
Abitibi	2	3
Total	32	50

In each of the 50 plantations selected, two plots were established in which we measured the tree vegetation. In these plots we also sampled the lower vegetation stratum, the litter and the soil to evaluate the carbon content. In a few plantations, more than two plots were established; however, after some testing, it was agreed that a total of two plots was sufficient for the study's purposes. In each of the plantations, a third plot (control wildland) was established in a non-reforested sector deemed to be the most representative of the initial state of each site before reforestation. In this plot, the lower vegetation stratrum, the litter and the soil were sampled in order to compare the carbon content with the reforested sector.

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Species

- Hybrid poplar

Treatment(s)

Data activity

Inactive available - data set is static but available

Data stability

Very stable - data digitized recently; available in hard copy; well documented

Measurement(s)

- Biomass
- Diameter at breast height (dbh)
- Stem height
- Forest inventory (Temporary sample plot)
- C and N pool
- Soil Carbon

Establishment year(s)	2004
Measurement year(s)	2004
Treatment year(s)	1983 - 2004
Data location	All digital files pertaining to this project are saved on the LFC common disk U:\Ecosystemes Forestiers\Ecoleap\RBoutin\C_Friches_Plantations\Forêt 2020
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre
Metadata creation date	2008-03-26
Metadata modification date	

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administrative region	Design status	Plot integrity	Plot type	Comments
Forêt 2020 - CFL-AT-AMOS-NO1	Amos	-78.08	48.61			Boreal Shield	Western balsam fir-white birch	08	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)	
Forêt 2020 - CFL-AT-ANG-NO	Angliers	-79.21	47.50			Boreal Shield	Western balsam fir-yellow birch	08	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)	

Forêt 2020 - CFL-BEL-AG1	Saint-Camille	-70.28	46.46	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-BEL-AG2	Saint-Camille	-70.26	46.45	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-BEL-LB2	Saint-Camille	-70.26	46.45	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-BEL-PP	Lac-Etchemin	-70.56	46.43	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-BEL-STA	Saint-Anselme	-70.96	46.65	Mixedwood Plains	Eastern sugar maple-basswood	12	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-BSL-STL	Sainte-Luce	-68.38	48.52	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-CDQ-ASJ1	Aston-Jonction	-72.23	46.18	Mixedwood Plains	Eastern sugar maple-basswood	17	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-CDQ-ASJ2	Aston-Jonction	-72.22	46.18	Mixedwood Plains	Eastern sugar maple-basswood	17	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)

Forêt 2020 - CFL-CDQ-SGG	Saint-Germain-de-Grantham	-72.58	45.88	Mixedwood Plains	Eastern sugar maple-basswood	17	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-CVX-LPF	Baie-Saint-Paul	-70.51	47.42	Boreal Shield	Eastern balsam fir-yellow birch	03	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-EST-SCH	Sainte-Catherine-de-Hatley	-72.05	45.24	Atlantic Maritime	Eastern sugar maple-basswood	05	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-EST-SFX	Saint-François-Xavier-de-Brompton	-72.02	45.50	Atlantic Maritime	Eastern sugar maple-basswood	05	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-EST-VGCC	Saint-Claude-Nord	-72.00	45.68	Atlantic Maritime	Eastern sugar maple-basswood	05	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-EST-WIN	Windsor	-71.98	45.55	Atlantic Maritime	Eastern sugar maple-basswood	05	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-EST-WINSP	Saint-Claude-Nord	-71.96	45.70	Atlantic Maritime	Eastern sugar maple-basswood	05	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-LAN-LAV	Lavaltrie	-73.34	45.90	Mixedwood Plains	Eastern sugar maple-basswood	14	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)

Forêt 2020 - CFL-LOTB-PLA	Lotbinière	-71.85	46.64	Mixedwood Plains	Eastern sugar maple-basswood	12	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-MTG-RIG	Rigaud	-74.35	45.50	Mixedwood Plains	Sugar maple-bitternut hickory	16	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-MTG-STH	Sainte-Hélène-de-Bagot	-72.76	45.72	Mixedwood Plains	Eastern sugar maple-basswood	16	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-MTG-STN	Saint-Nazaire	-72.69	45.77	Mixedwood Plains	Eastern sugar maple-basswood	17	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-MTG-STO	Saint-Ours	-73.19	45.88	Mixedwood Plains	Sugar maple-bitternut hickory	16	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-SAG-DD	Saint-François-de-Sales	-72.17	48.33	Boreal Shield	Western balsam fir-white birch	02	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-SAG-HPC	Saint-Fulgence	-70.87	48.45	Boreal Shield	Eastern balsam fir-yellow birch	02	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-SAG-MDG	Saint-François-de-Sales	-72.14	48.35	Boreal Shield	Western balsam fir-white birch	02	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)

Forêt 2020 - CFL-SAG-NORM	Normandin	-72.51	48.85	Boreal Shield	Eastern balsam fir-yellow birch	02	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-SAG-SHW	Shipshaw	-71.20	48.46	Boreal Shield	Eastern balsam fir-yellow birch	02	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-SAG-SJG	Chicoutimi	-70.75	48.35	Boreal Shield	Western balsam fir-white birch	02	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-TEM-FP	Cabano	-68.87	47.66	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-TEM-NO1	Cabano	-68.86	47.67	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)
Forêt 2020 - CFL-TEM-SED	Saint-Eusèbe	-68.92	47.55	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Hiatus	Average	Round (50 m²: 3.99 m radius, 100 m²: 5.64 m radius and 400 m²: 11.28 m radius)

Publication(s)

- Boutin, R.; Joncas, G.; Daoust, G. 2006. Évaluation des stocks de carbone dans des plantations de peupliers hybrides au Québec. Ressources naturelles Canada, Service canadien des forêts, Centre de foresterie des Laurentides. Document d'information.

Genetics, genomics and breeding

Abstract

Prior to the 1960s, forest geneticists from the Petawawa National Forestry Institute carried out research in the genetics and engineering of forest species in Quebec. This is how the first provenance tests were established, with the collaboration of the staff of the Canadian Forest Service in Quebec, the forest industry, the provincial government and Université Laval. Since the mid-1960s, following regionalization of the Canadian Forest Service, forest geneticists hired at the Laurentian Forestry Centre took charge of the program.

In any genetic engineering program, it is essential that introduction trials and studies of geographic variation in species of interest be carried out before undertaking the selection and crossbreeding program. This information is vital to the delineation of seed use areas, to the recommendation of the genetic stock most efficient for each area and to the identification of criteria to be used for selection and improvement. Subsequently, the implementation of genecological tests provides access to basic information needed to estimate genetic parameters, gains arising from the selection and the magnitude of genotype x environment interactions.

Black Spruce
A pan-federal test comprised of 100 sources was established by the CFS in the mid 1970s on six sites in Quebec. Data collected at the age of 16 years helped to delineate five improvement zones. Superior provenances were recommended for each zone. Thus, using the best sources translates into a gain in height from 6 to 15% versus local sources. Superior genotypes were selected from these best sources and were intercrossed. The seedlings obtained were multiplied by cuttings and genetic tests were introduced. New selections in these multi-family tests served to establish second generation seed orchards. Genecological tests including 90 families from 30 Quebec provenances were established in the late 1990s on three sites along a latitudinal gradient. The phenotypic and phenological data collected was used to construct a geoclimatic model to predict the adaptability of seed sources displaced from their place of origin to reforest sites elsewhere in Quebec.

White Spruce
About ten provenance tests established in the mid 1950s and mid 1960s have demonstrated the presence of significant geographic genetic variation in this species. The results showed the superiority of seed sources particularly from the Ottawa River valley. A number of provenances have been recommended for reforestation in Quebec. Volume gains resulting from the use of these sources are as high as 50% compared to the original Quebec sources tested in the same trials. Superior trees were selected in these tests. They were grafted and used in seed orchards. In addition, they were put in breeding arboretums to form part of the first generation breeding population. Eight genecological tests were developed during the 1970s and 1980s. The data collected helped to delimit two white spruce breeding areas in addition to providing the superior material necessary for the formation of a second generation of seed orchards and breeding populations. Studies of the potential impact of climate change on the adaptation of white spruce were also conducted using these experimental designs. Similarly, many studies on its wood properties were carried out thanks to tests in place, including a research program on diagnostic DNA markers for early selection.

Norway spruce
One hundred provenances have been tested in the southern Quebec area since the 1950s. The data collected served to subdivide the territory into three breeding zones. One dozen superior provenances were recommended for each zone. The superiority in volume of the recommended material is about 25 to 30% compared to all sources tested. Seed orchards were established by grafting the best individuals from the best performing provenances. These fulfil the province's needs in improved seed for reforestation. Studies have been conducted on the wood quality of this species, taking into account the damage caused by the white pine weevil. It turns out that the

mechanical properties of the wood are superior to those of white spruce, much like its superior yield due to a lesser stem curve.

White Pine
The research program started with a selection of superior individuals in the finest stands listed in Quebec by the Canadian Forest Service. A breeding arboretum was established using grafted copies of these individuals to form the first generation breeding population. Since then, two-parent families were created through controlled cross-breeding in the arboretum, and hybridization tests were established for the next phases of the improvement program. In addition, copies of these superior trees were used to establish first generation seed orchards. A genecological study of the white pine was initiated by the Canadian Forest Service in the mid 1980s. Height data was collected at the age of 10 years, which served to demonstrate the existence of a significant variation between the families and provenances tested. The genetic parameters were estimated and genetic gains of about 7.5% can be expected from the selection of families that make up the top 10% in superiority. The best individuals from fifty superior families were grafted to form the second improvement generation and advanced generation seed orchards. A breeding arboretum was installed and a controlled cross-breeding program began. Preliminary studies on wood quality were also initiated.

Objective(s)

The experimental softwood designs established under the Forest Genetics research program conducted by researchers at the Laurentian Forestry Centre were established to achieve the following objectives:
1) To determine, for each species, the geographic genetic variation of a set of adaptive and economic quantitative characteristics;
2) Determine the extent of "genotype x environment" interactions for the same characteristics in order to verify the phenotypic stability of various sources and families;
3) Assess the range of clonal variation in economic value characteristics among the same species;
4) Assess the impact of climate change on the adaptability of the various sources tested;
5) Assess the tolerance and/or resistance of the various sources and families to adverse biotic factors such as insects and diseases;
6) Assess the genetic parameters of these same characteristics so as to be able to evaluate collective gains from the selection of the best sources, families and individuals;
7) Provide the basic material for the selection of superior genotypes to make up the breeding populations of these species as well as populations for improved seed production (seed orchards).

Comment(s)

Project status

Active

Layout/design

The designs take on different shapes, dimensions and areas.

Study leader(s)

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Collaborator(s)

Species	• Black spruce • Eastern white pine • Norway spruce • White spruce
Treatment(s)	
Data activity	Active regular - data set is updated regularly
Data stability	Very stable - data digitized recently; available in hard copy; well documented
Measurement(s)	• Stem height • Diameter at breast height (dbh) • Height of infection
Establishment year(s)	1956 - 2007
Measurement year(s)	1971 - 2007
Treatment year(s)	1971 - 2007
Data location	Paper archives and maps are located in filing cabinets in room 1.28J at the LFC.
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre
Metadata creation date	2008-01-31
Metadata modification date	

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administrative region	Design status	Plot integrity	Plot type	Comments
Génétique - E. 57-B	Saint-Henri-de-Taillon	-71.92	48.88	122	0.58	Boreal Shield	Eastern balsam fir-yellow birch	02	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 1.5 x 1.5 m spacing. The plantation was established in 1956.
Génétique - E. 57-C	Saint-Roch-de-Mékinac	-72.75	46.78	183	1	Boreal Shield	Eastern sugar maple-yellow birch	04	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 1.5 x 1.5 m spacing. The plantation was established in 1957.
Génétique - E. 57-D	Sainte-Anne-de-la-Pocatière	-70.02	47.35	183	0.32	Mixedwood Plains	Eastern sugar maple-basswood	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 1.5 x 1.5 m spacing. The plantation was established in 1956.
Génétique - E. 57-E	Valcartier	-71.50	46.93	183	1.1	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies. The plantation was established in 1957.
Génétique - E. 57-G	Valcartier	-71.45	46.90	335	0.93	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 1.2 x 1.8 m spacing. The plantation was established in 1957.
Génétique - E. 57-H	Causapscal	-67.20	48.52	366	1	Atlantic Maritime	Eastern balsam fir-white birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 1.2 x 1.5 m spacing. The plantation was established in 1957.
Génétique - E. 93-E	Drummondville	-72.49	45.95	76	2.06	Mixedwood Plains	Eastern sugar maple-basswood	17	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.2 x 1.2 m spacing. The plantation was established in 1958.
Génétique - E. 93-F	Harrington	-74.63	45.85	183	1.2	Boreal Shield	Western sugar maple-yellow birch	15	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.2 x 1.2 m spacing. The plantation was established in 1958.

Génétique - E. 95-D	Saint-Gabriel-de-Valcartier	-71.50	46.93	183	1.56	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea rubens. The plantation was established in 1959.
Génétique - E. 95-E	Drummondville	-72.05	45.95	76	2.1	Mixedwood Plains	Eastern sugar maple-basswood	17	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea rubens. The plantation was established in 1959.
Génétique - E. 95-F	Lac-Mégantic	-70.78	45.57	457	2	Atlantic Maritime	Eastern sugar maple-yellow birch	05	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea rubens. The plantation was established in 1959.
Génétique - E. 96-C	Valcartier	-71.50	46.93	183		Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus resinosa. The plantation was established in 1958.
Génétique - E. 96-D	Harrington	-74.63	45.85	183		Boreal Shield	Western sugar maple-yellow birch	15	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus resinosa. The plantation was established in 1956.
Génétique - E.001-1	Grondines	-72.02	46.63	65	0.46	Mixedwood Plains	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 2 x 2 m spacing. The plantation was established in 2003.
Génétique - E.001-2	Saint-Côme	-70.53	46.05	330	0.062	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 2 x 2 m spacing. The plantation was established in 2003.
Génétique - E.002-1	Grondines	-72.02	46.63	65	0.37	Mixedwood Plains	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea mariana with a 2 x 2 m spacing. The plantation was established in 2003.
Génétique - E.002-2	Saint-Côme	-70.53	46.05	330	0.65	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea mariana with a 2 x 2 m spacing. The plantation was established in 2003.

Génétique - E.003-1	La Tuque	-73.98	48.30		0.8	Boreal Shield	Western balsam fir-white birch	04	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies et P. glauca with a 2 x 2 m spacing. The plantation was established in 2000.
Génétique - E.003-2	La Tuque	-74.52	48.82		0.8	Boreal Shield	Western spruce-moss	04	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies et P. glauca with a 2 x 2 m spacing. The plantation was established in 2000.
Génétique - E.003-3	La Tuque	-74.68	48.83		0.8	Boreal Shield	Western spruce-moss	04	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies et P. glauca with a 2 x 2 m spacing. The plantation was established in 2000.
Génétique - E.003-4	La Tuque	-73.83	48.78		0.8	Boreal Shield	Western balsam fir-white birch	02	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies et P. glauca with a 2 x 2 m spacing. The plantation was established in 2000.
Génétique - E.003-5	La Tuque	-73.97	48.43		0.8	Boreal Shield	Western balsam fir-white birch	04	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies et P. glauca with a 2 x 2 m spacing. The plantation was established in 2000.
Génétique - E.004-Anglier	Rouyn-Noranda	-79.23	48.47	308	34.8	Boreal Shield	Western balsam fir-white birch	08	Actively Managed	Good	Plots of variable form and size	The design is composed of P. abies, P. glauca and Populus sp. The planting was done in 2002.
Génétique - E.004-Duparquet	Témiscamingue	-79.23	47.55	283	34.8	Boreal Shield	Western balsam fir-yellow birch	08	Actively Managed	Good	Plots of variable form and size	The design is composed of P.abies, P.glauca et Populus sp. The plantation was established in 2002.
Génétique - E.004-Harricana	Amos	-77.83	48.76	305	34.8	Boreal Shield	Western balsam fir-white birch	08	Actively Managed	Good	Plots of variable form and size	The design is composed of P. abies, P. glauca and Populus sp. The planting was done in 2002.
Génétique - E.004-Tembec-Norbord	La Sarre	-79.28	48.53	276	34.8	Boreal Shield	Western balsam fir-white birch	08	Actively Managed	Good	Plots of variable form and size	The design is composed of P. abies, P. glauca and Populus sp. The planting was done in 2002.

Génétique - E.011-1	Mont-Laurier	-75.76	46.61	257	0.8	Boreal Shield	Western sugar maple-yellow birch	07	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea mariana with a 2 x 2 m spacing. The plantation was established in 2004.
Génétique - E.011-2	Saint-Mathieu-de-Rioux	-68.90	48.12	330	0.7	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea mariana with a 2 x 2 m spacing. The plantation was established in 2004.
Génétique - E.011-3	Mistissini	-72.55	50.54		0.7	Boreal Shield	Western spruce-moss	02	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea mariana with a 2 x 2 m spacing. The plantation was established in 2004.
Génétique - E.011-4	Baie-Saint-Paul	-70.85	47.76	745	0.63	Boreal Shield	Eastern balsam fir-white birch	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea mariana with a 2 x 2 m spacing. The plantation was established in 2004.
Génétique - E.011-5	Roberval	-72.53	48.36		0.66	Boreal Shield	Western balsam fir-white birch	02	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea mariana with a 2 x 2 m spacing. The plantation was established in 2004.
Génétique - E.011-6	Rouyn-Noranda	-79.47	48.55	330	0.72	Boreal Shield	Western balsam fir-white birch	08	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea mariana with a 2 x 2 m spacing. The plantation was established in 2004.
Génétique - E.011-7	Biencourt	-68.46	47.93			Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea mariana with a 2 x 2 m spacing. The plantation was established in 2006.
Génétique - E.011-8	Lac-Bouchette	-72.17	48.19			Boreal Shield	Western balsam fir-white birch	02	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea mariana with a 2 x 2 m spacing. The plantation was established in 2006.
Génétique - E.011-9	Lac-Bouchette	-65.68	48.57			Atlantic Maritime	Eastern balsam fir-white birch	11	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea mariana with a 2 x 2 m spacing. The plantation was established in 2006.

Génétique - E.012-1	Biencourt	-68.46	47.93			Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 2 x 2 m spacing. The plantation was established in 2006.
Génétique - E.012-2	Lac-Bouchette	-72.17	48.19			Boreal Shield	Western balsam fir-white birch	02	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 2 x 2 m spacing. The plantation was established in 2006.
Génétique - E.012-3	Carleton	-65.68	48.57			Atlantic Maritime	Eastern balsam fir-white birch	11	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 2 x 2 m spacing. The plantation was established in 2006.
Génétique - E.135-B	Drummondville	-72.05	45.95	76	0.41	Mixedwood Plains	Eastern sugar maple-basswood	17	Actively Managed	Good	Plots of variable form and size	The design is composed of P. glauca X sitchiensis with a 1.8 x 1.8 m spacing. The plantation was established in 1959.
Génétique - E.194-G	Harrington	-74.63	45.85	183	2.6	Boreal Shield	Western sugar maple-yellow birch	15	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.8 x 1.8 m spacing. The plantation was established in 1964.
Génétique - E.194-H	Mont-Laurier	-76.13	46.97	244	2.6	Boreal Shield	Western balsam fir-yellow birch	15	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.8 x 1.8 m spacing. The plantation was established in 1964.
Génétique - E.194-I-1	Saint-Jean-des-Piles	-72.75	46.73	152	1.9	Boreal Shield	Eastern sugar maple-yellow birch	04	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.8 x 1.8 m spacing. The plantation was established in 1964.
Génétique - E.194-I-2	Grandes-Piles	-72.68	46.70	183	1.1	Mixedwood Plains	Eastern sugar maple-yellow birch	04	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.8 x 1.8 m spacing. The plantation was established in 1965.
Génétique - E.194-I-3	Casey	-74.10	47.73	427	0.6	Boreal Shield	Western balsam fir-white birch	04	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.8 x 1.8 m spacing. The plantation was established in 1965.

Génétique - E.194-X-2	Saint-Gabriel-de-Valcartier	-71.50	46.93	183	0.3	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 2 x 2.5 m spacing. The plantation was established in 1977.
Génétique - E.200-M	Saint-Magloire	-70.32	46.58	640	0.18	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 1.2 x 1.2 m spacing. The plantation was established in 1961.
Génétique - E.253-F	Saint-Magloire	-70.32	46.58	640	0.19	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Actively Managed	Good	Plots of variable form and size	The design is composed of P.abies X asperata with a 1.2 x 1.2 m spacing. The plantation was established in 1961.
Génétique - E.277-D-1	Saint-Gabriel-de-Valcartier	-71.50	46.93	183	1	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 1.8 x 1.8 m spacing. The plantation was established in 1969.
Génétique - E.277-TC	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.18	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 2 x 2.25 m spacing. The plantation was established in 1992.
Génétique - E.292-P-1	Saint-Gabriel-de-Valcartier	-71.50	46.93	183	0.8	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.8 x 1.8 m spacing. The plantation was established in 1969.
Génétique - E.310-E-1	Valcartier	-71.52	46.95	274	1	Boreal Shield	Eastern balsam fir-yellow birch	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 1.8 x 1.8 m spacing. The plantation was established in 1969.
Génétique - E.320-C	Saint-Gabriel-de-Valcartier	-71.50	46.93	183	0.65	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 1.8 x 1.8 m spacing. The plantation was established in 1971.
Génétique - E.328-C	Valcartier	-71.52	46.95	274	0.4	Boreal Shield	Eastern balsam fir-yellow birch	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Abies spp. The plantation was established in 1971.

Génétique - E.348-C	Saint-Gabriel-de-Valcartier	-71.50	46.93	183	0.44	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.8 x 1.8 m spacing. The plantation was established in 1971.
Génétique - E.349-C-1	Valcartier	-71.58	46.85	152	0.97	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 1.8 x 2.4 m spacing. The plantation was established in 1976.
Génétique - E.349-C-2	Bonaventure	-65.46	48.05	213	0.97	Atlantic Maritime	Eastern balsam fir-yellow birch	11	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 1.8 x 2.4 m spacing. The plantation was established in 1976.
Génétique - E.349-C-3	Mont-Laurier	-75.80	46.60	244	0.97	Boreal Shield	Western sugar maple-yellow birch	07	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 2.4 x 2.4 m spacing. The plantation was established in 1976.
Génétique - E.350-D	Matapédia	-67.42	48.05	198	1.9	Atlantic Maritime	Eastern balsam fir-yellow birch	11	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 1.8 x 1.8 m spacing. The plantation was established in 1971.
Génétique - E.353-B-1	Mont-Laurier	-75.80	46.60	244	6.44	Boreal Shield	Western sugar maple-yellow birch	07	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea mariana..The plantation was established in 1974.
Génétique - E.353-B-2		-66.03	49.00	457	6.44	Atlantic Maritime	Eastern balsam fir-white birch	11	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea mariana. The plantation was established in 1974.
Génétique - E.353-B-3	Chibougamau	-74.25	49.97	366	6.44	Boreal Shield	Western spruce-moss	10	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea mariana. The plantation was established in 1974.
Génétique - E.353-B-4	Valcartier	-71.53	46.85	152	6.16	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea mariana. The plantation was established in 1975.

Génétique - E.384-B-1	Valcartier	-71.58	46.85	152	0.86	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 1.8 x 2.4 m spacing. The plantation was established in 1978.
Génétique - E.390-A-1	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	2.5	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 1.5 x 1.8 m spacing. The plantation was established in 1994.
Génétique - E.390-A-2	Armstrong	-70.38	45.97	400	3.6	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies. The plantation was established in 1994.
Génétique - E.390-A-3	Mont-Laurier	-75.69	46.51	250	3.6	Boreal Shield	Western sugar maple-yellow birch	15	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies. The plantation was established in 1994.
Génétique - E.390-A-TEC	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.3	Boreal Shield	Eastern sugar maple-basswood	03	Completed but watched	Logged	Plots of variable form and size	The design is composed of Picea abies with a 75 x 75 cm spacing. The plantation was established in 1994.
Génétique - E.390-B-1	Danville	-72.02	45.73	210	3.6	Atlantic Maritime	Eastern sugar maple-basswood	05	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies. The plantation was established in 1998.
Génétique - E.390-B-2	Harrington	-74.63	45.85	183	4.5	Boreal Shield	Western sugar maple-yellow birch	15	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies. The plantation was established in 1998.
Génétique - E.390-B-3	Béarn	-79.12	47.23	305	3.2	Boreal Shield	Western sugar maple-yellow birch	08	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies. The plantation was established in 1998.
Génétique - E.390-B-TEC	Harrington	-74.63	45.85		0.31	Boreal Shield	Western sugar maple-yellow birch	15	Completed but watched	Logged	Plots of variable form and size	The design is composed of Picea abies with a 75 x 75 cm spacing. The plantation was established in 1996.

Génétique - E.390-C-1	Rivière-Patapédia-Est	-67.74	48.15	416	4	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies. The plantation was established in 1992.
Génétique - E.390-C-2	Escuminac	-66.60	48.15	305	4	Atlantic Maritime	Eastern balsam fir-yellow birch	11	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies. The plantation was established in 1992.
Génétique - E.390-C-3	Biencourt	-68.52	47.97	305	4	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies. The plantation was established in 1992.
Génétique - E.390-C-TC1	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.2	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 1.5 x 1.3 m spacing. The plantation was established in 1995.
Génétique - E.390-C-TC2	Biencourt	-68.52	47.97	305	0.2	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 1.75 x 1.52 m spacing. The plantation was established in 1995.
Génétique - E.397-1	Amos	-77.83	48.76	305	1.1	Boreal Shield	Western balsam fir-white birch	08	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 2 x 2.5 m spacing. The plantation was established in 2000.
Génétique - E.397-2	Amos	-77.83	48.76	305	1.1	Boreal Shield	Western balsam fir-white birch	08	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 2 x 2.5 m spacing. The plantation was established in 2000.
Génétique - E.398-1	Mont-Tremblant	-74.13	49.47	395	0.2	Boreal Shield	Western spruce-moss	02	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 2 x 2 m spacing. The plantation was established in 1998.
Génétique - E.398-2	Chibougamau	-74.20	50.25	395	0.2	Boreal Shield	Western spruce-moss	10	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 2 x 2 m spacing. The plantation was established in 1998.

Génétique - E.398-3	Dolbeau-Mistassini	-71.93	49.55	275	0.2	Boreal Shield	Western balsam fir-white birch	02	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 2 x 2 m spacing. The plantation was established in 1998.
Génétique - E.399	Baie-Comeau	-68.40	49.20	200	0.12	Boreal Shield	Eastern balsam fir-white birch	09	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 1.5 x 1.3 m spacing. The plantation was established in 1995.
Génétique - E.404-1	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.04	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 75 x 75 cm spacing. The plantation was established in 1997.
Génétique - E.404-2	Saint-Claude	-72.00	45.68	240	0.04	Atlantic Maritime	Eastern sugar maple-basswood	05	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 75 x 75 cm spacing. The plantation was established in 1997.
Génétique - E.404-3	Biencourt	-68.52	47.97	305	0.04	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 75 x 75 cm spacing. The plantation was established in 1997.
Génétique - E.405-I-1	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.06	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 75 x 75 cm spacing. The plantation was established in 1997.
Génétique - E.405-I-2	Saint-Claude	-72.00	45.68	240	0.06	Atlantic Maritime	Eastern sugar maple-basswood	05	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 75 x 75 cm spacing. The plantation was established in 1997.
Génétique - E.405-I-3	Biencourt	-68.52	47.97	305	0.047	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 75 x 75 cm spacing. The plantation was established in 1997.
Génétique - E.405-II-A	Saint-Claude	-72.00	45.68	240	0.02	Atlantic Maritime	Eastern sugar maple-basswood	05	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 75 x 75 cm spacing. The plantation was established in 1999.

Génétique - E.405-II-B	Biencourt	-68.52	47.97	305	0.02	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 75 x 75 cm spacing. The plantation was established in 1999.
Génétique - E.405-II-C	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.02	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 75 x 75 cm spacing. The plantation was established in 1999.
Génétique - E.405-III	Edmundston	-68.08	47.53	420	0.54	Atlantic Maritime			Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 2 x 1.5 m spacing. The plantation was established in 1999.
Génétique - E.406-TC	Saint-Gabriel-de-Valcartier	-71.50	46.93	183	0.04	Boreal Shield	Eastern sugar maple-basswood	03	Completed but watched	Logged	Plots of variable form and size	The design is composed of Picea abies with a 1.8 x 1.8 m spacing. The plantation was established in 1996.
Génétique - E.407-I-1	Biencourt	-68.52	47.97	305	0.12	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 2 x 2 m spacing. The plantation was established in 2001.
Génétique - E.407-I-2	Saint-Vallier-Station	-70.78	46.83	91	0.12	Mixedwood Plains	Eastern sugar maple-basswood	12	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 2 x 2 m spacing. The plantation was established in 2001.
Génétique - E.407-I-3	Lac-Saint-Joseph	-71.65	46.85	152	0.12	Boreal Shield	Eastern balsam fir-yellow birch	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 2 x 2 m spacing. The plantation was established in 2001.
Génétique - E.408-II-1	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.4	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 1 x 2 m spacing. The plantation was established in 2006.
Génétique - E.408-TEC	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.22	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 75 x 75 cm spacing. The plantation was established in 1998.

Génétique - E.410-D-1	Mont-Laurier	-75.80	46.60	244	1	Boreal Shield	Western sugar maple-yellow birch	07	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.5 x 2.5 m spacing. The plantation was established in 1981.
Génétique - E.410-D-2	Rivière-Bleue	-69.05	47.52	259	2.83	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.5 x 2.5 m spacing. The plantation was established in 1980.
Génétique - E.410-D-3	Matapédia	-67.42	48.05	198	3.24	Atlantic Maritime	Eastern balsam fir-yellow birch	11	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.5 x 2.5 m spacing. The plantation was established in 1980.
Génétique - E.410-D-4	Mirabel	-74.08	45.62	61	3.9	Mixedwood Plains	Sugar maple-bitternut hickory	15	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.5 x 2.5 m spacing. The plantation was established in 1983.
Génétique - E.410-D-6	Saint-Edgar	-65.63	48.27	184	3.9	Atlantic Maritime	Eastern balsam fir-yellow birch	11	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.5 x 2.5 m spacing. The plantation was established in 1983.
Génétique - E.410-D-7	Fort-Coulonge	-76.73	45.85			Boreal Shield	Sugar maple-bitternut hickory	07	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.5 x 2.5 m spacing. The plantation was established in 1983.
Génétique - E.411-I-1	Sainte-Luce	-68.37	48.50	90	1.25	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 2.0 x 3.0 m spacing. The plantation was established in 2004.
Génétique - E.411-I-2	Saint-Benoît-Labre	-70.73	46.03	305	1.25	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 2.0 x 2.5 m spacing. The plantation was established in 2004.
Génétique - E.411-I-3	Murdochville	-65.78	48.55	420	1	Atlantic Maritime	Eastern balsam fir-white birch	11	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 2.0 x 2.0 m spacing. The plantation was established in 2004.

Génétique - E.411-I-4	Val-Brillant	-67.57	48.48	425	1.2	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 2.0 x 2.0 m spacing. The plantation was established in 2004.
Génétique - E.411-I-5	Maricourt	-72.27	45.53	130	1	Atlantic Maritime	Eastern sugar maple-basswood	05	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 2.0 x 2.5 m spacing. The plantation was established in 2004.
Génétique - E.411-I-TEC	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.16	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 1 x 1 m spacing. The plantation was established in 2002.
Génétique - E.412-TC	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.05	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 2 x 2 m spacing. The plantation was established in 2004.
Génétique - E.510-A-1	Valcartier	-71.52	46.95	274		Boreal Shield	Eastern balsam fir-yellow birch	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Pseudotsuga menziesii. The plantation was established in 1971.
Génétique - E.510-A-2	Matapédia	-67.42	48.05	198		Atlantic Maritime	Eastern balsam fir-yellow birch	11	Actively Managed	Good	Plots of variable form and size	The design is composed of Pseudotsuga menziesii. The plantation was established in 1971.
Génétique - E.520-A-1	Valcartier	-71.53	46.85	152	0.92	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Abies balsamea. The plantation was established in 1972.
Génétique - E.530-A-1	Valcartier	-71.53	46.85	152	1.68	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of P. glauca var. albertiana. The plantation was established in 1972.
Génétique - E.540-A-1	Valcartier	-71.53	46.85	152	0.2	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of P. mariana X rubens. The plantation was established in 1972.

Génétique - E.550-A-1	Valcartier	-71.58	46.85	152	0.45	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies with a 1.8 x 1.8 m spacing. The plantation was established in 1978.
Génétique - E.550-A-2	Chibougamau	-74.25	49.97	366	0.45	Boreal Shield	Western spruce-moss	10	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea abies. The plantation was established in 1978.
Génétique - E.560-A-1	La Patrie	-71.28	45.37	457	3.2	Atlantic Maritime	Eastern sugar maple-yellow birch	05	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.2 x 2.4 m spacing. The plantation was established in 1979.
Génétique - E.560-A-2	Dablon	-72.22	48.35	323	3.2	Boreal Shield	Western balsam fir-white birch	02	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.2 x 2.4 m spacing. The plantation was established in 1979.
Génétique - E.560-A-3	Saint-Alexis-des-Monts	-73.22	46.63	230	2.8	Boreal Shield	Eastern sugar maple-yellow birch	04	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.2 x 2.4 m spacing. The plantation was established in 1979.
Génétique - E.570-A	Saint-Eusèbe	-68.88	47.50	330	3	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 2 x 2 m spacing. The plantation was established in 1995.
Génétique - E.570-B	Saint-Marc-du-Lac-Long	-68.77	47.37	300	3	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 2 x 2 m spacing. The plantation was established in 1995.
Génétique - E.570-C	Saint-Charles-Garnier	-67.92	48.37	300	3	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 2 x 2 m spacing. The plantation was established in 1995.
Génétique - E.570-TC-A	Biencourt	-68.52	47.97	305	0.22	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.8 x 1.8 m spacing. The plantation was established in 1997.

Génétique - E.570-TC-B	Saint-Nicolas	-71.43	46.68	90	0.34	Mixedwood Plains	Eastern sugar maple-basswood	12	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 2 x 3 m spacing. The plantation was established in 1997.
Génétique - E.596	Béarn	-79.12	47.23	305	4.4	Boreal Shield	Western sugar maple-yellow birch	08	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus with a 1.8 x 1.8 m spacing. The plantation was established in 1997.
Génétique - E.600-I-1	Fort-Coulonge	-76.70	45.97	244	4.2	Boreal Shield	Western sugar maple-yellow birch	07	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus with a 2 x 3 m spacing. The plantation was established in 1986.
Génétique - E.600-II-1	Notre-Dame-du-Laus	-75.55	46.00	210	3.4	Boreal Shield	Western sugar maple-yellow birch	15	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus with a 2 x 2 m spacing. The plantation was established in 1988.
Génétique - E.600-II-2	Grand-Mère	-72.63	46.58	110	3.3	Mixedwood Plains	Eastern sugar maple-basswood	04	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus with a 2 x 2 m spacing. The plantation was established in 1988.
Génétique - E.600-II-3	Notre-Dame-du-Rosaire	-71.45	48.90	183	3.1	Boreal Shield	Western balsam fir-white birch	02	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus with a 2 x 2 m spacing. The plantation was established in 1988.
Génétique - E.600-II-4	Lévis	-71.02	46.78		2.2	Mixedwood Plains	Eastern sugar maple-basswood	12	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus with a 1.5 x 2 m spacing. The plantation was established in 1989.
Génétique - E.600-II-5R1	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.86	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus with a 1.5 x 1.3 m spacing. The plantation was established in 1989.
Génétique - E.600-II-5R2	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.48	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus with a 2 x 2 m spacing. The plantation was established in 1989.

Génétique - E.600-II-6	Saint-Valérien	-68.63	48.33	180	1.6	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus. The plantation was established in 1989.
Génétique - E.600-X	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.36	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus koraiensis with a 1.5 x 3.8 m spacing. The plantation was established in 1990.
Génétique - E.601-I-1	Saint-Casimir	-72.12	46.70	60	0.5	Mixedwood Plains	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus with a 2 x 2 m spacing. The plantation was established in 2001.
Génétique - E.601-I-2	Saint-Charles-Garnier	-67.89	48.31	427	0.64	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus with a 2 x 2 m spacing. The plantation was established in 2001.
Génétique - E.601-I-3	Saint-Fabien	-68.71	48.18	244	0.51	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus with a 2 x 2 m spacing. The plantation was established in 2001.
Génétique - E.601-II-1	Lévis	-71.02	46.78	80	0.64	Mixedwood Plains	Eastern sugar maple-basswood	12	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus with a 2 x 2 m spacing. The plantation was established in 2003.
Génétique - E.601-II-2	Valcourt	-72.28	45.54	250	0.84	Atlantic Maritime	Eastern sugar maple-basswood	05	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus with a 2 x 2 m spacing. The plantation was established in 2004.
Génétique - E.601-II-3	Mont-Laurier	-75.67	46.85	248	0.83	Boreal Shield	Western sugar maple-yellow birch	15	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus with a 2 x 2 m spacing. The plantation was established in 2004.
Génétique - E.601-TC	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.04	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus with a 2 x 2 m spacing. The plantation was established in 2002.

Génétique - E.602-I-1	Huntingdon	-74.37	45.05	61	0.75	Mixedwood Plains	Sugar maple-bitternut hickory	16	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus with a 2 x 2 m spacing. The plantation was established in 2003.
Génétique - E.602-I-2	Saint-Raymond	-71.77	46.87	152	0.6	Boreal Shield	Eastern balsam fir-yellow birch	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus with a 2 x 2 m spacing. The plantation was established in 2003.
Génétique - E.602-I-3	Mont-Laurier	-75.67	46.85	248	0.36	Boreal Shield	Western sugar maple-yellow birch	15	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus with a 2 x 2 m spacing. The plantation was established in 2004.
Génétique - E.603-I-1	Huntingdon	-74.37	45.05		0.25	Mixedwood Plains	Sugar maple-bitternut hickory	16	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus with a 2 x 2 m spacing. The plantation was established in 2003.
Génétique - E.603-I-2	Saint-Raymond	-71.77	46.87	152	0.25	Boreal Shield	Eastern balsam fir-yellow birch	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus with a 2 x 2 m spacing. The plantation was established in 2003.
Génétique - E.603-I-3	Mont-Laurier	-75.67	46.85	248	0.25	Boreal Shield	Western sugar maple-yellow birch	15	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus strobus with a 2 x 2 m spacing. The plantation was established in 2003.
Génétique - E.604-I-1	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.08	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus sp (exotiques) with a 2 x 2 m spacing. The plantation was established in 2004.
Génétique - E.604-I-2	Valcourt	-72.28	45.54	250	0.08	Atlantic Maritime	Eastern sugar maple-basswood	05	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus sp (exotiques) with a 2 x 2 m spacing. The plantation was established in 2004.
Génétique - E.604-I-3	Mont-Laurier	-75.67	46.85	248	0.08	Boreal Shield	Western sugar maple-yellow birch	15	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus sp (exotics) with a 2 x 2 m spacing. The plantation was established in 2004.

Génétique - E.605-I-1	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.09	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus sp (hybrids) with a 2 x 2 m spacing. The plantation was established in 2004.
Génétique - E.605-I-2	Valcourt	-72.28	45.54	250	0.07	Atlantic Maritime	Eastern sugar maple-basswood	05	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus sp (hybrids) with a 2 x 2 m spacing. The plantation was established in 2004.
Génétique - E.605-I-3	Mont-Laurier	-75.67	46.85	248	0.07	Boreal Shield	Western sugar maple-yellow birch	15	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus sp (hybrids) with a 2 x 2 m spacing. The plantation was established in 2004.
Génétique - E.605-I-4	Saint-Gabriel-de-Valcartier	-71.50	46.93	183	0.07	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus sp (hybrids) with a 2 x 2 m spacing. The plantation was established in 2003.
Génétique - E.605-II	Sainte-Foy	-71.28	46.78	99		Mixedwood Plains	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Pinus sp (hybrids). The plantation was established in 2005.
Génétique - E.767	Saint-Gabriel-de-Valcartier	-71.50	46.93	183	0.15	Boreal Shield	Eastern sugar maple-basswood	03	Completed but watched	Logged	Plots of variable form and size	The design is composed of Pinus strobus with a 1 x 1 m spacing. The plantation was established in 1996.
Génétique - E.800	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.13	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Larix sp (hybrids) et L. laricina with a 2 x 2 m spacing. The plantation was established in 1998.
Génétique - E.812-1	Saint-Gabriel-de-Valcartier	-71.47	46.95			Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Taxus canadensis. The plantation was established in 2002.
Génétique - E.813	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.007	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Taxus canadensis with a 1 x 1 m spacing. The plantation was established in 1997.

Génétique - E.900	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.07	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.5 x 1.5 m spacing. The plantation was established in 1995.
Génétique - E.940-C-TEC	Saint-Claude	-72.00	45.68	240	0.15	Atlantic Maritime	Eastern sugar maple-basswood	05	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 75 x 75 cm spacing. The plantation was established in 1997.
Génétique - E.941-A	Baie-Comeau	-68.24	49.12	200	1	Boreal Shield	Eastern balsam fir-white birch	09	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 2 x 2 m spacing. The plantation was established in 1995.
Génétique - E.941-B-TEC	Baie-Comeau	-68.24	49.12	200	0.4	Boreal Shield	Eastern balsam fir-white birch	09	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 2 x 2 m spacing. The plantation was established in 1995.
Génétique - E.941-C-TEC	Rivière-Sainte-Marguerite	-70.05	48.33	120	1	Boreal Shield	Eastern balsam fir-yellow birch	02	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 2 x 2 m spacing. The plantation was established in 1995.
Génétique - E.941-D-TEC	Les Escoumins	-69.73	48.70	460	1	Boreal Shield	Eastern balsam fir-white birch	09	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 2 x 2 m spacing. The plantation was established in 1995.
Génétique - E.951-A-TEC	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.12	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 75 x 75 cm spacing. The plantation was established in 1996.
Génétique - E.951-B	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.52	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.5 x 1.8 m spacing. The plantation was established in 1996.
Génétique - E.951-C	Matane	-66.93	48.83	400	1	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.75 x 2 m spacing. The plantation was established in 1997.

Génétique - E.951-D	Saint-Félicien	-72.52	48.83	120	1	Boreal Shield	Eastern balsam fir-yellow birch	02	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca. The plantation was established in 1997.
Génétique - E.951-E	Saint-Prosper	-70.57	46.25	330	1	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca. The plantation was established in 1997.
Génétique - E.951-F	Mont-Laurier	-75.32	46.72	270	1	Boreal Shield	Western sugar maple-yellow birch	15	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca. The plantation was established in 1997.
Génétique - E.951-G	Laverlochère	-79.23	47.47	270	1	Boreal Shield	Western balsam fir-yellow birch	08	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca. The plantation was established in 1997.
Génétique - E.952-A-1	Rivière-Bleue	-69.05	47.48	255	0.72	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca. The plantation was established in 1996.
Génétique - E.952-A-2	Cabano	-69.00	47.58	305	1.4	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca. The plantation was established in 1999.
Génétique - E.952-B-1	Saint-Rémi-de-Tingwick	-71.82	45.85	350	0.4	Atlantic Maritime	Eastern sugar maple-basswood	17	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca. The plantation was established in 1996.
Génétique - E.952-B-2	Windsor	-71.95	45.68	250	1.8	Atlantic Maritime	Eastern sugar maple-basswood	05	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca. The plantation was established in 1999.
Génétique - E.952-C	Rivière-du-Loup	-68.43	47.88	360	2.63	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca. The plantation was established in 1999.

Génétique - E.952-D	Saint-Casimir	-72.12	46.70	60	4.65	Mixedwood Plains	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 2 x 2 m spacing. The plantation was established in 1999.
Génétique - E.953-A	Rivière-du-Loup	-68.43	47.88	360	0.22	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.5 x 2 m spacing. The plantation was established in 1998.
Génétique - E.953-B	Saint-Michel-des-Saints	-73.73	46.72	470	0.23	Boreal Shield	Eastern sugar maple-yellow birch	14	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.5 x 2 m spacing. The plantation was established in 1999.
Génétique - E.953-C	Stoneham	-71.18	47.25	820	0.24	Boreal Shield	Eastern balsam fir-white birch	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.5 x 2 m spacing. The plantation was established in 1999.
Génétique - E.955-A	Rivière-du-Loup	-68.43	47.88	360	0.35	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.5 x 2 m spacing. The plantation was established in 1998.
Génétique - E.955-B	Danville	-72.02	45.73	210	0.41	Atlantic Maritime	Eastern sugar maple-basswood	05	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.5 x 2 m spacing. The plantation was established in 1998.
Génétique - E.955-X	Saint-Gabriel-de-Valcartier	-71.50	46.93	183	0.15	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 2 x 4 m spacing. The plantation was established in 1998.
Génétique - E.956-A	Sainte-Blandine	-68.13	48.12	360	0.4	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.8 x 1.8 m spacing. The plantation was established in 1998.
Génétique - E.956-B	Saint-Rémi-de-Tingwick	-71.82	45.85	350	0.4	Atlantic Maritime	Eastern sugar maple-basswood	17	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.8 x 1.8 m spacing. The plantation was established in 1998.

Génétique - E.956-C	Saint-Félicien	-72.50	48.67	120	0.4	Boreal Shield	Eastern balsam fir-yellow birch	02	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.8 x 1.8 m spacing. The plantation was established in 1998.
Génétique - E.970-A	Danville	-72.02	45.73	210	0.41	Atlantic Maritime	Eastern sugar maple-basswood	05	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.5 x 2 m spacing. The plantation was established in 1999.
Génétique - E.970-B	Saint-Michel-des-Saints	-73.73	46.72	470	0.8	Boreal Shield	Eastern sugar maple-yellow birch	14	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.5 x 2 m spacing. The plantation was established in 1999.
Génétique - E.970-C	Rivière-du-Loup	-68.43	47.88	360	0.9	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.5 x 2 m spacing. The plantation was established in 1999.
Génétique - E.971-A	Saint-Michel-des-Saints	-73.73	46.72	470	0.92	Boreal Shield	Eastern sugar maple-yellow birch	14	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.5 x 2 m spacing. The plantation was established in 1999.
Génétique - E.971-B	Mékinac	-72.98	47.00	310	1.12	Boreal Shield	Eastern sugar maple-yellow birch	04	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.5 x 2 m spacing. The plantation was established in 1999.
Génétique - E.972-A	Stoneham	-71.18	47.25	820	0.17	Boreal Shield	Eastern balsam fir-white birch	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.5 x 2 m spacing. The plantation was established in 1999.
Génétique - E.972-B	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.15	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a 1.5 x 2 m spacing. The plantation was established in 1999.
Génétique - E.973-A	Saint-Gabriel-de-Valcartier	-71.47	46.95	150	0.05	Boreal Shield	Eastern sugar maple-basswood	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea glauca with a variable spacing. The plantation was established in 2000.

Génétique - E.980-A	Saint-Hilaire-de-Dorset	-70.73	45.80	425	0.8	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea mariana. The plantation was established in 1999.
Génétique - E.980-B	Stoneham	-71.17	47.27	790	0.8	Boreal Shield	Eastern balsam fir-white birch	03	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea mariana with a 1.5 x 2 m spacing. The plantation was established in 1999.
Génétique - E.980-C	Chibougamau	-74.40	49.32	395	0.8	Boreal Shield	Western spruce-moss	10	Actively Managed	Good	Plots of variable form and size	The design is composed of Picea mariana. The plantation was established in 1999.

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Geographic biotype and host-associated local adaptation in a polyphagous species, Lambdina fiscellaria (Lepidoptera: Geometridae), feeding on balsam fir on Anticosti Island, Canada

Abstract

The debate about mechanisms underlying the evolution of host specialization by herbivorous insects remains open. Natural selection may act locally and lead to different patterns of geographic variation in life history traits of polyphagous herbivores. The hypothesis of genetically-based trade-offs in offspring performance on different hosts has been proposed, but this has rarely been demonstrated. Under laboratory conditions, the biological performance of two populations of the hemlock looper Lambdina fiscellaria (Guenée), a highly polyphagous lepidopteran, was compared when reared on three different tree host species: balsam fir, eastern hemlock and sugar maple. One population originated from Anticosti Island, Québec, Canada, where the insect has evolved without having access to two of the three tree species tested, the other being from the mainland where all tree species are present. When reared on balsam fir foliage, which was naturally available to each population, larvae from Anticosti Island underwent four instars compared with five for the mainland population, indicating the existence of geographic biotypes in L. fiscellaria. When reared on the foliage of non-naturally available host trees, larvae from Anticosti Island had a higher incidence of supernumerary instars. This is a unique example where local adaptation to environmental conditions of an insect herbivore is expressed through a different number of larval instars. Moreover, the Anticosti Island population showed a higher growth-related index on the host available to both populations, thus indicating that a fitness trade-off was the evolutionary process underlying the local adaptation of this population on balsam fir.

Objective(s) Testing the hypothesis of genetically-based trade-offs in offspring performance on different hosts.

Comment(s) Keywords: local adaptation, specialization, fitness trade-off, growth related index, geographic biotype, island ecology, geographic isolation

Project status Completed

Layout/design Hundreds of pupae were collected in a pure and mature balsam fir stand near Lac Princeton (49°52' N, 64°11' W) on Anticosti Island, hereinafter referred to as the island population. Emerging moths were reared in groups of 25-50 in screened Plexiglas cages (0.12 m^3) at 20°C, 45% RH and 16L : 8D photoperiod. An 8% sugar-water solution put in a vial plugged with cotton wool was provided to feed the moths, and balsam fir branches bearing lichens were added for oviposition. Female moths (n = 75) were collected with an insect net in a pure and mature balsam fir stand at Saint-Jacques-de-Leeds (46°17' N, 71°21' W), hereinafter referred to as the mainland population, and reared as described for the island population. Following the oviposition period, cages containing several thousand overwintering eggs of each population were placed in a field insectary. The following spring, at peak hatching (June 10), 225 larvae of each population were randomly selected and allocated to one of three groups of 75 that were fed on the foliage of balsam fir, eastern hemlock or sugar maple. Five trees from each species were selected and numbered prior to the beginning of the experiment near the St-Jacques-de-Leeds balsam fir stand where all tree species were found within a radius of 500 m. Therefore, each host tree treatment was replicated five times (15 larvae per population were reared on the foliage from each tree). Shoots bearing two or three young leaves of sugar maple or 1-yearold+ current-year needles of the two coniferous species were provided as food for the larvae. Throughout the experiment, larvae always received foliage from the same trees.

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	• Brodeur, Jacques - E-Mail:	- - Tel. Ext.
Species	• Balsam fir	
Treatment(s)		
Data activity		
Data stability		
Measurement(s)	•	
Establishment year(s)	1994	
Measurement year(s)	1994	
Treatment year(s)		
Data location		
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre	
Metadata creation date	2009-02-04	

Metadata
modification date

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administra-tive region	Design status	Plot integrity	Plot type	Comments
	Port-Menier	-63.01	49.48			Boreal Shield	Eastern balsam fir-white birch	09	Abandoned			

Publication(s)

- Hébert, C. 2006. Geographic biotype and host-associated local adaptation in a polyphagous species, Lambdina fiscellaria (Lepidoptera: Geometridae) feeding on balsam fir on Anticosti Island, Canada, Bulletin of Entomological Research 96:619-627.

Ice storm case study

Abstract

A major ice storm hit the south-western Quebec, eastern Ontario and some parts of the Maritime provinces in January 1998. This is the most devastating storm known to date. The purpose of this case study is to examine the impact of this storm on forests, their resilience and their capacity for recovery. This case study uses the knowledge and data accumulated over ten years in two networks of study places in forest health.

Objective(s)

1) examine the survival and restoration of trees and forest stands following the ice storm of 1998 according to the intensity of ice, the tree species in the stands, the inital state of the stand, and the ungoing stand management (NAMP);
2) Measuring changes in the damage and pest populations following ice storms, especially wood-boring tissues and bark;
3) Measure the change in growth based on the damage to trees and canopy forest opening;
4) Measuring changes in the regeneration following damage caused by ice and make assumptions about the evolution of stands;
5) Propose silvicultural interventions that can mitigate the impacts of an ice storm on the stands.

Comment(s)

Methodologies:

1) D'Eon, S.P., Magasi, L.P., Lachance, D. and DesRochers, P. 1995. DNARPA, Réseau national de surveillance de l'état de santé des forêts au Canada : Guide d'établissement et de surveillance des parcelles (version revue). Rapport d'information Pi-X-117F, Chalk River, Ontario, 99 pages.

2) Millers, I.; Lachance, D.; Burkman, W.G.; Allen, D.C. 1991. North American Sugar Maple Decline Project: Organization and Field Methods. USDA For. Serv. Northeast. For. Exp. Stn. Gen. Tech. Rep. NE-154/Forestry Canada. 26 p.

Project status

Completed

Layout/design

Quebec, New Brunswick, Ontario.

Methodologies:

1) D'Eon, S.P., Magasi, L.P., Lachance, D. and DesRochers, P. 1995. DNARPA, Réseau national de surveillance de l'état de santé des forêts au Canada : Guide d'établissement et de surveillance des parcelles (version revue). Rapport d'information Pi-X-117F, Chalk River, Ontario, 99 pages.

2) Millers, I.; Lachance, D.; Burkman, W.G.; Allen, D.C. 1991. North American Sugar Maple Decline Project: Organization and Field Methods. USDA For. Serv. Northeast. For. Exp. Stn. Gen. Tech. Rep. NE-154/Forestry Canada. 26 p.

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Species	• Conifers • Hardwoods
Treatment(s)	
Data activity	Inactive available - data set is static but available
Data stability	Very stable - data digitized recently; available in hard copy; well documented
Measurement(s)	• Diameter at breast height (dbh) • Crown condition • Seedlings inventorry • Plant cover • Lenght of live crown • Dieback • Transparency • Vigour • dbh five year increment
Establishment year(s)	1998
Measurement year(s)	1998 - 2002
Treatment year(s)	
Data location	Virtual: pidesroc on s2-que-nas\perso$' VERGLAS\Données\ and Oracle database housed at AFC, Database National Forest Health (AFC). Hard copy: 1-50. Paper archives located in identified filing cabinets.

Contributor(s) to the creation of the metadata
- Canadian Forest Service, Laurentian Forestry Centre

Metadata creation date 2001-01-21

Metadata modification date

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administrative region	Design status	Plot integrity	Plot type	Comments
Verglas - Numéro de grappe 1QU002 - Buckingham	Buckingham	-75.47	45.57			Boreal Shield	Sugar maple-bitternut hickory	07	Completed but watched			
Verglas - Numéro de grappe 1QU004 - Nord Duhamel (L. de la Grange)	Duhamel	-75.05	46.13			Boreal Shield	Western sugar maple-yellow birch	15	Completed but watched			
Verglas - Numéro de grappe 1QU006 - Rivière-à-Pierre (Perthuis)	Perthuis	-72.08	46.95			Boreal Shield	Eastern sugar maple-yellow birch	03	Completed but watched			
Verglas - Numéro de grappe 1QU010 - Notre-Dame-du-Rosaire (Montmagny)	Montmagny	-70.45	46.88			Atlantic Maritime	Eastern sugar maple-yellow birch	12	Completed but watched			
Verglas - Numéro de grappe 1QU012 - Auclair (Témiscouata)	Auclair	-68.63	47.70			Atlantic Maritime	Eastern balsam fir-yellow birch	01	Completed but watched			

Verglas - Numéro de grappe 1QU014 - Sutton Jonction	Sutton Junction	-72.55	45.13	Atlantic Maritime	Eastern sugar maple-basswood	16	Completed but watched
Verglas - Numéro de grappe 1QU016 - Valcourt	Valcourt	-72.30	45.45	Atlantic Maritime	Eastern sugar maple-basswood	05	Completed but watched
Verglas - Numéro de grappe 1QU018 - Brébeuf	Brébeuf	-74.65	46.12	Boreal Shield	Western sugar maple-yellow birch	15	Completed but watched
Verglas - Numéro de grappe 1QU020 - Sud St-Bruno (Lac-de-l'Est)	Lac-de-l'Est	-69.57	47.23	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Completed but watched
Verglas - Numéro de grappe 1QU022 - Milan	Milan	-71.07	45.52	Atlantic Maritime	Eastern sugar maple-yellow birch	05	Completed but watched
Verglas - Numéro de grappe 1QU024 - Sainte-Praxède	Sainte-Praxède	-71.17	45.75	Atlantic Maritime	Eastern sugar maple-yellow birch	05	Completed but watched
Verglas - Numéro de grappe 2QU001 - N-O Hull (Parc Gatineau)	Heyworth	-75.90	45.53	Boreal Shield	Western sugar maple-basswood	07	Completed but watched
Verglas - Numéro de grappe 2QU003 - Sud Kiamika (Lac Misérable, Parc Papineau-Labelle)	Duhamel	-75.32	46.22	Boreal Shield	Western sugar maple-yellow birch	15	Completed but watched

Verglas - Numéro de grappe 2QU005 - Rivière-à-Pierre (Perthuis)	Perthuis	-72.10	46.95	Boreal Shield	Eastern sugar maple-yellow birch	03	Completed but watched
Verglas - Numéro de grappe 2QU007 - Saint-Hilaire-de-Dorset	Saint-Hilaire-de-Dorset	-70.87	45.82	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Completed but watched
Verglas - Numéro de grappe 2QU009 - Notre-Dame-du-Rosaire (Montmagny)	Montmagny	-70.45	46.88	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Completed but watched
Verglas - Numéro de grappe 2QU011 - Auclair (Témiscouata)	Auclair	-68.70	47.73	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Completed but watched
Verglas - Numéro de grappe 2QU013 - Sutton	Sutton	-72.58	45.07	Atlantic Maritime	Eastern sugar maple-basswood	16	Completed but watched
Verglas - Numéro de grappe 2QU015 - Magog (Parc Mont Orford)	Magog	-72.22	45.35	Atlantic Maritime	Eastern sugar maple-basswood	05	Completed but watched
Verglas - Numéro de grappe 2QU017 - Saint-Faustin (C.E.F. Laurentides)	Saint-Faustin	-74.47	46.05	Boreal Shield	Eastern sugar maple-yellow birch	15	Completed but watched
Verglas - Numéro de grappe 2QU019 - Sud Saint-Bruno (Lac-de-l'Est)	Lac-de-l'Est	-69.57	47.23	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Completed but watched

Verglas - Numéro de grappe 2QU021 - La Patrie (Mont-Mégantic)	La Patrie	-71.20	45.45		Atlantic Maritime	Eastern sugar maple-yellow birch	05	Completed but watched
Verglas - Numéro de grappe 2QU023 - Sainte-Praxède (Parc Frontenac)	Sainte-Praxède	-71.20	45.85		Atlantic Maritime	Eastern sugar maple-yellow birch	12	Completed but watched
Verglas - Parcelle 301 - Lac Misérable, Réserve faunique de Papineau-Labelle	Notre-Dame-du-Laus	-75.39	46.14	360	Boreal Shield	Western sugar maple-yellow birch	15	Completed but watched
Verglas - Parcelle 302 - Lac des Sept Frères, Réserve faunique de Papineau-Labelle	Duhamel	-75.26	46.24	305	Boreal Shield	Western sugar maple-yellow birch	15	Completed but watched
Verglas - Parcelle 303 - Lac des Sept Frères, Réserve faunique de Papineau-Labelle	Duhamel	-75.26	46.24	300	Boreal Shield	Western sugar maple-yellow birch	15	Completed but watched
Verglas - Parcelle 305 - Lac Tremblant, Parc Provincial du Mont-Tremblant	Mont-Tremblant	-74.61	46.23	305	Boreal Shield	Eastern sugar maple-yellow birch	15	Completed but watched
Verglas - Parcelle 306 - Lac du Chat, Parc Provincial du Mont-Tremblant	Mont-Tremblant	-74.61	46.23	366	Boreal Shield	Eastern sugar maple-yellow birch	15	Completed but watched

Verglas - Parcelle 307 - C.E.F. des Laurentides, Saint-Faustin	Saint-Faustin	-74.61	45.96	366	Boreal Shield	Western sugar maple-yellow birch	15	Completed but watched
Verglas - Parcelle 308 - Oka, Parc Paul-Sauvé	Oka	-74.11	45.42	120	Mixedwood Plains	Sugar maple-bitternut hickory	16	Completed but watched
Verglas - Parcelle 312 - Mont Saint-Hilaire	Richelieu	-73.21	45.50	270	Mixedwood Plains	Sugar maple-bitternut hickory	16	Completed but watched
Verglas - Parcelle 313 - Mont Sutton	Sutton	-72.59	45.04	455	Atlantic Maritime	Eastern sugar maple-basswood	16	Completed but watched
Verglas - Parcelle 314 - Perthuis	Perthuis	-72.11	46.92	275	Boreal Shield	Eastern sugar maple-yellow birch	03	Completed but watched
Verglas - Parcelle 315 - Dudswell	Dudswell	-71.82	45.57	310	Atlantic Maritime	Eastern sugar maple-basswood	05	Completed but watched
Verglas - Parcelle 319 - Mont Mégantic	La Patrie	-71.30	45.40	500	Atlantic Maritime	Eastern sugar maple-yellow birch	05	Completed but watched
Verglas - Parcelle 320 - Mont Mégantic	La Patrie	-71.30	45.40	550	Atlantic Maritime	Eastern sugar maple-yellow birch	05	Completed but watched
Verglas - Parcelle 321 - Mont Mégantic	La Patrie	-71.17	45.40	900	Atlantic Maritime	Eastern sugar maple-yellow birch	05	Completed but watched

Verglas - Parcelle 322 - Saint-Hilaire-de-Dorset	Saint-Hilaire-de-Dorset	-70.93	45.77	520		Atlantic Maritime	Eastern sugar maple-yellow birch	05	Completed but watched
Verglas - Parcelle 323 - Armagh	Armagh	-70.57	46.76	335		Atlantic Maritime	Eastern sugar maple-yellow birch	12	Completed but watched
Verglas - Parcelle 324 - Parc du Bic	Le Bic	-68.87	48.31	170		Atlantic Maritime	Eastern balsam fir-yellow birch	01	Completed but watched
Verglas - Parcelle 325 - Rivière Patapédia	Rivière-Patapédia-Est	-67.86	48.02	425		Atlantic Maritime	Eastern balsam fir-yellow birch	01	Completed but watched
Verglas - Parcelle 327 - Parc de la Gatineau, Belvédère Huron	Heyworth	-75.91	45.50	330		Boreal Shield	Western sugar maple-basswood	07	Completed but watched
Verglas - Parcelle 328 - Parc de la Gatineau, Lac la Pêche	Pontiac	-76.19	45.64	243		Boreal Shield	Western sugar maple-basswood	07	Completed but watched
Verglas - Parcelle 329 - Maniwaki, Kitigan Zibi	Maniwaki	-76.13	46.40	208		Boreal Shield	Western sugar maple-yellow birch	07	Completed but watched
Verglas - Parcelle 332 - Lac Bluteau, Réserve faunique Ashuapmushuan	Roberval	-73.10	48.96	360		Boreal Shield	Western balsam fir-white birch	02	Completed but watched
Verglas - Parcelle 335 - Seigneurie Nicolas-Rioux, Lac Blanc	Esprit-Saint	-68.66	48.22	230		Atlantic Maritime	Eastern balsam fir-yellow birch	01	Completed but watched

Verglas - Parcelle 336 - Seigneurie de Mitis, Lac des Quatre Pattes	Les Hauteurs-de-Rimouski	-67.84	48.29	350	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Completed but watched
Verglas - Verglas - Numéro de grappe 1QU008 - Saint-Hilaire-de-Dorset	Saint-Hilaire-de-Dorset	-70.85	45.88		Atlantic Maritime	Eastern sugar maple-yellow birch	12	Completed but watched
Verglas - X12 - Satelite, Mont Saint-Hilaire	Richelieu	-73.21	45.50		Mixedwood Plains	Sugar maple-bitternut hickory	16	Completed but watched
Verglas - X24 - Satelite, Mont Saint-Bruno	Saint-Bruno	-73.32	45.55		Mixedwood Plains	Sugar maple-bitternut hickory	16	Completed but watched
Verglas - Y12 - Satelite, Parc du Bic	Le Bic	-68.87	48.31		Atlantic Maritime	Eastern balsam fir-yellow birch	01	Completed but watched

Publication(s)

- DesRochers, P. 1999. Dommages causés par le verglas dans les érablières exploitées pour le sucre et les forêts naturelles du Projet Nord-Américain de l'Érable (NAMP). <http://www.centreacer.qc.ca/publications/colloques/1999/idxcol99.html>. Résumé.
- DesRochers, P. 2005. Ice Damage and Management of Maple Stands. Research note. Canadian Forest Service, Laurentian Forestry Centre. 4 p.
- DesRochers, P. 2005. Verglas et aménagement des érablières. Note de recherche. Service canadien des forêts, Centre de foresterie des Laurentides. 4 p.
- DesRochers, P. 2005. Verglas et forêts : reprise et mesures d'atténuation. Verglas et forêt : Qu'en est-il cinq ans plus tard? Actes du colloque tenu à Sherbrooke, 28-30 janvier 2003. Centre Acer. Pages 35-44. < http://www.centreacer.qc.ca/publications/colloques/2003/idxcol03.html>
- DesRochers, P., coord. 1999. La tempête de verglas de 1998. Pages 32-33 dans L'État de la santé des forêts au Canada : Un sommaire 1998. Réseau sur la santé des forêts, Service canadien des forêts, Ressources Naturelles Canada, Fredericton, N.-B.
- DesRochers, P.; Allen, D.C. 2001. Impact of the January 1998 Ice Storm on Some Maple Stands in the North American Maple Project. Proceedings, New York Society of American Foresters Ice Storm Symposium, January 29, 1999, Cortland, New York. USDA Forest Service, Northeastern Area, Report NA-TP-03-01. Pages 41-59.
- Turbis, C.; DesRochers, P.; Rioux, D. 2007. La santé et l'aménagement des érablières - L'aménagement des érablières : des choix pour l'avenir. Partenariat Innovation Forêt, Fiche technique 4, Progrès Forestier, février 2007. Pages 24-25.

Impact of different silvicultural scenarios, 20 years after cutting, on the diversity and abundance of Coleoptera and ant species in ecosystem-based management

Abstract

In ecosystem management, it is important to acquire the knowledge necessary to maintain the biodiversity of forest ecosystems. The balsam fir-white birch stand is a boreal ecosystem that is affected by numerous natural disturbances that give it large quantities of woody debris. This debris is important because it is involved in many ecological functions and it provides significant quantities of microhabitats for saproxylic organisms, including many insects, that depend on dead wood to complete at least part of their life cycle. The presence of dead wood, in all stages of degradation, is a characteristic attribute of natural forests. The overall objective of the project is to evaluate whether the different scenarios used in this forest ecosystem maintain this natural variability in woody debris, a key attribute for the maintenance of insect diversity (beetles, ants). The experimental design is composed of three silvicultural treatments and a control repeated five times. At each site, three multidirectional barrier traps and 12 pitfall traps were installed. The results expected are that saproxylic species associated with recent woody debris will be more abundant and diverse in natural forest since there is a continual presence of recently dead wood.

Objective(s)

Stands affected by the last spruce budworm epidemic, the leading natural disturbance regime in balsam fir-white birch stands, represent the benchmark of the ecosystem under study. The overall objective is to assess whether the various silvicultural scenarios being used in this ecosystem maintain, within their limits of natural variability (a fundamental concept of ecosystem-based management), the quantity and quality of woody debris, a key attribute for the maintenance of insect diversity. Thus, the objectives of this research project are:
1) to compare the diversity and structural abundance imparted by deadwood in different silvicultural scenarios;
2) to characterize the entomological diversity associated with different silvicultural scenarios, especially saproxylic beetle and ant communities; and
3) related to work on polypores - woody debris.

Comment(s)

Project status

Active

Layout/design

The study sites are all located in the ecological boreal eastern fir-yellow birch subdomain (Grondin et al., 1996 in Bélanger, 2001). The developed areas are located in the Montmorency forest and in the Laurentian Wildlife Reserve stands, while control stands are in Jacques Cartier Provincial Park. As this is a protected area, there are still balsam fir - white birch stands affected by the latest spruce budworm infestation that have not recovered. This is therefore the closest ecologically-comparable area to the silvicultural treatments.

The area studied has a rugged terrain, characterized by a plateau at an altitude of about 750 m with hills reaching up to 1000 m (Bélanger, 2001). The different sites are subjected to a cold climate and high humidity. Average annual temperatures are 0.3°C and precipitation is known to be among the largest in the province, with 1,527 mm (1/3 as snow) (Environment Canada, 1993 in Bélanger, 2001).

Silvicultural treatments
The various study sites were subjected to 4 treatments with 5 replicas/treatment each time:
- Severe spruce budworm infestation;
- Logging with protection of regeneration and soil (CPRS) without any other intervention;
- CPRS + pre-commercial thinning (PCT);

- CPRS with planting of black spruce (EPN) + mechanical cleaning.

A total of 20 sites have been studied in which three plots were established (60 plots in total). Each circular plot was 400 m² (11.28 m radius) and distanced at least 50 meters from the next.

Beetle inventory
Insects were sampled using multidirectional traps and pitfall traps. The multidirectional trap is a method widely used in literature and characterized by its ability to obtain both quantitative and qualitative data on saproxylic beetles in different forest environments (Okland 1996, St-Germain et al. 2004a). In addition, pitfall traps are a very widely used method in entomological inventory which makes it possible to capture insects moving on the soil surface including ground beetles which are considered to be good bioindicators of environmental conditions (Hebert 2000; Latty et al. 2006). The traps were screened to avoid trapping micromammals which were the subject of another study. In each plot, a multidirectional trap was placed at the centre and 4 pitfall traps were placed at 7 m from the central trap, forming a square measuring 10 m long on each side.

Inventory of beetles in polypores
Samples of Fomitopsis pinicola will be taken in spring 2009 and will be placed in Berlèse funnels to recover the insect fauna that is associated with them. Five fungi will be sampled in each plot from different debris in each of the stands (300 total fungi). The debris from which the fungi will be collected will be selected randomly from the inventory of woody debris carried out during the summer of 2008. All of the data characterizing the woody debris will be available as well as the height of the fungi sampled which we measure during sampling on the ground. In the laboratory, several variables will be determined on each fungi: age, hymenium surface, volume, mass, moisture and signs of insects.

Inventory of woody debris
An inventory of woody debris was carried out during the summer of 2008 to characterize the forest structure. Several measurements were taken of standing woody debris (snags), as well as ground debris. Thus, the first transect was at 0 degrees north. For each of the three transects, snags and stumps are recorded at 2 m from either side of the transect.

In addition, in each spruce budworm infested forest, 4 sections of 50 cm of each class of woody debris (amended Hunter classes, see Barnouin 2005) could be sampled during the spring of 2009 and placed in cages for breeding. This approach would make it possible to precisely associate species with precise micro-habitat characteristics, which would in turn facilitate subsequent interpretation of trapping results (St-Germain et al. 2004b). Four sections of woody debris would be collected at each site of silvicultural scenarios for woody debris on the ground with advanced degradation (Barnouin class 3, 2005; main branches absent, wood soft, bark loose on 51-100% of the surface and same degree of moss cover).

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Species

Treatment(s)

Data activity

Data stability

Measurement(s) •

Establishment year(s) 2008

Measurement year(s) 2008

Treatment year(s)

Data location

Contributor(s) to the creation of the metadata • Canadian Forest Service, Laurentian Forestry Centre

Metadata creation date 2009-01-04

Metadata modification date

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administra-tive region	Design status	Plot integrity	Plot type	Comments

	Stoneham	-71.15	47.32	Boreal Shield	Eastern balsam fir-white birch	03	Actively Managed

Publication(s)

Impact of the proportion of recovery in prescribed burns at the landscape level on saproxylic Coleoptera species

Abstract

One of the current shortcomings of the Regulation respecting standards of forest management for forests in the domain of the State that could jeopardize the implementation of sustainable forest management, including the maintenance of biodiversity, is the absence of a standard for the harvesting of burned forests. Recovery operations were carried out for fires that raged in the Chibougamau area in 2005. The project's main objective is to determine the level of recovery of burns consistent with the maintenance of insect diversity across the landscape. More specifically, the aim of our work is to understand the impact of recovery on the families of beetles known to be associated with burning. The experimental setup includes 42 multidirectional barrier traps spread over a gradient of landscape recovery levels between jack pine and black spruce. This design has been in operation for the past three years and all specimens of the Cerambycidae and Salpingidae families have been identified (4,613 beetles; 26 species). For each site, the level of recovery was assessed according to three spatial scales (1, 2 and 2.4 ha). The impact of these levels of recovery was then assessed in relation to species abundance and diversity. Based on preliminary analyses, the proportion of recovery in the landscape would have a neutral or positive impact on diversity and abundance, with the exception of Cerambycidae Acmaeops pratensis which is negatively affected by increased recovery in the black spruce forest landscape.

Objective(s)

Determine the recovery level of burns consistent with the preservation of biodiversity, particularly insect species associated with burns across the landscape. We will consider certain families known to be associated with burns, such as the Cerambycidae, Elateridae, and Curculionidae Lathridiidae and some species of Salpingidae and Corylophidae (Saint-Germain et al., 2004a). More specifically, the objectives of the project are to determine:
1) whether saproxylic beetle communities differ by level of recovery across the landscape; and
2) which species are opportunistic and which species are pyrophilous among saproxylic beetles associated with recent burns.

In connection with these objectives, certain hypotheses were formulated. The first hypothesis (H1) in connection with Objective 1, suggests the existence of pyrophilous indicator species whose mere presence on the residual patches of salvaged burns would indicate that the characteristics of these patches are sufficient to maintain communities of saproxylic insects associated with burns. The absence of these indicator species on a given residual patch should be linked to a significant decrease that can go as far as the absence of other saproxylic beetle species associated with burning, thus indicating that the characteristics (i.e. the level of recovery) of the patch and/or landscape are not suitable for the maintenance of these communities. The second hypothesis (H2), associated with the same objective, suggests that residual patches left after salvage logging may not be representative of salvaged stands in terms of physical characteristics (age, density, diameter and height of the stems), because only those stands that are economically unprofitable are spared from salvage and left in the area. (Nappi et al., 2004). This would maintain only the saproxylic insect communities related to burns in non-commercial forests, rather than those related to mature forests (Bouget and Duelli, 2004). In fact, it is known that commercial forests contain larger trees and an older and larger tree offers a greater number of habitats (Bouget et al., 2005); one should therefore expect to find differences in community composition between unsalvaged burned mature stands and residual patches in non-commercial forests. The circumstances of the western black spruce stand allows us to propose a third hypothesis (H3) to the effect that there are different entomological faunae associated with the burning of jack pine and black spruce stands. Thus, there may be a different gradient of sensitivity for communities associated with each species with regard to stand characteristics and landscape-level recovery due to the fact that the ecology and the representativeness of these species across the landscape are not the same. The last hypothesis (H4) on Objective 2 suggests that saproxylic beetles associated with burning are an opportunistic species and not pyrophilous, and that in the absence of burned habitats on the landscape, they use other sources of dead or highly stressed wood to maintain their populations. This suggests that saproxylic beetles associated with burns should be found in recently disturbed environments such as windthrows (Bouget

and Duelli, 2004), epidemics and residual patches from forest operations (logging separators) that are highly exposed to wind and provide a lot of dead trees (Bouget and Duelli, 2004), etc.

Comment(s)

Project status Active

Layout/design The sampling design was installed in 2006, one year after the burn, and includes 50 sites equally distributed between stands of black spruce and jack pine. Forty of these sites were installed in the residual stands (islets) recovered from prescribed burns, in order to cover the range of different levels of recovery in the landscape for the two main species. The traps were not installed directly on the cutting area, as we are seeking to find out if the residual islets possess the necessary characteristics to maintain beetle communities associated with the prescribed burns. The degree of recovery was determined for each site by visual estimates in the field of the percentage of recovered area in the landscape. These sites were established to meet objective 1. The ten other sites were established in unburned stands (5 black spruce and 5 jack pine) where clusters of 11 trees were girdled (a circumferential band of a few centimeters was attached at DBH) in early June 2006. Overall, the design includes five sites per treatment and per species, at a distance of at least 500 m from each other. For each of the 50 sites, a multidirectional trap was installed at the heart of the site to optimize the capture of saproxylic and pyrophilous beetles. The multidirectional trap is a standardized sampling method based on the activity of flying insects such as beetles colonizing prescribed burn areas. It is considered effective for catching beetles, especially saproxylic species (Saint-Germain et al. 2004c; Okland et al. 1996). The multidirectional impact trap consists of four panels of 15 × 40 cm (2 made of Plexiglas ® and 2 made of netting) mounted in a cross on a black ABS pipe of 10 cm in diameter, where a funnel is mounted at each end leading to collection pots (Saint-Germain et al. 2004c). The collection pots contained a preservation solution of 40% ethanol and 5% white vinegar. The traps were visited and samples collected every two weeks between June 6 and October 29, 2006 and June 4 and August 28, 2007. Once the traps were collected, the samples were placed in a solution of 70% alcohol while awaiting sorting and identification. This design was in operation during the 2006-2007 growing seasons and will serve for a third season in the summer of 2008. In order to address hypothesis H2 of objective 1, the sites of each species will be chosen from the prescribed burns that took place in the region in 2007, five in un-harvested non-commercial stands (total of 20 sites). In these sites, a predetermined basal area (to be determined) will be felled to harvest logs of 50 cm which will then be reared (number of logs per felled stems to be determined) in order to compare the abundance and diversity of saproxylic species in these two types of stands. The harvesting of a basal area rather than a defined number of stems is recommended in order to rear a comparable volume of wood per site. The system for rearing these logs will consist of a mosquito net around the log (50 cm section of trunk) attached to a board of plywood which, in turn, is screwed under a shelf in an unheated building sheltered from adverse weather (Figure 7). At the bottom of the net surrounding the log, a funnel is attached which guides the insects emerging from the log to a collection pot containing ethylene glycol to kill and preserve the insects (Boulanger and Sirois 2007). The ends of each log will be pre-sealed with paraffin to slow the desiccation of the wood that can affect insect development. This design will serve to determine whether unburned non-commercial forests house beetle communities comparable to those of burned commercial forests, usually recovered first. In sites where clusters of 11 trees were girdled, one randomly chosen tree per site (10 trees, 5 black spruce and 5 jack pine) should be felled and 50 cm sections of trunk (about 4 logs taken from the bottom two-thirds of the stem) will be reared. This will serve to identify the species that really use the trees at these sites. The operation for rearing these logs will be the same as described above. At least ten other sites should be established in areas of recent disturbance in unburned forests (objective 2, H4). These sites should be installed either in recent windthrow or on the edge of recent forest operations, where there are windthrown, injured or severely stressed trees, depending on the availability of these sites in the territory. Five sites should be installed in stands of black spruce and five others in the stands of jack pine that have suffered recent disruptions in unburned forest. A multidirectional trap would be installed in each of these sites, following the methodology explained and taking care to maintain a distance of 500 m between sites.

For each site where a trap has been or will be installed, a vegetation inventory will be done. A sample plot will be made around the midpoint of each site, namely from the multidirectional trap, in order to characterize the environment in which the insects are caught. The characteristics of the sample plots were determined based on forest inventory standards (MNR 2002). These sample plots consist of a large plot with a radius of 11.28 m (400 m²), a sub-plot with a radius of 3.57 m (40 m²) and four microplots, placed at the four cardinal points of the 400 m² plot, with a 1.13 m radius (4 m²). In the 11.28 m plot, all commercial-size stems are counted by species (for all species), their DBH will be measured to the half-centimetre (smallest measure on a tree caliper), as well as their burn intensity (for burned stands) and their stage of decomposition. In addition, we will determine, for burned sites, the quantity of dead trees before the fire. In the 3.57 m radius sub-plot, the DBH, the species and vigor will be inventoried on saplings only, i.e. on stems with a non-commercial DBH (greater than 0 cm and = 9 cm). In the microplots (1.13 m radius), shrub and grass cover will be inventoried as well as regeneration. Therefore anything that does not have a DBH in these plots will be identified and a recovery percentage per species will be attributed. This information will serve to find out what is available in the area, mainly for adult stage saproxylics, many of which require pollen and nectar from flowers for food and for the maturation of their eggs (Speight 1989). As for soil characteristics such as surface deposit and drainage, they will be evaluated from ecoforestry maps. The inventory of woody debris will be made along two transects measuring of 22.56 m in length (shown by dotted lines in Figure 7), for a total of 45.12 m, passing through the centre of the sample plot in north-south and east-west directions, along which the diameter of all woody debris on the ground will be measured.

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Species

Treatment(s)

Data activity

Data stability

Measurement(s) •

Establishment year(s)	2006
Measurement year(s)	2006; 2007
Treatment year(s)	
Data location	
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre
Metadata creation date	2009-02-04
Metadata modification date	

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administra-tive region	Design status	Plot integrity	Plot type	Comments
	Chibougamau	-74.38	49.90			Boreal Shield	Western spruce-moss	10	Abandoned			

Publication(s)

Impact of the white-tailed deer (Odocoileus virginianus) on populations of arthropods in the context of plant regeneration on Anticosti Island

Abstract

The study aims to compare the impacts of deer density on insect populations. These impacts are related to the pressure of browsing on vegetation and are verified by looking at the abundance and species diversity of four guilds of insects: herbivores (Macrolepidoptera and Hemiptera), phytophilous predators (Cantharidae), pollinators (Apoidea and Syrphidae) and epigeal predators (Carabidae).

Objective(s)

The objective of this study is to determine the impact of white-tailed deer on the regeneration of arthropod populations. This falls within the context of a larger study aimed at characterizing vegetation regeneration patterns and the impact on animals (arthropods, birds and small mammals) on Anticosti Island. To answer questions relating to arthropods, several taxa in epigeal, pollinizing, phytophagous and phytophilous predator guilds will be studied. Given the diversity of taxa studied, several hypotheses (H) were established and corresponding predictions (P) made: (H1.1) Deer browsing has an impact on epigeal arthropod communities in open areas. (P1.1) It should promote the abundance and diversity of Carabidae (Melis et al. 2007, Suominen et al. 2003, Gardner et al. 1997) and Staphylinidae (Megías-González et al. 2004, Dennis et al. 1997) and (P1.2) have no impact on spiders. (H1.2) The impact should be insignificant in the forest (Allombert 2005). (H2) An overabundance of deer has a negative impact on phytophagous insects and phytophilous predators. If this is the case, the diversity of all plant-eaters and predatory phytophilous beetles (Cantharidae, Coccinellidae) should (P2.1) follow the curve of plant diversity in open areas, but to different degrees depending on their rate of polyphagy (Dennis 1998, Baines et al. 1994, Morris 1967). Where abundance is concerned, (P2.2) they should all follow the curve of plant diversity (P2.3) with the exception of Auchenorrhyncha that should not be affected by this variable (Morris 1973). (P2.4) Hemiptera should also be affected in the forest environment. (P2.5) Their needs, being a little different from Vespidae, should make them negatively dependent on deer density (Guiglia 1972). (H3) The decrease in the abundance of flowering plants and the negative effect of the presence of deer on other needs (prey for larvae, need for nesting) (Carvell 2002 Vockeroth 1992) affects pollinators (Ghazoul 2006, Vázquez and Simberloff 2004). (P3.1) We should therefore find them in larger numbers in areas of medium deer density (7.5 deer/km²). A fourth hypothesis to be tested (H4) is that the number of visits by pollinators to a given flower species is proportional to the occurrence of this flower compared to other species (Ghazoul 2006). Lastly (H5), phytophiles found on an individual of a given plant species should be more plentiful and diversified where the plant is most abundant (Lawton 1977) and where deer density is lowest for plants affected by browsing (Shimazaki and Miyashita 2001).

Comment(s)

Project status

Active

Layout/design

For the purposes of the study, a controlled-browsing design is used (described in Tremblay et al. 2006) involving enclosures where deer density is experimentally controlled. The design includes four levels of deer density each replicated three times (4 x 3 = 12 experimental units). One of the replicas (or blocks) is located in the Lake Simone sector (block A, Fig. 1) and the two others in the Jupiter 24 sector (Block B and C). The experimental densities are 0 deer/km² (20 ha), 7.5 deer/km² (3 deer in 40 ha) and 15 deer/km² (3 deer in 20 ha). In addition, each block is matched with a natural density control site (~56 deer/km² in blocks A and C, and ~27 deer/km² in Block B). The density of deer in the controls was estimated by counting droppings (Tremblay et al. 2007). In 2001, ~70% of each experimental unit was turned into cutover by eliminating all trees larger than 9 cm at breast height. The remaining units are covered by a forest of mature balsam fir. Each spring, deer are captured to be relocated in the management enclosures. They are then euthanized at the end of autumn.

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Species				
Treatment(s)				
Data activity				
Data stability				
Measurement(s)	•			
Establishment year(s)	2007			
Measurement year(s)	2007; 2008			
Treatment year(s)				
Data location				
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre			
Metadata creation date	2009-02-04			

Metadata
modification date

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administra-tive region	Design status	Plot integrity	Plot type	Comments
	L'Île-d'Anticosti	-63.00	49.49			Boreal Shield	Eastern balsam fir-white birch	09	Completed but watched			

Publication(s)

Influence of alternative silvicultural methods on the diversity and abundance of Coleoptera and ant species in the irregular boreal forest of the Quebec North Shore

Abstract

The boreal forest of the North Shore is a virgin forest characterized by a significant presence of balsam fir, an irregular structure and an abundance of snags and downed woody debris. This region's humid climate decreases the frequency of fires, so the forest dynamic is controlled by minor disturbances and the natural mortality of trees. The result is a heterogeneity of the territory which is in turn accentuated by silvicultural practices. This project aims to determine the impact of four silvicultural treatments, two that are already used on the territory (cutting with protection of regeneration and soils, or CPRS, and cutting with protection of small merchantable stems) and two new treatments designed to maintain the irregular structure of the forest (selection cutting with temporary trails, and selection cutting with permanent trails) on the diversity and abundance of beetles and ants. A design made up of 400 traps (80 barrier traps and 320 pitfall traps) was deployed within four experimental blocks on the territories of three logging companies. Over 25,000 beetles were captured during a sampling from June 5 to August 22, 2007. Several insect species respond strongly to changes in their environment such as the opening of the canopy, increased downed woody debris and the creation of transition zones. In order to supplement the data acquired in 2007, a further sampling, concentrated exclusively on ant nests, is scheduled for summer 2008. The project is in keeping with a sustainable development perspective where conservation of biodiversity is a central element.

Objective(s)

This study aims to characterize the influence of alternative silvicultural methods on the diversity and abundance of beetles and ants in North Shore irregular forests. Four treatments will be studied, two that are already being used in the area and generate a regular structure (cutting with protection of regeneration and soil (CPRS) and cutting with protection of small merchantable stems (CPSMT)) (Boucher et al., 2003) and two new experimental treatments designed to maintain the irregular structure of the forest and to minimize impacts on plant and animal communities (selection cutting with temporary trails (CJST) (Appendix 1) and selection cutting with permanent trails (CJSP) (Appendix 2)) (Ruel et al., 2007). More specifically, the project attempts to define which of these treatments allows the attributes and ecological functions of natural irregular forests to be maintained.

Comment(s)

Project status

Completed

Layout/design

The project is registered in the NSERC - University Laval research chair in silviculture and wildlife. This chair was established in the regior of the North Shore to study the distinctiveness of the eastern boreal forest which differs from that of the west by its irregular stand structure (2006-2007 Annual Report, NSERC - University Laval research chair in silviculture and wildlife.). The design consists of four blocks established in 2004 and 2005, arranged on the territories of three different forestry companies (Kruger 2004, Abitibi Consolidated (ACI_01 2004 and ACI_02 2005) and Arbec 2005) (Fig. 2). In each block, there are five experimental units, namely the four treatments (CPRS, CPSMT, CJST and CJSP) and a control, made on areas of approximately 20 hectares. In each experimental unit, there are four plots of 400 m² for a total of 80 plots in the study.

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Species

Treatment(s)
- Cutting with protection of regeneration and soil
- Cutting with protection of small merchantable trees

Data activity

Data stability

Measurement(s)
-

Establishment year(s) 2004; 2005

Measurement year(s) 2007; 2008

Treatment year(s)

Data location

Contributor(s) to the creation of the metadata
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Metadata creation date 2009-02-04

Metadata modification date

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administrative region	Design status	Plot integrity	Plot type	Comments

	Manicouagan	-69.09	50.85		Boreal Shield	Eastern spruce-moss	09	Completed but watched

Publication(s)

Influence of habitat heterogeneity on Coleoptera species richness in the boreal forest

Abstract

The objective of this study was to evaluate the relationship between beetle species diversity and the compositional and structural heterogeneity of the habitat, characterized at several spatial scales. During the summers of 2004 and 2005, 70 sites were sampled in old boreal forests of the Quebec North Shore. Overall, 133 species of beetles were captured on the ground and 251 species in the air. The influence of the type of heterogeneity and spatial scale varied between these two functional groups of beetles. Compositional heterogeneity, estimated stand-wide, best explained spatial variations in ground beetle diversity, whereas it was the joint influence of structural and compositional heterogeneity assessed at both stand and landscape levels that best explained the spatial variations in flying beetle diversity. The study demonstrates the importance of considering several components of heterogeneity and multiple spatial scales to understand patterns of diversity.

Objective(s)

This study aims to characterize the biodiversity patterns of beetles in irregular boreal forests. This characterization falls within the context of understanding the relationships that exist between habitat heterogeneity and beetle diversity at several spatial scales. More specifically, the response of two groups of beetles to habitat heterogeneity is studied: ground beetles, which move mostly by walking, and beetles in the air, which move mostly by flying. Also, for each of these groups, two sources of heterogeneity are studied: compositional heterogeneity and structural heterogeneity. The core objective of the study is therefore to understand the influence of the type of heterogeneity on the affluence of the two groups of beetles, at several spatial scales, in the old boreal forests of Quebec's North Shore.

Comment(s)

Project status

Active

Layout/design

Our study is situated in the boreal forest on the north shore of Quebec between the 49th and 51st parallels. In total, 70 sites were sampled over two years, 36 in 2004 and 34 in 2005. These sites were selected according to criteria of representativeness of the structural and compositional diversity of the north shore boreal forest.

Two types of passive traps were used in a complementary manner to sample the beetles. The multidirectional trap is a standardized sampling method aimed at capturing flying insects. It is considered effective for capturing beetles, especially saproxylic species (Økland 1996, Brustel 2004). The pitfall trap collects insects walking on the ground and is particularly effective for the capture of Carabidae (Dávalos and Blossey 2006).

Three spatial scales were considered. The stand scale corresponds to a circular plot of 400 m² (11.28 m radius), from which numerous descriptive attributes of the stand were measured. The landscape scale corresponds to circles of a 400 and 800 m radius from the center of the plot and in which the components of the landscape were extracted from ecoforestry maps.

Two sources of heterogeneity were measured in all three spatial scales. Compositional heterogeneity corresponds to the diversity of species of trees and shrubs throughout the stand, whereas for the landscape, this heterogeneity is characterized by the diversity of cover types. Structural heterogeneity refers to the variety of diameter classes in the stand and the diversity of types of cover structure throughout the landscape.

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Species	
Treatment(s)	
Data activity	
Data stability	
Measurement(s)	•
Establishment year(s)	2004; 2005
Measurement year(s)	2004; 2005
Treatment year(s)	
Data location	
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre
Metadata creation date	2009-02-04
Metadata modification date	

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administrative region	Design status	Plot integrity	Plot type	Comments
	Manicouagan	-69.09	50.85			Boreal Shield	Eastern spruce-moss	09	Completed but watched			

Publication(s)

- Janssen, P. 2007. Diversité des insectes en forêt boréale : influence de l'hétérogénéité environnementale à plusieurs échelles. Bulletin d'information No 8 - décembre 2007, Université Laval.
- Janssen, P. 2008. Beetle diversity in old-growth boreal forests: Influence of habitat heterogeneity at multiple scales, Chaire de recherche industrielle CRSNG-Université Laval en sylviculture et faune et Département de biologie, Université Laval, Québec

Lac Métis Seigneury Observation Area

Abstract

This protocol is part of a network of 15 observation areas that were established in the province of Quebec in the early 1950s by the Canadian Forest Service. The protocol is located in the Seigneurie du Lac Métis, which belongs to Abitibi-Price. The two blocks that form this protocol were established in 1950, and part of the territory where it was established has been subjected to diameter-limit cutting from 1942 to 1950, whereas the other part had been left intact. In 2007, the owner of the Seigneurie du Lac Métis signed an agreement with Groupe Cedrico in order to be recognized as manager of the territory, replacing the Lower St. Lawrence Model Forest.

Objective(s)

The following themes are being studied:
- productivity after partial cutting;
- changes in diameter structures, age structures and compositions after partial cutting;
- characterization of the age structure, diameter structure and composition of the primary forest.

Comment(s)

As of January 2007, only 23 sample plots were found and made permanent following the MRNFQ ecological observation point. These plots are located in block 1, located south of Lac Métis. A protective strip of approximately 15 m was identified by the diagonal paint markings on trees at DBH level and by red pieces of tape attached to trees outside the sample plots.

Project status

Active

Layout/design

The design is composed of two blocks. Block 1, covering 8.4 km², is composed of 200 sample plots whereas block 2, covering 3.6 km², has 99 sample plots. This permanent inventory system was established in 1950 and was remeasured in 1960 and again in 1970. In 1994, 28 sample plots were remeasured in block 1 by the Université Laval and in 2003, the Canadian Forest Service (CFS) measured 23 plots from this same block. Eight of these plots were measured twice, i.e. in 1994 and 2003. Partial or total cutting was conducted in certain sectors in 1910, 1930, 1939 and from 1942 to 1950. Partial and/or total cutting was also conducted from 1950 to the mid-1970s. Cutting took place in block 1 in 2002 and 2003. The information included herein mainly involves block 1 since it was investigated since 2003.

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Species	• Balsam fir • White spruce • Mountain maple • Yellow birch
Treatment(s)	• Diameter-limit harvest
Data activity	Active irregular - data set is updated on an irregular basis
Data stability	Moderately stable - data digitized recently; available in hard copy
Measurement(s)	• Diameter at breast height (dbh) • Stem height • Inventory according to the Québec ecological sampling point • Soil measurement
Establishment year(s)	1950
Measurement year(s)	1950; 1960; 1970; 1994; 2003; 2008
Treatment year(s)	1910; 1930; 1939; 1942 - 1970; 2002; 2003
Data location	Paper archives and maps are located in filing cabinets in room 1.25 at the LFC. Digital data are stored in an ACCESS database located on the PC of Claude Delisle and on the common disk U:\Ecosystemes Forestiers\Aires observation\BD_Aires_Observation_CFL. The name of the database is Aires_CFLyyyy_mm_dd
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre • Laval University (Faculty of Forestry, Geography and Geomatics)
Metadata creation date	2007-01-09
Metadata modification date	

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administrative region	Design status	Plot integrity	Plot type	Comments
Lac Métis - Bloc 1	Les Hauteurs	-67.88	48.32	375	850	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Actively Managed	Good	Square (20 x 20 m)	Block located South of Lac Métis.
Lac Métis - Bloc 2	Les Hauteurs	-67.86	48.37	400	370	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Abandoned	Poor	Square (20 x 20 m)	Block located North of Lac Métis near the Saint-Pierre river

Publication(s)

- Archambault, L.; Delisle, C.; Larocque, G.R. 2006. Fifty years of forest dynamics following diameter-limit cuttings in balsam fir-yellow birch stands of the Lower St. Lawrence region, Quebec. Can. J. For. Res. 36:2745-2755.
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Lake Edouard Experimental Forest (La Mauricie National Park of Canada)

Abstract

The Lake Edouard Experimental Forest was officially created in 1918 following an agreement between the Canadian Forest Service and the Laurentide Pulp and Paper Co. After this company was consolidated into the Consolidated Paper Corporation, it continued to provide support and maintained an interest in the research being conducted. In 1970, the research area was integrated into La Mauricie National Park. After this date, changes in forest research priorities put a stop to the monitoring. Between 1994 and 1996, the Forestry and Geomatics Faculty at the Université Laval conducted a new measurement of the research protocol. Then, in 2001 and 2002, collaboration between the Forestry and Geomatics Faculty and the Canadian Forest Service (CFS) made it possible to monitor one of the oldest observation areas in Eastern Canada. From 2003 to 2006, the CFS made it a priority to gather data to satisfy the requirements of the ZELIG forest succession program. The main purpose of this data gathering was to remeasure the stems and saplings in 30 Oxalis-Cornus-type sample plots and in 15 Viburnum-Oxalis-type sample plots, to geographically locate the stems and saplings, to assess the regeneration and to take allometric measurements in and outside the plots. In 2007, the remeasurement of stems and saplings and the assessment of the regeneration have continued in 29 sample plots in different forest types. In 2007, the remeasurement of stems and saplings and the regeneration assessment continued in 29 sample plots from different forest types. In 2009, the remeasurement of stems and saplings was conducted in 18 Cornus-type plots. Aluminum labels indicating the stem number were affixed to stems with a dbh greater than 50 mm in 31 plots. Finally, a regeneration inventory with labelling of seedlings was initiated in 63 sub-plots of 4 m² (7 main plots of 404 m²) of the Oxalis-Cornus type.

In 2010, aluminum labels indicating the stem number were affixed to stems with a dbh greater than 50 mm in 114 plots. On August 6, 2010, 163 plots have been labeled on the 200 found to date.

Objective(s)

The following themes are being studied:
- productivity after partial cutting;
- changes in diameter structures, age structures and compositions after partial cutting;
- characterization of the age structure, diameter structure and composition of the primary forest;
- changes in the wildlife potential following partial cuts; - assessment of the necessary growth conditions for red spruce regeneration;
- characterization of the primary forest across the landscape.

Comment(s)

The plots measured in 1920 were digitized using the 1936 map. A quick tour of these permanent sample plots (PSP) in the summer of 2007 made it possible to relocate a few labelled trees. It would be possible to redefine the boundaries of the PSPs using labelled trees and boundary trees that were marked with an ax and still have visible scars on some of the stems. As of September 2009, 200 plots that were found had been made permanent, i.e. the trees have been numbered and there is an inventory corresponding to the ecological observation point.

Project status

Active

Layout/design

In 1925, a network of 321 plots was established. The plots, covering an area of 2 square chains, were distributed systematically with intervals of 10 chains by 10 chains between the plots. Square stakes with a label indicating the plot number marked the corners of each plot.

In 1936, the design was measured under the supervision of R.G. Ray. The spacing between the cruise lines was maintained, but the plots were resized to a square chain and marked with only one numbered stake. The plots were moved slightly forward or backward when they

encompassed two different types of sites, but this did not happen very often. In total, 343 permanent plots were established to systematically cover the entire Lac Édouard Experimental Forest.

The design was measured once again in 1946. A few plots were added, bringing the total number of plots to 401.

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Species

- Balsam fir
- Eastern white-cedar
- Red spruce
- American beech
- Red maple
- Sugar maple
- Yellow birch

Treatment(s)

- Diameter-limit harvest

Data activity

Active regular - data set is updated regularly

Data stability

Very stable - data digitized recently; available in hard copy; well documented

Measurement(s)

- Diameter at breast height (dbh)
- Stem height

- Stem width
- Inventory according to the Québec ecological sampling point
- Light measurement (PAR)

Establishment year(s)	1918
Measurement year(s)	1919; 1920; 1925; 1930; 1935; 1936; 1946; 1956; 1957; 1967; 1994; 1995; 1996; 2001-2007; 2009
Treatment year(s)	1875; 1890; 1910; 1950 - 1957
Data location	Paper archives are located in filing cabinets in room 1.25 at the LFC. Digital data are stored in an ACCESS database located on the PC of Claude Delisle and on common disk U:\Ecosystemes Forestiers\Aires observation\BD_Aires_Observation_CFL. The name of the database is Aires_CFLyyyy_mm_dd
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre • Laval University (Faculty of Forestry, Geography and Geomatics)
Metadata creation date	2007-01-09
Metadata modification date	2010-09-21

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administrative region	Design status	Plot integrity	Plot type	Comments
Lac Édouard	Saint-Jean-des-Piles	-72.93	46.75	430	1650	Boreal Shield	Eastern sugar maple-yellow birch	04	Actively Managed	Average	Square (20 x 20 m)	See the general description of the layout.

Publication(s)

- Archambault, L.; Bégin, J.; Delisle, C.; Fortin, M. 2003. Dynamique forestière après coupe partielle dans la Forêt expérimentale du Lac Édouard, Parc de la Mauricie, Québec. For. Chron. 79 : 672-684.
- Archambault, L.; Delisle, C. 2003. Experimental Partial Cutting in Oxalis-Cornus stand in Lac Edward Experiment Forest. Présentation donnée aux congressistes du XIIe Congrès forestier mondial lors de la visite de terrain au Lac Édouard dans le cadre de la journée technique, 25 septembre 2003.

- Archambault, L.; Delisle, C.; Desrochers, P.; Fortin, M.; Larocque, G.R. 2004. Vegetation dynamics following partial cutting in the Lake Edouard Experimental Forest. ISEM Conference, Quebec City, August 22, 2004.
- Archambault, L.; Delisle, C.; Fortin, M.; Bégin, J. 2003. Succession forestière après coupe partielle dans la Forêt expérimentale du Lac Édouard, Parc de la Mauricie, Québec. Affiche présentée lors du Carrefour de la recherche, Québec, 19-20 février 2003.
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- Fortin, M.; Archambault, L.; Bégin, J.; Delisle, C. 2004. Dynamique et croissance des sapinières à bouleau jaune de la Basse-Mauricie après une coupe partielle de faible intensité. Présentation donnée dans le cadre du 2e séminaire sur la recherche forestière en Mauricie organisé par l'Association forestière de la vallée du St-Maurice,18 mars 2004.
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Landscape-scale habitat selection patterns of Monochamus scutellatus (Coleoptera: Cerambycidae) in a recently burned black spruce forest

Abstract

The host selection process of most phytophagous insects includes several steps ranging from landscape-scale habitat location to host plant-scale microsite selection. For the whitespotted sawyer, Monochamus scutellatus (Say), host location and acceptance patterns have been relatively well described, but landscape-scale distribution patterns in recently disturbed areas have received virtually no attention. We evaluated the variability in larval density in 569 trees, located in 114 plots, in a recently burned black spruce forest of Canada by using entry hole counts. This variability was then related to multiscale environmental variables.

Both diameter at breast height and fire severity were related to larval density at the tree scale. At larger scales, altitude had a negative effect on larval density, whereas plots having a higher percentage of unburned forest in a 500-m radius were more intensely colonized. The importance of the proximity of unburned stands can be linked to the feeding requirements of adults, which should show preference for stands offering both egg-laying and feeding substrata since several species of Monochamus have been shown to feed while being sexually active. In our models, large-scale variables explained more variability than tree-scale variables. Thus, our results suggest that large-scale habitat location mechanisms play an important role in the host selection process of the whitespotted sawyer.

Objective(s) Explain the choice of habitat location across the landscape by the whitespotted sawyer Monochamus scutellatus (Say).

Comment(s) KEY WORDS habitat location, host selection,

Project status Completed

Layout/design Study Area. Sampling was conducted in August 2001 in the Grands-Jardins Provincial Park and in the adjacent des Martres controlled harvesting zone (Both territories are located on a plateau averaging 800 m in altitude in the Laurentian Mountains. Recent fires have occurred within the park's boundaries in 1991, 1995, and 1999 (Payette et al. 2000). Pure black spruce, Picea mariana (Miller), stands dominate the landscape, with the occasional presence of balsam fir, Abies balsamea (L.); trembling aspen, Populus tremuloides Michaux; and tamarack, Larix laricina (Du Roi). Sampling speciÞcally took place in a 5,097-ha fire that occurred between 30 May and 5 June 1999. It was a strikingly uniform, highintensity fire, with very few lightly burned areas. After the Þre, the ground vegetation layer was dominated by fire-resistant shrubs such as Ledum groenlandicum Oeder and Vaccinium spp. Sample Plot Establishment and Characterization.A total of 114 plots was established in the burned forestto cover the widest possible range of topographic and spatial contexts. Sample plots were mostly established along transects, in which they were distanced by 300-400 m from each other. Plots were characterized on 225 m².

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Species

- Black spruce
- Spruce stand

Treatment(s)

Data activity

Data stability

Measurement(s) •

Establishment year(s)

Measurement year(s) 2001

Treatment year(s)

Data location

Contributor(s) to the creation of the metadata • Canadian Forest Service, Laurentian Forestry Centre

Metadata creation date 2009-02-10

Metadata modification date

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administra-tive region	Design status	Plot integrity	Plot type	Comments
	Saint-Urbain	-70.72	47.68			Boreal Shield	Eastern balsam fir-white birch	03	Abandoned			

Publication(s)

- Saint-Germain, M.
(Coleoptera: Cerambycidae) in a Recently Burned Black Spruce Forest 2004. Landscape-Scale Habitat Selection Patterns of Monochamus scutellatus (Coleoptera: Cerambycidae) in a Recently Burned Black Spruce Forest, Environ. Entomol. 33(6):1703-1710

LFC observation areas

Abstract

From 1947 to 1954, the Canadian Forest Service, Quebec Region, set up 15 experimental designs distributed among hardwood, softwood and mixed stands located in different regions of Quebec. These 15 designs are called LFC observation areas. The Lac Métis Seigneury Observation Area wich is one of the LFC Observation Area is not mentionned here but it is described as a project research.

In 1978, measuring of the designs was discontinued after a series of three measurements. Then, in the early 1990's, measurement was resumed in seven designs (see "Research site(s)" section for more details on the number of plots found and measured). In January 2009, it was determined that approximately 500 plots could still be found.

Objective(s)

To establish a network of permanent sample plots allowing a recurring measuring every 10 years in order to evaluate the growth, regeneration, mortality and the defects on the stems before and after the cut.

Comment(s)

The vast majority of information found on the plots since 1990 has been stored in a Microsoft Access database.

Project status

Active

Layout/design

On July 2008, over 500 plots located in the LFC Observation Areas could still be uncovered.

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Species

- Balsam fir
- Pines
- Spruces
- Birches

Treatment(s)

- Diameter-limit harvest

Data activity	Active irregular - data set is updated on an irregular basis
Data stability	Moderately stable - data digitized recently; available in hard copy
Measurement(s)	• Diameter at breast height (dbh) • Stem height • Stem status (living/dead) • Age • Stem mortality
Establishment year(s)	1947 - 1954
Measurement year(s)	1947 - 2004
Treatment year(s)	
Data location	Paper archives and maps are located in filing cabinets in room 1.25 at the LFC. Digital data are stored in an ACCESS database located on the PC of Claude Delisle and on the common disk U:\Ecosystemes Forestiers\Aires observation\BD_Aires_Observation_CFL. The name of the database is Aires_CFLyyyy_mm_dd
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre • Laval University (Faculty of Forestry, Geography and Geomatics)
Metadata creation date	2009-01-21
Metadata modification date	

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administra-tive region	Design status	Plot integrity	Plot type	Comments

Cyriac - Bloc 1	Laterrière	-71.23	48.15	414	Boreal Shield	Western balsam fir-white birch	02	Abandoned	Unknown	Square (20 x 20 m)	Last measurement made in 1969, 84 plots were measured. These same plots still existed in 1978.
Cyriac - Bloc 2	Laterrière	-71.23	48.02	415	Boreal Shield	Eastern balsam fir-white birch	02	Abandoned	Unknown	Square (20 x 20 m)	Last measurement made in 1963, 53 plots were measured.
Harricana - Bloc 1	Val-d'Or	-78.03	47.93	346	Boreal Shield	Western balsam fir-white birch	08	Abandoned	Unknown	Square (20 x 20 m)	The last inventory of the block dates back to 1978. No data from old inventory is available. An attempt to recover data stored on magnetic tapes is underway as of January 2010. It is possible to find at least 90 sample plots in the device.
Harricana - Bloc 2	Val-d'Or	-78.15	47.92	333	Boreal Shield	Western balsam fir-white birch	08	Abandoned	Unknown	Square (20 x 20 m)	The last inventory of the block dates back to 1978. No data from old inventory is available. An attempt to recover data stored on magnetic tapes is underway as of January 2010. It is possible to find at least 90 sample plots in the device.
Manicouagan - Bloc 1	Baie-Comeau	-68.40	50.15	321	Boreal Shield	Eastern spruce-moss	09	Abandoned	Unknown	Square (20 x 20 m)	According to Jean Bégin (Professor at Laval University), dated July 5, 2007, several parcels of blocks 2 and 3 were cut in the '90s and early 2000 by Abitibi Consol but it would remain block 1.
Manicouagan - Bloc 2	Baie-Comeau	-68.42	50.17	389	Boreal Shield	Eastern spruce-moss	09	Abandoned	Unknown	Square (20 x 20 m)	According to Jean Bégin (Professor at Laval University), dated July 5, 2007, several parcels of blocks 2 and 3 were cut in the '90s and early 2000 by Abitibi Consol but it would remain block 1.

Manicouagan - Bloc 3	Baie-Comeau	-68.47	50.13	343		Boreal Shield	Eastern spruce-moss	09	Abandoned	Unknown	Square (20 x 20 m)	According to Jean Bégin (Professor at Laval University), dated July 5, 2007, several parcels of blocks 2 and 3 were cut in the '90s and early 2000 by Abitibi Consol but it would remain block 1.
Matane - Bloc 1	Saint-Jean-de-Cherbourg	-66.62	48.77	368	410	Atlantic Maritime	Eastern balsam fir-white birch	01	Abandoned	Unknown	Square (20 x 20 m)	The last measurement of block 1 was made in 1978.
Matane - Bloc 2	Saint-Jean-de-Cherbourg	-66.87	48.70	405	210	Atlantic Maritime	Eastern balsam fir-white birch	01	Abandoned	Unknown	Square (20 x 20 m)	The last measurement of block 2 was made in 1990.
Matane - Bloc 3	Saint-Jean-de-Cherbourg	-66.65	48.73	380	260	Atlantic Maritime	Eastern balsam fir-white birch	01	Abandoned	Unknown	Square (20 x 20 m)	20 plots measured in 1991. There is no GPS location of plots.
Matane - Bloc 4	Saint-Jean-de-Cherbourg	-67.05	48.78	275	260	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Abandoned	Unknown	Square (20 x 20 m)	40 plots measured in 2001 by Mathieu Fortin. There is no GPS location of plots.
Montmorency	Stoneham	-71.17	47.32			Boreal Shield	Eastern balsam fir-white birch	03	Hiatus	Unknown	Square (20 x 20 m)	Some plots have been made in the years 1990-2000. See Jean Bégin and Louis Bélanger at Laval University for more information.
Ouareau - Bloc 1	Saint-Donat	-74.20	46.47	496	1150	Boreal Shield	Eastern sugar maple-yellow birch	14	Actively Managed	Good	Square (20 x 20 m)	47 plots have been remeasured in this block in 2003/2004. According to M. Fortin it would be possible to find 200 places in the 2 blocks.
Ouareau - Bloc 2	Saint-Donat	-74.12	46.40	575	850	Boreal Shield	Eastern sugar maple-yellow birch	14	Actively Managed	Good	Square (20 x 20 m)	47 plots have been remeasured in this block in 2003/2004. According to M. Fortin it would be possible to find 200 places in the 2 blocks.

Pabos	Chandler	-64.90	48.53	390		Atlantic Maritime	Eastern balsam fir-white birch	11	Abandoned	Unknown	Square (20 x 20 m)	Visited by C. Delisle and M. Fortin in 2003 and there is no chance to find sample plots.
Porneuf	Les Escoumins	-69.78	48.72			Boreal Shield	Eastern balsam fir-white birch	09	Abandoned			The experimental design burned in 1955 and 1963. Latest measurements of 68 sample plots conducted in 1964
Rivière Bell - Bloc 1	Lebel-sur-Quévillon	-77.17	48.80	304	890	Boreal Shield	Western balsam fir-white birch	08	Actively Managed	Good	Square (20 x 20 m)	35 plots measured in 2000-2001. All plots have been found.
Rivière Bell - Bloc 2	Lebel-sur-Quévillon	-77.08	49.03	285	1650	Boreal Shield	Western balsam fir-white birch	10	Actively Managed	Good	Square (20 x 20 m)	84 plots measured in 2000-2001. All plots have been found.
Rivière Bell - Bloc 3	Lebel-sur-Quévillon	-77.01	49.06	292	590	Boreal Shield	Western balsam fir-white birch	10	Actively Managed	Good	Square (20 x 20 m)	11 plots measured in 2002. All plots have been found.
Rivière-aux-Rats - Bloc 1	Dolbeau-Mistassini	-72.33	49.50	324	950	Boreal Shield	Western balsam fir-white birch	02	Actively Managed	Good	Square (20 x 20 m)	Last inventory made in 2002-2003. According to M. Fortin it would be possible to find several other plots (Sept. 2007).
Rivière-aux-Rats - Bloc 2	Dolbeau-Mistassini	-72.20	49.53	234	220	Boreal Shield	Western balsam fir-white birch	02	Actively Managed	Good	Square (20 x 20 m)	Last inventory made in 2002-2003. According to M. Fortin it would be possible to find several other plots (Sept. 2007).

Sault-au-Cauchon	Sault-au-Cochon	-69.36	48.92	200	1280	Boreal Shield	Eastern balsam fir-white birch	09	Abandoned	Poor	Square (20 x 20 m)	Observation Area No. 1 (Project Q-12). This design has been established in the summer of 1947 on the limits of the Anglo-Canadian Pulp and Paper Mills, Limited located in Forestville. A portion of the design (some transects) was established in an area burned in 1946. In August 1953 a fire completely destroyed the experimental design. A remeasurement of 10 years was made in 1957. An internal report on the establishment of the Observation Area (Smithers LA and JC Boynton, 1950) and remeasurement after 10 years (Hatcher R.J., September 24, 1957) are in a binder of local CFL 2.11. These two reports are binded together.
Shipshaw (Huit Chutes)	Saint-David-de-Falardeau	-70.93	48.90	645		Boreal Shield	Eastern balsam fir-white birch	02	Abandoned	Unknown	Square (20 x 20 m)	This device is composed of 4 experimental blocks. Depending on the block, past measurements were conducted from 1974 to 1977. In 1978, a total of 284 plots were still existing.
Vermillon - Bloc 1	La Tuque	-73.70	47.30	468	1270	Boreal Shield	Western balsam fir-yellow birch	04	Actively Managed	Good	Square (20 x 20 m)	According to M. Fortin, it is possible to find several other plots (Sept.2007). Last measurement was made in 2001.
Vermillon - Bloc 2	La Tuque	-73.68	47.37	380	90	Boreal Shield	Western balsam fir-yellow birch	04	Actively Managed	Unknown	Square (20 x 20 m)	According to M. Fortin, it is possible to find several other plots (Sept.2007). Last measurement was made in 2001.
Vermillon - Bloc 3	La Tuque	-73.75	47.37	461	130	Boreal Shield	Western balsam fir-yellow birch	04	Abandoned	Unknown	Square (20 x 20 m)	According to M. Fortin, it is possible to find several other plots (Sept.2007). Last measurement was made in 2001.

Watopeca - Bloc 1	Windsor	-71.83	45.62	261	350	Atlantic Maritime	Eastern sugar maple-basswood	05	Abandoned	Poor	Square (20 x 20 m)	The last measurement was made in 1969. In 2006, Domtar was cutting sample plots in this block.
Watopeca - Bloc 2	Windsor	-71.78	45.62	287	420	Atlantic Maritime	Eastern sugar maple-basswood	05	Abandoned	Poor	Square (20 x 20 m)	The last measurement was made in 1969. In 2006, Domtar was cutting sample plots in this block.
Watopeca - Bloc 3	Windsor	-71.82	45.59	295	440	Atlantic Maritime	Eastern sugar maple-basswood	05	Abandoned	Poor	Square (20 x 20 m)	The last measurement was made in 1969. In 2006, Domtar was cutting sample plots in this block.

Publication(s)

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Macrolepidoptera biodiversity in the La Mauricie National Park of Canada

Abstract

Three inventories of macrolepidoptera were carried out in La Mauricie National Park of Canada during the summers of 2003, 2004 and 2005. In total, 36 plots were sampled using Luminoc traps, at a rate of 12 per year; 184 day and night hunts were also carried out during the study. A total of 607 species were catalogued among the 20,497 specimens collected. Sampling using light traps was performed at a harvesting intensity of 540 nights in 2003, 576 in 2004 and 432 in 2005. Hunts conducted by the author helped to lengthen the harvesting period since the traps were only active from mid-May to late August. The specimens were captured throughout the 11 sampled stands using the light traps and throughout the twenty habitats visited for short active hunts.

Objective(s)

Take an inventory of butterflies at La Mauricie National Park of Canada (LMNPC) over three summers (2003, 2004 and 2005).

Highlight the biodiversity of 'Macrolepidoptera' in the park. The results will be used in several ways. First, they will be used to help certain federal and provincial species management organizations to improve their knowledge. If necessary, the LMNPC may establish practical management strategies for certain species. The first part of the report is a spatial and temporal analysis of data collected during the three years of sampling. The data was compiled in an attempt to showcase the distribution of species in their environments. It was thus possible to determine which habitats are most productive in terms of abundance and species diversity. Secondly, an in-depth analysis was made of the various families and species observed. A description of families and subfamilies was developed in order to showcase common, occasional or rare species and the habitats they frequent in the LMNPC. One section was reserved for those Lepidoptera species considered the most rare. In closing, the discussion was focused on the status of certain species in the LMNPC and possible management plans for these butterflies. Thus, the objectives of this study were met.

Comment(s)

Project status

Completed

Layout/design

The LMNPC is located in the heart of the Laurentians, in the Mauricie region. This area has numerous bodies of water and an undulating topography. This leaves room for many landscapes resembling the one shown in Figure 1. The LMNPC has nearly thirty species of trees forming more than one hundred different associations (LALUMIERE, 1988). The territory of the LMNPC is located in the sugar maple-yellow birch area. To the north, hardwood stands appear to be less abundant than coniferous stands composed mostly of pine, fir and spruce.

In total, 36 plots were sampled over three years. In 2003, they were positioned in the area west of Lac Édouard. In 2004 and 2005, 24 plots were distributed along 62 km of the touristic road. The first year of study helped to identify three stands: sugar maple, yellow birch and red spruce. A total of four traps were installed in each of these three types of forests. This served to compare plant associations between them as well as to try to estimate their contribution to the biodiversity of “macrolepidoptera” in this sector. In 2004 and 2005, different objectives led to a more diversified selection of sites, reducing replicas and opportunities for comparison, however.

Study leader(s)

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Species

Treatment(s)

Data activity

Data stability

Measurement(s) •

Establishment year(s) 2003 - 2005

Measurement year(s) 2003; 2004; 2005

Treatment year(s)

Data location

Contributor(s) to the creation of the metadata • Canadian Forest Service, Laurentian Forestry Centre

Metadata creation date 2009-02-04

Metadata modification date

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administra-tive region	Design status	Plot integrity	Plot type	Comments

	Grand-Mère	-72.83	46.64		Boreal Shield	Eastern sugar maple-yellow birch	04	Abandoned

Publication(s)

- Domaine, É. Biodiversité des « MACROLÉPIDOPTÈRES » au parc national du Canada de la Mauricie. Compilation des inventaires réalisés en 2003, 2004 et 2005.

North American Maple Decline Project (NAMP)

Abstract

Canada has a total of 62 sites, 24 of which are located in Quebec, which have been monitored annually. Half of these sites have been established in natural stands and the other half in maple syrup production stands. All deciduous trees with at least 10 cm in diameter at breast height (1.3 m) are evaluated annually in terms of its degree of deterioration and its transparency. The decline means a mortality of shoots which progresses downward from the end of each branch. The overall proportion of decline is visually evaluated by a team of two people and recorded as a percentage (0, 5, 10% and thereafter at 10% accuracy). Transparency is defined as the proportion of sky visible through the leaves portion of the tree. One estimates the average transparency of the living part of the crown, and one registers it in the same classes as for the percentage decline.

Objective(s)

Launched in 1988 in collaboration with the United States, Canada-US project to study the decline of maple (NAMP) was to monitor the status of sugar maple (Acer saccharum Marsh.) in the entire north-eastern North America.

Comment(s)

Details of plot establishment and all annual assessments are described in:

Millers, I.; Lachance, D.; Burkman, W.G.; Allen, D.C. 1991. North American Sugar Maple decline project: organization and field methods. Forestry Canada, Quebec Region, Sainte-Foy, Quebec. General Technical Report NE 154, USDA Forest Service, Northeastern Forest Experimental Station, Radnor, Pennsylvania, USA. 26 p.

Project status

Completed

Layout/design

The plots were established in southern Quebec.

The device is inactive since 1999. Some places were followed until 2003 through the case study on the icestorm. No follow-up has been done since. The sites are not protected, except those sites in National Parks of Quebec or in places of RESEF of the MRNF of Quebec.

Details of plot establishment and all annual assessments can be found in Millers, I.; Lachance, D.; Burkman, W.G.; Allen, D.C. 1991. North American Sugar Maple decline project: organization and field methods. Forestry Canada, Quebec Region, Sainte-Foy, Quebec. General Technical Report NE 154, USDA Forest Service, Northeastern Forest Experimental Station, Radnor, Pennsylvania, USA. 26 p.

Study leader(s)

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Species

- Hardwoods
- Maples

Treatment(s)

Data activity	Inactive available - data set is static but available
Data stability	Very stable - data digitized recently; available in hard copy; well documented
Measurement(s)	• Dieback • Transparency • Vigour • Diameter at breast height (dbh) • Stem status (living/dead)
Establishment year(s)	1988
Measurement year(s)	1988 - 1998
Treatment year(s)	1988 - 1998
Data location	Virtual: pidesroc on s2-que-nas\perso$'\AnalyseDNARPA\données\ and Oracle database housed at AFC, Database National Forest Health (AFC). Hard copy: 1-50. Paper archives located in identified filing cabinets. Quebec documents only
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre
Metadata creation date	2009-01-21
Metadata modification date	

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administra-tive region	Design status	Plot integrity	Plot type	Comments

NAMP - Numéro de grappe 1QU002 - Buckingham	Buckingham	-75.47	45.57	Boreal Shield	Sugar maple-bitternut hickory	07	Completed but watched
NAMP - Numéro de grappe 1QU004 - Nord Duhamel (L. de la Grange)	Lac-Chapleau	-75.05	46.13	Boreal Shield	Western sugar maple-yellow birch	15	Completed but watched
NAMP - Numéro de grappe 1QU006 - Rivière-à-Pierre (Perthuis)	Rivière-à-Pierre	-72.08	46.95	Boreal Shield	Eastern sugar maple-yellow birch	03	Completed but watched
NAMP - Numéro de grappe 1QU008 - Saint-Hilaire-de-Dorset	Saint-Hilaire-de-Dorset	-70.85	45.88	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Completed but watched
NAMP - Numéro de grappe 1QU010 - Notre-Dame-du-Rosaire (Montmagny)	Notre-Dame-du-Rosaire	-70.45	46.88	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Completed but watched
NAMP - Numéro de grappe 1QU012 - Auclair (Témiscouata)	Auclair	-68.63	47.70	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Completed but watched
NAMP - Numéro de grappe 1QU014 - Sutton-Jonction	Sutton Junction	-72.55	45.13	Atlantic Maritime	Eastern sugar maple-basswood	16	Completed but watched
NAMP - Numéro de grappe 1QU016 - Valcourt	Valcourt	-72.30	45.45	Atlantic Maritime	Eastern sugar maple-basswood	05	Completed but watched
NAMP - Numéro de grappe 1QU018 - Bréboeuf	Brébeuf	-74.65	46.12	Boreal Shield	Western sugar maple-yellow birch	15	Completed but watched

NAMP - Numéro de grappe 1QU020 - Sud St-Bruno (Lac de l'Est)	Saint-Omer-de-L'Islet	-69.57	47.23	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Completed but watched
NAMP - Numéro de grappe 1QU022 - Milan	Milan	-71.07	45.52	Atlantic Maritime	Eastern sugar maple-yellow birch	05	Completed but watched
NAMP - Numéro de grappe 1QU024 - Sainte-Praxède	Sainte-Praxède	-71.17	45.75	Atlantic Maritime	Eastern sugar maple-yellow birch	05	Completed but watched
NAMP - Numéro de grappe 2QU001 - N-O Hull (Parc Gatineau)	Heyworth	-75.90	45.53	Boreal Shield	Western sugar maple-basswood	07	Completed but watched
NAMP - Numéro de grappe 2QU003 - Sud Kiamika (Lac Misérable, Parc Papineau-Labelle)	Notre-Dame-du-Laus	-75.32	46.22	Boreal Shield	Western sugar maple-yellow birch	15	Completed but watched
NAMP - Numéro de grappe 2QU005 - Rivière-à-Pierre (Perthuis)	Rivière-à-Pierre	-72.10	46.95	Boreal Shield	Eastern sugar maple-yellow birch	03	Completed but watched
NAMP - Numéro de grappe 2QU007 - Saint-Hilaire-de-Dorset	Saint-Hilaire-de-Dorset	-70.87	45.82	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Completed but watched
NAMP - Numéro de grappe 2QU009 - Notre-Dame-du-Rosaire (Montmagny)	Notre-Dame-du-Rosaire	-70.45	46.88	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Completed but watched

NAMP - Numéro de grappe 2QU011 - Auclair (Témiscouata)	Auclair	-68.70	47.73	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Completed but watched
NAMP - Numéro de grappe 2QU013 - Sutton	Sutton	-72.58	45.07	Atlantic Maritime	Eastern sugar maple-basswood	16	Completed but watched
NAMP - Numéro de grappe 2QU015 - Magog (Parc Mont Orford)	Magog	-72.22	45.35	Atlantic Maritime	Eastern sugar maple-basswood	05	Completed but watched
NAMP - Numéro de grappe 2QU017 - Saint-Faustin (C.E.F. Laurentides)	Saint-Faustin	-74.47	46.05	Boreal Shield	Eastern sugar maple-yellow birch	15	Completed but watched
NAMP - Numéro de grappe 2QU019 - Sud St-Bruno (Lac de l'Est)	Saint-Omer-de-L'Islet	-69.57	47.23	Atlantic Maritime	Eastern balsam fir-yellow birch	01	Completed but watched
NAMP - Numéro de grappe 2QU021 - La Patrie (Mont-Mégantic)	La Patrie	-71.20	45.45	Atlantic Maritime	Eastern sugar maple-yellow birch	05	Completed but watched
NAMP - Numéro de grappe 2QU023 - Sainte-Praxède (Parc Frontenac)	Sainte-Praxède	-71.20	45.85	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Completed but watched

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- Houston, D.R.; Allen, D.C.; Lachance, D. 1990. Aménagement de l'érablière : guide de protection de la santé des arbres. Rapport NE-129. USDA Forest Service, Northeastern Forest Experiment Station, Radnor, Pennsylvania, et Forêts Canada, Région du Québec, Sainte-Foy (Québec). Rapport d'information LAU-X-92F. 59 p.
- Houston, D.R.; Allen, D.C.; Lachance, D. 1990. Sugarbush management: A guide to maintaining tree health. General Technical Report number NE-129. USDA Forest Service, Northeastern Forest Experiment Station, Radnor, Pennsylvania, and Forestry Canada, Quebec Region, Sainte-Foy, Quebec. Information Report LAU-X-92E. 55 p.
- Lachance, D. 1989. Collaboration Canada-États-Unis dans une étude contre le dépérissement. Pages 45-46 (Vol. Supplément dossier l'érable, 9 février 1989) dans Terre de chez nous. Service canadien des forêts, Région du Québec, Sainte-Foy (Québec).
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Old-growth forests

Abstract

Permanent plots of 1 ha each were established in old-growth forests to monitor forest dynamics over several years. More specifically, tree mortality and light variations are monitored every year, whereas dendrometric measurements, wood debris and new stems are monitored every 5 years. All trees >5 cm (d.b.h.) in the plot are mapped.

Objective(s)

Principal objective: monitor the forest dynamics of old-growth forests over several years.

Specific objectives:
1) Acquire data on changes in the composition, structure and structural attributes of the stands;
2) Supply data for the models predicting changes in forest stands, making it possible to evaluate the impact of various silvicultural scenarios.

Comment(s)

Project status

Active

Layout/design

Three 100 x 100 m permanent plots in a grid design, with posts every 10 m. All trees greater than 5 cm are mapped.

Study leader(s)

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Species

- Balsam fir
- Black spruce
- Jack pine
- Larch/Tamarack
- White spruce
- Trembling aspen
- White birch

Treatment(s)

Data activity	Active regular - data set is updated regularly
Data stability	Very stable - data digitized recently; available in hard copy; well documented
Measurement(s)	• Forest inventory (Permanent sample plot) • Stem height • Diameter at breast height (dbh) • Stem status (living/dead) • Light measurement (PAR) • Stem width • tree cartography • Age • Coarse woody debris
Establishment year(s)	2005; 2006
Measurement year(s)	2005; 2006; 2007
Treatment year(s)	
Data location	In a filing cabinet located in room 2.14 at the LFC
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre
Metadata creation date	2008-02-05
Metadata modification date	

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administrative region	Design status	Plot integrity	Plot type	Comments
Vieilles forêts - Placette 1	Baie-Comeau	-67.91	49.63		1	Boreal Shield	Eastern balsam fir-white birch	09	Actively Managed	Good	Square (100 x 100 m)	
Vieilles forêts - Placette 13	Baie-Comeau	-67.78	49.58		1	Boreal Shield	Eastern balsam fir-white birch	09	Actively Managed	Good	Square (100 x 100 m)	
Vieilles forêts - Placette 15	Baie-Comeau	-68.12	49.71		1	Boreal Shield	Eastern balsam fir-white birch	09	Actively Managed	Good	Square (100 x 100 m)	

Publication(s)

Portneuf Project (Green Plan)

Abstract: Portneuf county, located along the main pollutant transport line from the American Midwest and the great Lakes, is associated with industrial development. Eighteen plots, located in the southern part of the county, were assessed from 1992 to 1997 for sugar maple health, crown condition, defoliation and abiotic symptoms.

Objective(s): Determine the impact of pollutants transported to long distance and the pollutants produced locally in a rural industrial locality.

Comment(s): Green Plan Project of the Canadian Government.

The methodology can be found in the following publications:

Magasi, L.P. 1988. Acid rain national early warning system: manual on plot establishment and monitoring. Canadian Forestry Service, Headquarters, Forest Science Directorate, Ottawa. Information Report DPC-X-25. 59 p.

Project status: Completed

Layout/design: The sample plots were installed in the county of Portneuf, Quebec.

The methodology can be found in the following publications:

Magasi, L.P. 1988. Acid rain national early warning system: manual on plot establishment and monitoring. Canadian Forestry Service, Headquarters, Forest Science Directorate, Ottawa. Information Report DPC-X-25. 59 p.

Magasi, L.P. 1988. Dispositif national d'alerte rapide pour les pluies acides : guide pour l'établissement et la surveillance des parcelles. 1988. Service canadien des forêts, Administration centrale, Ottawa (Ontario). Rapport d'information DPC-X-25F. 59 p.

Study leader(s)
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Species
- Conifers
- Hardwoods
- Maples

Treatment(s)
- Tapping

Data activity	Inactive available - data set is static but available
Data stability	Moderately stable - data digitized recently; available in hard copy
Measurement(s)	• Crown condition • Plant cover • Diameter at breast height (dbh) • Lenght of live crown • Stem mortality • Stem quality • Abiotic symptoms
Establishment year(s)	1991
Measurement year(s)	1991 - 1997
Treatment year(s)	
Data location	Virtual : pidesroc sur 's2-que-nas\perso$' \PORTNEUF Physique : Documents papier dans les classeurs identifiés à cet effet.
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre
Metadata creation date	2009-01-21
Metadata modification date	

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administra-tive region	Design status	Plot integrity	Plot type	Comments

Plan Vert - Érablière no 1 - Grondines	Saint-Casimir	-72.10	46.64	100	Mixedwood Plains	Eastern sugar maple-basswood	03	Completed but watched
Plan Vert - Érablière no 2 - Saint-Marc (ouest)	Saint-Marc-des-Carrières	-72.07	46.67	140	Mixedwood Plains	Eastern sugar maple-basswood	03	Completed but watched
Plan Vert - Érablière no 3 - Saint-Marc	Saint-Marc-des-Carrières	-72.03	46.68	140	Mixedwood Plains	Eastern sugar maple-basswood	03	Completed but watched
Plan Vert - Érablière no 4 - Saint-Gilbert	Saint-Gilbert	-71.96	46.72	350	Mixedwood Plains	Eastern sugar maple-basswood	03	Completed but watched
Plan Vert - Érablière no 5 - Portneuf-Station	Portneuf-Station	-71.89	46.72	300	Mixedwood Plains	Eastern sugar maple-basswood	03	Completed but watched
Plan Vert - Érablière no 6 - Cap-Santé	Cap-Santé	-71.80	46.70	250	Mixedwood Plains	Eastern sugar maple-basswood	03	Completed but watched
Plan Vert - Érablière no 7 - Sainte-Jeanne	Pont-Rouge	-71.77	46.74	250	Mixedwood Plains	Eastern sugar maple-basswood	03	Completed but watched
Plan Vert - Érablière no 8 - Neuville	Neuville	-71.64	46.72	275	Mixedwood Plains	Eastern sugar maple-basswood	03	Completed but watched
Plan Vert - Érablière no 9 - Neuville (est)	Neuville	-71.57	46.75	400	Mixedwood Plains	Eastern sugar maple-basswood	03	Completed but watched

Plan Vert - Érablière no 10 - Saint-Augustin	Saint-Augustin	-71.52	46.79	300	Boreal Shield	Eastern sugar maple-basswood	03	Completed but watched
Plan Vert - Érablière no 11 - Saint-Casimir	Saint-Casimir	-72.14	46.70	150	Mixedwood Plains	Eastern sugar maple-basswood	03	Completed but watched
Plan Vert - Érablière no 12 - Saint-Gilbert (nord)	Saint-Gilbert	-72.02	46.75	300	Mixedwood Plains	Eastern sugar maple-basswood	03	Completed but watched
Plan Vert - Érablière no 13 - Saint-Basile	Saint-Basile	-71.85	46.78	500	Mixedwood Plains	Eastern sugar maple-basswood	03	Completed but watched
Plan Vert - Érablière no 14 - Route d'Irlande	Notre-Dame-de-Portneuf	-71.97	46.77	375	Mixedwood Plains	Eastern sugar maple-basswood	03	Completed but watched
Plan Vert - Érablière no 15 - Sainte-Catherine	Sainte-Catherine-de-la-Jacques-Cartier	-71.56	46.81	550	Boreal Shield	Eastern sugar maple-basswood	03	Completed but watched
Plan Vert - Érablière no 16 - Saint-Thuribe	Saint-Thuribe	-72.19	46.73	450	Mixedwood Plains	Eastern sugar maple-basswood	03	Completed but watched
Plan Vert - Érablière no 18 - Sainte-Christine	Sainte-Christine-d'Auvergne	-71.97	46.85	600	Boreal Shield	Eastern sugar maple-basswood	03	Completed but watched
Plan Vert - Érablière no 19 - Pont-Rouge	Pont-Rouge	-71.72	46.82	550	Boreal Shield	Eastern sugar maple-basswood	03	Completed but watched

Plan Vert - Érablière no 20 - Duschenay	Fossambault-sur-le-Lac	-71.64	46.87	550		Boreal Shield	Eastern balsam fir-yellow birch	03	Completed but watched

Publication(s)

- Desmarais, V.; DesRochers, P. 2006. La santé et l'aménagement des érablières - Un bref historique… Partenariat Innovation Forêt, Fiche technique 1, Progrès Forestiers, juin 2006. Pages 24-25.
- DesRochers, P.; Dusabenyagasani, M.; Bérubé, J.A.; Hamelin, R.C. 2003. Impact of Armillaria rRNA - IGS groups on crown conditions of maples in Portneuf County. In Root and Butt Rots of Forest trees, Proceedings of the IUFRO Working Party 7.02.01 Quebec City, Canada, September 16-22, 2001. Ressources naturelles Canada, Service canadien des forêts, Centre de foresterie des Laurentides, Rapport d'information Lau-X-126. Pages 105-112.
- Turbis, C.; DesRochers, P.; Rioux, D. 2007. La santé et l'aménagement des érablières - L'aménagement des érablières : des choix pour l'avenir. Partenariat Innovation Forêt, Fiche technique 4, Progrès Forestiers, février 2007. Pages 24-25.

Program of Energy Research and Development (PERD)

Abstract

Soil respiration is an important component of the global carbon cycle and it represents a flux that is at least ten times greater than the emissions caused by the combustion of fossil fuel. Forest soils, and especially soils of the boreal forest, contain large stores of carbon. A small net change in the dynamics of these stores could represent a large sink or a large source of carbon. The prediction of current simulation models can be improved by obtaining better information on the fluxes of soil carbon and on the factors controlling these fluxes.

The goal of this project is to provide a better understanding of the factors controlling the dynamics of soil carbon for two important ecosystems: balsam fir and black spruce forests. The main factor studied is soil organic matter quality, which varies with stand composition and soil temperature, which are in turn affected by climate change and disturbances. The project provides detailed empirical information on stocks and fluxes of carbon for selected stands. Also, using a climatic gradient where other factors such as stand composition, stand age and soil types are kept constant, and using laboratory incubation at different temperature regimes, this study will describe the relationships between temperature and soil carbon heterotrophic respiration.

Objective(s)

The main objective of this project is to compare carbon (C) dynamics in two types of conifer stands (balsam fir and black spruce) located in eastern Canada's boreal zone across a climatic gradient. The project is aimed at providing a better characterization of soil C pools and fluxes in two selected forest ecosystem types across a climatic gradient. This knowledge should improve the representation of detrital and soil C dynamics in national C models. More specifically, the objectives are to:
1. Provide rules for assessing the dynamics of soil C sequestration in two important forest biomes of the Canadian forest (i.e. black spruce and balsam fir) as a function of climate (i.e. how does temperature affect C inputs, outputs and storage in the soil).
2. Determine the extent to which vegetation and temperature control soil C pools and fluxes for a transect of boreal forests in eastern Canada.

Comment(s)

This project is included in the following PERD component:

EGGS POL 6.2: Forest Component - Theme: Soil carbon dynamics

Project's theme: Dynamics of root, detritus, and soil carbon in representative forest ecosystems across Canada. Appendix 1-E: Improving the prediction of changes in soil C sequestration - How does climate and species control soil carbon cycling at ECOLEAP sites?

Project status

Completed

Layout/design

The central core of the PERD design is composed of 23 research sites spread out over three climate zones, i.e. the plain on the north shore of the St. Lawrence west of Quebec City (zone 1: 200 to 325 m in altitude), the mountainside of the Laurentians (zone 2: 425 to 575 m in altitude) and the Parc des Laurentides (zone 3: 725 to 825 m in altitude). The difference in the average annual air temperatures is 4°C (-1.2 to 3.2°C) and 4°C (7.1 to 11.0°C) for the average soil temperature 15 cm below the surface as estimated for the period of May 1 to October 31. Two other sites were included in zone 2, i.e. a black spruce - jack pine stand at Lac Tirasse (TIR site of the ECOLEAP project) located in the Ashuapsmichuan Reserve northwest of Lac Saint-Jean, and a black spruce stand in the Corner Brook region of Newfoundland (in collaboration with Martin Moroni). Generally, a given site is defined by a circular plot of 400 m² located in a mature stand or one that is near maturity (more than 50 years old) established on a deposit of till, except for spruce stands in the Pont-Rouge region (zone 1) where fluvioglacial drifts are dominant. There are 6 main sites and 19 satellite sites. The main sites differ from the satellite sites

due to a larger array of types of measurements and by a greater intensity in measurement frequency. The following measurements are available for all sites: 1) diameter and height of the trees in 2001 and 2005; 2) coring to determine the age; 3) coring to determine growth over the last 10 years; 4) biomass of the undergrowth plants and stems less than 5 cm; 5) foliar analyses; 6) soil and air temperature; 7) light measurements using a quantum probe; 8) flux in the seedbeds and elements (C, N, P, K, Ca and Mg) in the various seedbed components; 9) total C and N reserves in layers L, F, H, 0-20 cm and 20-40 cm beneath the surface; 10) soil respiration (with soil temperature and water content) using the LICOR 6200 or 6400 for the 2001-2002 to 2006 period; 11) ground wood debris measurements. The following additional measurements were conducted at the satellite sites: 12) estimation of the heterotrophic respiration in the trenched areas; 13) root growth using the minirhizotron technique; 14) soil coring to determine the biomass of the fine roots; 15) laboratory incubation of layers FH and 0-20 cm at temperatures of 3, 10, 15 and 22°C; 16) laboratory incubation of the various seedbed components

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Species

- Balsam fir
- Black spruce

Treatment(s)

Data activity

Active regular - data set is updated regularly

Data stability

Very stable - data digitized recently; available in hard copy; well documented

Measurement(s)

- Diameter at breast height (dbh)
- Stem height
- Root productivity
- Soil respiration
- Micrometeorology
- Soil measurement
- C and N pool

- Light measurement (PAR)
- Litter decomposition

Establishment year(s)	2001
Measurement year(s)	2001 - 2007
Treatment year(s)	
Data location	Electronic data saved on the LFC common disk U in the Ecosytème forestier\ECOLEAP\PERD directory
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre
Metadata creation date	2008-01-21
Metadata modification date	2008-03-25

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administrative region	Design status	Plot integrity	Plot type	Comments
PERD - ACAD - Acadie	Saint-Raymond	-71.83	46.84	171		Boreal Shield	Eastern sugar maple-basswood	03	Abandoned	Poor	Round (400 m²: 11.28 m radius)	
PERD - AVRP - Avant Rivière-à-Pierre	Rivière-à-Pierre	-72.13	46.94	208		Boreal Shield	Eastern sugar maple-yellow birch	03	Abandoned	Poor	Round (400 m²: 11.28 m radius)	

PERD - CJCART-1 - Camp Jacques-Cartier	L'Étape	-71.23	47.60	800	Boreal Shield	Eastern balsam fir-white birch	03	Abandoned	Poor	Round (400 m²: 11.28 m radius)	
PERD - DUC-2 - Duchesnay 2	Lac-Saint-Joseph	-71.65	46.93	190	Boreal Shield	Eastern balsam fir-yellow birch	03	Abandoned	Poor	Round (400 m²: 11.28 m radius)	
PERD - FM - Forêt Montmonrency	Saint-Ferréol-les-Neiges	-71.10	47.32	870	Boreal Shield	Eastern balsam fir-white birch	03	Abandoned		Round (400 m²: 11.28 m radius)	See the device of ECOLEAP for more details.
PERD - FR - Francinette	Saint-Adolphe	-71.29	47.14	580	Boreal Shield	Eastern balsam fir-white birch	03	Abandoned	Poor	Round (400 m²: 11.28 m radius)	
PERD - J1 - Jumeau 1	L'Étape	-71.24	47.47	795	Boreal Shield	Eastern balsam fir-white birch	03	Abandoned	Poor	Round (400 m²: 11.28 m radius)	
PERD - J2 - Jumeau 2	L'Étape	-71.23	47.47	798	Boreal Shield	Eastern balsam fir-white birch	03	Abandoned	Poor	Round (400 m²: 11.28 m radius)	
PERD - J3 - Jumeau 3	L'Étape	-71.23	47.47	800	Boreal Shield	Eastern balsam fir-white birch	03	Abandoned	Poor	Round (400 m²: 11.28 m radius)	
PERD - KM82 - Kilomètre 82	Saint-Adolphe	-71.26	47.16	577	Boreal Shield	Eastern balsam fir-white birch	03	Abandoned	Poor	Round (400 m²: 11.28 m radius)	
PERD - NFL - Newfoundland	Little Rapids	-57.63	48.95	152	Boreal Shield			Abandoned	Poor	Round (400 m²: 11.28 m radius)	

PERD - PR - Pont-Rouge	Pont-Rouge	-71.61	46.81	175	Boreal Shield	Eastern sugar maple-basswood	03	Abandoned	Poor	Round (400 m²: 11.28 m radius)
PERD - PTR - La Truite	Saint-Adolphe	-71.33	47.12	407	Boreal Shield	Eastern balsam fir-yellow birch	03	Abandoned	Poor	Round (400 m²: 11.28 m radius)
PERD - REPO - Réserve de Portneuf	Rivière-à-Pierre	-72.12	47.03	200	Boreal Shield	Eastern sugar maple-yellow birch	03	Abandoned	Poor	Round (400 m²: 11.28 m radius)
PERD - RES - RESEF 203	La Doré	-72.77	48.81	280	Boreal Shield	Western balsam fir-white birch	02	Abandoned	Poor	Round (400 m²: 11.28 m radius)
PERD - RIV-M - Rivière Montmorency	Saint-Ferréol-les-Neiges	-71.13	47.31	719	Boreal Shield	Eastern balsam fir-white birch	03	Abandoned	Poor	Round (400 m²: 11.28 m radius)
PERD - RIVN-1 - Rivière Noire, route 33	Saint-Ferréol-les-Neiges	-71.10	47.35	790	Boreal Shield	Eastern balsam fir-white birch	03	Abandoned	Poor	Round (400 m²: 11.28 m radius)
PERD - RIVN-2 - Rivière Noire, chute	Saint-Ferréol-les-Neiges	-71.10	47.33	717	Boreal Shield	Eastern balsam fir-white birch	03	Abandoned	Poor	Round (400 m²: 11.28 m radius)
PERD - SAUT - Sauterisky	Stoneham	-71.21	47.32	829	Boreal Shield	Eastern balsam fir-white birch	03	Abandoned	Poor	Round (400 m²: 11.28 m radius)
PERD - SC-EPN - Sainte-Christine EPN	Sainte-Christine-d'Auvergne	-71.96	46.79	135	Boreal Shield	Eastern sugar maple-basswood	03	Abandoned	Poor	Round (400 m²: 11.28 m radius)

PERD - SC-SAB - Sainte-Christine SAB	Sainte-Christine-d'Auvergne	-71.96	46.79	135	Boreal Shield	Eastern sugar maple-basswood	03	Abandoned	Poor	Round (400 m²: 11.28 m radius)	
PERD - SE - Lac Sergent	Saint-Raymond	-71.72	46.88	208	Boreal Shield	Eastern balsam fir-yellow birch	03	Abandoned	Poor	Round (400 m²: 11.28 m radius)	This device comprise principal sites with measurement of the heterotrophic breathing of the ground in plots (1 to 2 m²) whose perimeter has been cut to 50 cm of depth in the ground in order to exclude the autotrophic root respiration.
PERD - SLAC7 - Lac sept-îles	Saint-Raymond	-71.78	46.93	320	Boreal Shield	Eastern balsam fir-yellow birch	03	Abandoned	Poor	Round (400 m²: 11.28 m radius)	
PERD - STMAT - Rang St-Mathias	La Jacques-Cartier	-71.66	47.06	200	Boreal Shield	Eastern balsam fir-yellow birch	03	Abandoned	Poor	Round (400 m²: 11.28 m radius)	
PERD - TIR - Lac Tirasse	La Doré	-73.05	49.18	430	Boreal Shield	Western balsam fir-white birch	02	Abandoned	Poor	Round (400 m²: 11.28 m radius)	See the device of ECOLEAP for more details.

Publication(s)

Scleroderris canker (LFC) in the Outaouais region

Abstract

Scleroderris canker is caused by an ascomycetous fungus, Gremmeniella abietina (Lagerberg) Morelet; it was not identified in North America until the early 1960s (Laflamme 1991). In Quebec, there are two strains of this fungus, namely the native fungus described as being a North American breed. This fungus grows only in snow. However, the other strain of this causal fungus described as European was imported into North America and first detected in Quebec in 1978 (Laflamme and Lachance 1987). This fungus is more damaging to red pine as it can develop over the entire height of the crown. In a special survey in the Outaouais, Gatineau, La Lièvre and La Rouge valleys in 1984, over 10% of 1,200 plantations inventoried were affected by the European strain of the disease (Laflamme and Lachance 1987). As there was no way to control this disease, we conducted, in conjunction with the foresters in these regions, a systematic pruning of the lower third of the whorls of red pine, with cutting of dead or dying pines. To measure the impact of this intervention on the disease, we selected 50 unpruned red pine plantations ranging in age from 8 to 15 years. Their state of health from 1983 to 1984 was already deteriorating. Pruning was carried out by very different teams and spanned several years, namely 24 in 1984, 10 in 1985 and 7 from 1986 to 1994. Nine plantations were not pruned. Preliminary results are presented in Laflamme 2006.

Objective(s) Control of scleroderris canker in plantations located in the Outaouais region.

Comment(s)

Project status Active

Layout/design One or two rectangular sample plots are distributed inside plantations of red pine.

Study leader(s)
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Collaborator(s)

Species
- Red pine

Treatment(s)
- Planting

Data activity Inactive available - data set is static but available

Data stability Very stable - data digitized recently; available in hard copy; well documented

Measurement(s)	• Stem status (living/dead) • Stem height • Age • Percentage of affected branches
Establishment year(s)	1983
Measurement year(s)	1983 - 1999
Treatment year(s)	1983 - 1999
Data location	Room 1.37 at the LFC
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre
Metadata creation date	2008-01-30
Metadata modification date	

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administra-tive region	Design status	Plot integrity	Plot type	Comments
Chancre	Bristol Ridge	-76.40	45.65	152	1	Boreal Shield	Sugar maple-bitternut hickory	07	Unknowned		Linear	
Chancre	Bristol Ridge	-76.35	45.65	152	3.2	Boreal Shield	Sugar maple-bitternut hickory	07	Unknowned		Linear	

Chancre	Charteris	-76.43	45.67	152	2.4	Boreal Shield	Sugar maple-bitternut hickory	07	Unknowned	Linear
Chancre	Charteris	-76.42	45.66	152	16	Boreal Shield	Sugar maple-bitternut hickory	07	Unknowned	Linear
Chancre	Chartierville	-76.41	45.67	183	4	Boreal Shield	Sugar maple-bitternut hickory	07	Unknowned	Linear
Chancre	Chute-Saint-Philippe	-75.27	46.65	305	9.6	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	Chute-Saint-Philippe	-75.24	46.67	274	4	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	Danford Lake	-76.19	45.88	213	5.2	Boreal Shield	Western sugar maple-basswood	07	Unknowned	Linear
Chancre	Duclos	-76.15	45.70	183	2.8	Boreal Shield	Western sugar maple-basswood	07	Unknowned	Linear
Chancre	Duclos	-76.14	45.72	183	2.8	Boreal Shield	Western sugar maple-basswood	07	Unknowned	Linear
Chancre	East Aldfield	-76.16	45.80	244	0.8	Boreal Shield	Western sugar maple-basswood	07	Unknowned	Linear

Chancre	Ferme-Neuve	-75.48	46.64	244	4	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	Kazabazua	-76.05	45.95	183	1.8	Boreal Shield	Western sugar maple-basswood	07	Unknowned	Linear
Chancre	La Macaza	-74.78	46.34	244	2	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	La Minerve	-75.01	46.25	244	8	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	La Minerve	-74.79	46.29	305	0.75	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	LaBelle	-74.70	46.24	244	0.5	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	Lac-du-Cerf	-75.51	46.31	244	2.6	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	Lac-Saguay	-75.07	46.43	305	0.6	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	Lac-Saint-Paul	-75.27	46.76	305	3.4	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear

Chancre	Lac-Saint-Paul	-75.26	46.77	305	6	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	L'Annonciation	-74.93	46.45	274	1	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	L'Annonciation	-74.89	46.44	244	2.4	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	L'Annonciation	-74.89	46.44	244	3.2	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	L'Annonciation	-74.86	46.38	244	5.6	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	L'Ascension	-74.85	46.60	305	3.2	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	L'Ascension	-74.83	46.55	305	2	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	L'Ascension	-74.82	46.55	305	10	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	L'Ascension	-74.81	46.58	244	1	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear

Chancre	L'Ascension	-74.81	46.58	305	0.8	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	Mont-Laurier	-75.59	46.54	244	1.4	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	Mont-Laurier	-75.48	46.47	244	1.6	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	Mont-Saint-Michel	-75.34	46.76	274	1	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	Mont-Saint-Michel	-75.33	46.76	274	2.6	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	Mont-Saint-Michel	-75.24	46.80	305	0.8	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	Mont-Saint-Michel	-75.21	46.83	305	1.2	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	Mont-Saint-Michel	-75.20	46.84	305	2.6	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	Mont-Saint-Michel	-75.20	46.84	305	3.2	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear

Chancre	Notre-Dame-de-Pontmain	-75.63	46.33	244	3.2	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	Sainte-Anne-du-Lac	-75.30	46.94	305	4.8	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	Sainte-Anne-du-Lac	-75.29	46.87	274	4.4	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	Sainte-Anne-du-Lac	-75.29	46.87	244	1.6	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	Shawville	-76.42	45.70	183	4	Boreal Shield	Sugar maple-bitternut hickory	07	Unknowned	Linear
Chancre	Shawville	-76.41	45.56	152	14	Boreal Shield	Sugar maple-bitternut hickory	07	Unknowned	Linear
Chancre	Stagsburn	-76.03	45.78	244	2	Boreal Shield	Western sugar maple-basswood	07	Unknowned	Linear
Chancre	Val-Barrette	-75.34	46.51	244	1.6	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear
Chancre	Val-Barrette	-75.30	46.50	305	0.8	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Linear

Chancre	Vendée	-74.84	46.08	244	16	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned		Linear
Chancre - 1	Ferme-Neuve	-75.34	46.78	274	2	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned	Unknown	Rectangular
Chancre - 2	Ferme-Neuve	-75.36	46.77	244	4.8	Boreal Shield	Western sugar maple-yellow birch	15	Unknowned		Linear

Publication(s)

- Laflamme, G. 1991. Le chancre scléroderrien des pins. Forêts Canada, Région du Québec, Sainte-Foy, Québec. Feuillet d'information CFL 3. 12 p.
- Laflamme, G. 2006. L'élagage phytosanitaire : maîtrise de maladies des pins. Pages 17-20 dans Actes du colloque : Élaguer pour enrichir nos forêts. Colloque sur l'élagage forestier, 14-15 mars 2006, Maniwaki, Québec. 57 p.
- Laflamme, G.; Lachance, D. 1987. Large infection center of Scleroderris canker (European race) in Quebec province. Plant Disease 71:1041-1043.

Second commercial thinning and shelterwood cutting protocol in a black spruce stand on clay

Abstract

The production of large-diameter stems seems to be an interesting economic possibility due to, on the one hand, a significant increase in the value per foot of the stems when the dbh exceeds 18 cm (Zhang 1998) and, on the other hand, the reduction in harvesting costs associated with the increase in average stem volume (Meek 2001).

Objective(s)

- Develop and try various means of treating black spruce stands that have undergone a commercial thinning in order to maximize stand value.
- Evaluate the costs of each method.
- Evaluate the impact of the treatments on stand wood production (quantity and quality).
- Evaluate the impact of the treatments on the regenaration growing under forest cover (density, composition, height, distribution and quality coefficient).

Comment(s)

Fifty sextets were established in the scarification protocol in 2002.

Project status

Active

Layout/design

The experimental design is composed of 5 blocks, each consisting of five experimental units measuring approximately 90 x 90 m. The units of measurement are arranged to cover three inter-path strips. A variable rectangular plot of + / - 400 m² (depending on the width of the paths) is located in the centre of each unit of measurement.
One of the following treatments is assigned at random to each experimental unit:
- Control (no harvesting)
- Selective cutting at 30% with use of existing paths;
- Selective cutting at 50% with use of existing paths;
- Semi-selective cutting at 30% with creation of new paths;
- Semi-selective cutting at 50% with creation of new paths.

Study leader(s)

• Lussier, Jean-Martin - Canadian Wood Fibre Centre
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Collaborator(s)

• Audet, Gilles -
- E-Mail: - Tel. Ext.

• Philippe Meek - Forest Engineering Research Institute of Canada (FERIC)
- E-Mail: philippe-m@mtl.feric.ca - Tel. (514) 694-1140 Ext.

Species

Treatment(s)

• Commercial thinning
• Partial harvest

Data activity	Inactive available - data set is static but available
Data stability	Moderately stable - data digitized recently; available in hard copy
Measurement(s)	• Forest inventory (Permanent sample plot) • Seedlings inventorry
Establishment year(s)	2001
Measurement year(s)	2001 - 2006
Treatment year(s)	2001; 2002
Data location	U:\Ecosystemes Forestiers\Pratiques forestieres\6903\6903-04 2e éclaircie Coupe progressive EPN Amos Data located in room 2.11B at the LFC, project book 6903-04
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre
Metadata creation date	2008-01-28
Metadata modification date	

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administra-tive region	Design status	Plot integrity	Plot type	Comments

Seconde éclaircie commerciale et coupe progressive - canton Miniac - Matériaux Blanchet	Amos	-78.16	48.92	25	Boreal Shield	Western balsam fir-white birch	08	Completed but watched	Good	Rectangular variable (+ or - 400 m²)

Publication(s)

Spruce budworm population dynamics

Abstract	Using various implantation methodes, the impact of parasitism and predation on two well-known populations of this insect in Central Quebec will be measured. This study is essential in obtaining a better understanding of the epidemic process of the spruce budworm.
Objective(s)	Fundamental study of spruce budworm, Choristoneura fumiferana (Clem.), endemic population dynamics.
Comment(s)	
Project status	Active
Layout/design	Path that crosses the stand with trees whose foliage can easily be reached from the ground.
Study leader(s)	• Régnière, Jacques - Canadian Forest Service, Laurentian Forestry Centre - E-Mail: jregnier@rncan.gc.ca - Tel. (418) 648/5257 Ext.
Collaborator(s)	
Species	• Balsam fir • White spruce
Treatment(s)	
Data activity	Active regular - data set is updated regularly
Data stability	Very stable - data digitized recently; available in hard copy; well documented
Measurement(s)	• Impact of natural ennemies •
Establishment year(s)	1985
Measurement year(s)	1985
Treatment year(s)	

Data location: Room 2.45 at the LFC

Contributor(s) to the creation of the metadata:
- Canadian Forest Service, Laurentian Forestry Centre

Metadata creation date: 2008-02-04

Metadata modification date:

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administrative region	Design status	Plot integrity	Plot type	Comments
TBE - Épaule	Montmorency	-71.19	47.30	789	1	Boreal Shield	Eastern balsam fir-white birch	03	Actively Managed	Poor		Choice of 100 balsam fir trees in a plot of approximately 1 hectare.
TBE - Placette d'Armagh	Armagh	-70.66	46.77	277	1	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Actively Managed	Poor		Choice of 100 balsam fir trees in a plot of approximately 1 hectare.

Publication(s)
- Lethiecq, J.-L.; Régnière, J. 1988. CFS. Spruce budworm population studies: site descriptions. Canadian Forest Service, Information Report LAU-X-83. 46 p.

Thinning and fertilization experimental protocol in a black spruce stand - Gordon Weetman

Abstract: In 1961, an experimental protocol was established to study the nitrogen cycle in a nitrogen-deficient black spruce stand growing on an accumulation of humus containing a large reserve of organic nitrogen (Weetman 1971). More specifically, the objective was to determine whether the growth and nitrogen supply of black spruce could be improved by: 1) conducting a thinning which, by increasing the soil temperature, could increase the mineralization of the organic nitrogen contained in the humus layer; and 2) applying a nitrogen fertilization treatment to directly increase the level of mineral nitrogen availability. In 2001, at a seminar, Michel Soucy reported on the results obtained 40 years after the treatments.

Objective(s): Effect of thinning and fertilization on the growth of a black spruce (Picea mariana) stand.

Comment(s):

Project status: Active

Layout/design: A Picea mariana (Mill.) B.S.P. stand located near Baie-Comeau, Quebec, was thinned and fertilized with urea using a split plot factorial design.

Study leader(s):
- Lussier, Jean-Martin - Canadian Wood Fibre Centre
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Collaborator(s):
- Gagné, Roger - Canadian Wood Fibre Centre
  - E-Mail: rgagne@rncan.gc.ca - Tel. (418) 648-7141 Ext.
- Soucy, Michel -
  - E-Mail: - Tel. Ext.

Species:
- Black spruce

Treatment(s):
- Fertilisation
- Thinning

Data activity: Inactive available - data set is static but available

Data stability: Moderately stable - data digitized recently; available in hard copy

Measurement(s):
- Diameter at breast height (dbh)
- Stem height
- Stem width

- Light measurement (PAR)

Establishment year(s)	1961
Measurement year(s)	2001
Treatment year(s)	1961
Data location	Data on U disk and in cabinet files located in room 2.11B at the LFC
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre
Metadata creation date	2007-12-14
Metadata modification date	2007-12-14

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administrative region	Design status	Plot integrity	Plot type	Comments
Weetman - Lac Dionne	Baie-Comeau	-68.14	49.73	230	3	Boreal Shield	Eastern balsam fir-white birch	09	Hiatus	Average	Round (101,25 m²: 5.677 m radius) 1/40 acre	

Publication(s)

- Soucy, M. Thèse de maîtrise. Éclaircie et fertilisation d'un peuplement d'épinette noire : effets à long terme sur la croissance des tiges, la production et la dynamique du peuplement.
- Weetman, G.F. 1968.The nitrogen fertilization of three black spruce stands. Pulp and Paper Research Institute of Canada, Woodland Paper No. 6.
- Weetman, G.F. 1971. Effects of thinning and fertilization on the nutrient uptake, growth and wood quality of upland black spruce. Pulp and Paper Research Institute of Canada, Woodland Paper No. 28.
- Weetman, G.F. 1975. Ten-year growth response of black spruce to thinning and fertilization treatments. Can. J. For. Res. 5: 302-309.

Use of Beauveria bassiana as biological control agent on bark pests

Abstract	Several tests were conducted in plantations to assess the efficacy of Beauveria bassiana against several forest insect species (white pine weevil, pine shoot beetle and spruce beetle).
Objective(s)	Determine the efficacy of Beauveria bassiana as biological control agent on bark pest species.
Comment(s)	The application method varies according to the insect species. Please consult our publications to find out more about it.
Project status	Active
Layout/design	Plantations are monospecific. White pine, Norway spruce and Scots pine plantations were used. The first two species were used to study white pine weevil and the third was used to study pine shoot beetle.
Study leader(s)	• Lavallée, Robert - Canadian Forest Service, Laurentian Forestry Centre - E-Mail: rlavalle@rncan.gc.ca - Tel. (418) 648-5803 Ext.
Collaborator(s)	• Chabot, Sarah - Canadian Forest Service, Laurentian Forestry Centre - E-Mail: schabot@rncan.gc.ca - Tel. (418) 648-7643 Ext. • Coulombe, Charles - Canadian Forest Service, Laurentian Forestry Centre - E-Mail: - Tel. Ext.
Species	• Norway spruce • Scots pine
Treatment(s)	
Data activity	Inactive available - data set is static but available
Data stability	Very stable - data digitized recently; available in hard copy; well documented
Measurement(s)	• Insect mortality
Establishment year(s)	2001
Measurement year(s)	

Treatment year(s)	2001 - 2008
Data location	Data stored in filing cabinets located in room 1.52 at the LFC
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre
Metadata creation date	2008-02-11
Metadata modification date	

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administra-tive region	Design status	Plot integrity	Plot type	Comments
Beauveria b. - 1a	Ascot Corner	-71.71	45.39			Atlantic Maritime	Eastern sugar maple-basswood	05	Abandoned	Unknown		Scots pine. Map available.
Beauveria b. - 23	Ascot Corner	-71.94	45.26			Atlantic Maritime	Eastern sugar maple-basswood	05	Abandoned	Unknown		Scots pine. Map available.
Beauveria b. - 25	Ascot Corner	-71.85	45.32			Atlantic Maritime	Eastern sugar maple-basswood	05	Abandoned	Unknown		Scots pine. Map available.
Beauveria b. - M. St Laurent 13b	Ascot Corner	-71.73	45.43			Atlantic Maritime	Eastern sugar maple-basswood	05	Abandoned	Unknown		Scots pine. Map available.

Publication(s)

• Trudel, R.; Lavallée, R.; Guertin, C.; Côté,C.; Todorova, S. I.; Alfaro, R.; Kope, H. 2007. Potential of Beauveria bassiana (Hyphomycetes: Moniliales) for controlling the white pine weevil, Pissodes strobi (Col., Curculionidae) Journal of Applied Entomology 131 (2):90-97

Use of prescribed burns to restore the original structures of the remaining white pine stands in the La Mauricie National Park of Canada

Abstract

The aim of this work is to evaluate the success of these practices on two different aspects of white pine stand dynamics in La Mauricie National Park of Canada (LMNPC). One part of the document focuses on the floristic aspect of the problem, i.e. white pine regeneration in the treated sites. An evaluation of the success of regeneration was made by comparing the treated sites to control sites in order to see if Parks Canada managers were meeting the targets set when the program was implemented. Secondly, the faunistic aspect was assessed by studying beetle communities in burned sites and control sites. The aim of this part of the study was to understand species distribution in burned and unburned forest. This will allow us to better understand the role of fire in maintaining certain species of beetles across the mosaic of white pine stands in the Park.

Objective(s)

Using prescribed burns to restore the original structures of residual white pine stands in La Mauricie National Park of Canada: using beetle community patterns to assess the attainment of the ecological integrity objectives of Parks Canada.

In order to restore the original structure of residual white pine stands in the LMNPC, managers have used prescribed burns. The objective of this current work is to assess the impacts of prescribed burns on the regeneration of white pine and beetle communities.

Comment(s)

Project status

Completed

Layout/design

The sampling took place on the territory of the LMNPC. This park is located in the heart of the Laurentian hills, in the Mauricie region (figure x). Its area is 544 km² and its territory lies between 46°38' and 46°56' N and between 72°45' and 73°11' W (Lalumiere et al., 1998). The LMNPC has numerous bodies of water and a hilly topography. It is bordered to the east by the Saint-Maurice River, to the north by the Mattawin river and to the west by the Mastigouche Wildlife Reserve. To the south are the villages of Saint-Mathieu-du-Parc, Saint-Gérard-des-Laurentides and the city of Shawinigan.

We sampled a total of 16 sites all located in the northwest sector of the LMNPC. Seven sites were treated using low intensity prescribed burning. The seven fires occurred in stands of white pine where this species had a density greater than 100 stems per hectare. These sites were prioritized in the context of ecological restoration of white pine in the LMNPC (Quenneville and Theriault, 1998). The choice of these sites and various details on the planning of prescribed burns at the LMNPC appear in various documents issued by Parks Canada. White pine control stands were selected by the author and some LMNPC managers who had very good knowledge of the territory. Site visits were then conducted to validate the type of forest stand present. A control site was appended to each burn. There was one exception for prescribed burns conducted in the area of Guilinette Lake in 2004 and 2005. One control stand of similar forest composition was found in this sector and served as a reference for both sites.

Two other sites (one burned and one control) were located in the western sector of the Mattawin river. A prescribed burn was planned in this sector in 2006 but it did not occur because of inadequate conditions. These two sites therefore played the role of controls at the time of our project. The last of the 16 sites was inventoried in 2007. It was the subject of forest inventories as part of a study of old growth eastern white pine in the LMNPC (Valcourt and Gagnon, 2000). It was thus an excellent control site to be sampled for the project.

Each of the 16 sites included three plots for a total of 48. The plots were all located within a minimum of 50 metres (m) of the treatment

edge and the distance between them was 50 m. Each plot measured 11.28 m radius, or 400 m². Within them, there were four plots of 25 m² (2.82 m radius) arranged at the four cardinal points. At the centre of these plots were four sub-plots of 4 m² (1.13 m radius).

Each of the 48 plots was the subject of a forest inventory. Trees, saplings and seedlings of commercial species were identified. The presence of non-commercial species, herbaceous plants, ferns and mosses was assessed according to a percentage of recovery. First, trees 9.1 cm DBH and over and belonging to commercial species were inventoried in the 400 m² plot. For the white pine (PIB) and red pine (PIR), the surfaces inventoried measured 1,250 m².

Study leader(s)	• Domaine, Éric - Canadian Forest Service, Laurentian Forestry Centre - E-Mail: edomaine@nrcan.gc.ca - Tel. Ext.
Collaborator(s)	• Hébert, Christian - Canadian Forest Service, Laurentian Forestry Centre - E-Mail: chhebert@rncan.gc.ca - Tel. (418) 648-5896 Ext.
Species	
Treatment(s)	• Prescribed burning
Data activity	
Data stability	
Measurement(s)	•
Establishment year(s)	2008
Measurement year(s)	
Treatment year(s)	
Data location	
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre

Metadata creation date 2009-02-04

Metadata modification date

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administra-tive region	Design status	Plot integrity	Plot type	Comments
	Grand-Mère	-72.83	46.64			Boreal Shield	Eastern sugar maple-yellow birch	04	Abandoned		Round (400 m²: 11.28 m radius)	

Publication(s)

White pine blister rust control

Abstract

White pine blister rust is an exotic disease introduced into North America around 1900 and detected in Quebec in 1917. The means of fighting this disease are quite limited and eradication of currants has been used in the United States since the introduction of the disease; however, results were mixed. Subsequently, the pruning of white pine to control the disease showed promising results in western Canada, but results on eastern white pine were quite disastrous. Lavallée (1992) observed that the rapid increase of the disease from the age of 6 years explained the failures of pruning done around the age of 15 in Quebec. It is from this information that we decided to test the effectiveness of pruning in younger plantations. In the Appalachian region, near Quebec, we located 22 white pine plantations. These plantations ranged in age from 7 to 12 years and were all located in rust-prone area number 3 (Lavallée 1986). The number of stems ranged from 500 to 6,500 per plantation. Each year we randomly observed a total of 100 pines per plantation. This allowed us to calculate the incidence and severity of the disease. We kept12 plantations as controls and we pruned the other 10 using the following criteria:
- pruning up to the average of the highest infections; or
- pruning up to 50% of the whorls; or
- leaving at least two whorls at the top of the pine.

Objective(s)

White pine blister rust control in plantations located in the Beauce-Appalaches region.

Comment(s)

Preleminary results are presented in Laflamme 2006.

Project status

Active

Layout/design

Sampling method and sample plan
-100 trees must be tallied in each of the plantations for the analysis of white pine blister rust (valid for plantations of less than 20,000 trees).
- Determine the number of trees and rows in the plantation to be evaluated.
- Choose the ideal number of cruise lines necessary for the evaluation (2 cruise lines can sometimes be sufficient in very small plantations, while a greater number may be necessary in larger plantations. The shape of the plantation can sometimes also help us in the choice of this number).
- Choose the starter tree and row numbers according to the table of random numbers.
- Following this step, proceed with the blister rust report by tallying, for each cruise line, 1 tree out of every 2 or 3 depending on whether the plantation has more or less than 7,000 trees.

C. ribicola report
- Measure the height of the first tree to be evaluated at the beginning of the first whorl of the current year (to the nearest 10 cm).
- Next, look at this tree to determine if disease is present or not.
- If no, checkmark the (Healthy Tree) column and proceed to the next tree.
- If yes, if the disease is found in the trunk or a branch within 10 cm of it, checkmark the (Trunk Infection) column. If the disease is found only on one or more branches above 10 cm from the trunk, checkmark (Branch Infection).
- Measure and write the height of the highest infection in the (Height at 10 cm) column.
- When the report for the 100 trees is complete. Calculate the average height of the trees, the height of the highest infection and the average height of all of them. Determine the % of trees affected at the trunk, the % of trees affected only at the branches and the total % of trees affected. These figures will determine if intervention should take place and the type of intervention that should be prescribed.

Study leader(s)	• Laflamme, Gaston - Canadian Forest Service, Laurentian Forestry Centre - E-Mail: glaflamme@rncan.gc.ca - Tel. (418) 648-4149 Ext.
Collaborator(s)	
Species	• Eastern white pine
Treatment(s)	• Planting • Pruning
Data activity	Inactive available - data set is static but available
Data stability	Unknown.
Measurement(s)	• Stem status (living/dead) • Height of infection
Establishment year(s)	2001
Measurement year(s)	2001; 2002; 2006
Treatment year(s)	
Data location	Room 1.37 at the LFC
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre
Metadata creation date	2008-01-30
Metadata modification date	

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administrative region	Design status	Plot integrity	Plot type	Comments
Rouille - A-1- 2	Saint-Méthode-de-Frontenac	-71.04	45.99	400	4	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Abandoned		Linear	
Rouille - A-1- 6	Saint-Méthode-de-Frontenac	-71.03	45.99	350	1.1	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Abandoned		Linear	
Rouille - A-1-11	Saint-Méthode-de-Frontenac	-71.03	45.99	391	0.5	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Abandoned		Linear	
Rouille - A-1-12	Lambton	-71.13	45.84	302	0.75	Atlantic Maritime	Eastern sugar maple-yellow birch	05	Abandoned		Linear	
Rouille - A-2- 3	Saint-Gédéon	-70.59	45.85	366	0.37	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Abandoned		Linear	
Rouille - B-2-20	Saint-Magloire	-70.27	46.59	500	0.57	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Abandoned		Linear	
Rouille - B-2-21	Saint-Magloire	-70.28	46.59	500	0.29	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Abandoned		Linear	
Rouille - B-2-22	Saint-Fabien-de-Panet	-70.13	46.63	464	0.5	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Abandoned		Linear	

Rouille - B-6-19	Saint-Éphrem-de-Beauce	-70.97	46.03	391	0.35	Atlantic Maritime	Eastern sugar maple-yellow birch	12	Abandoned	Linear

Publication(s)

- Laflamme, G. 2006. L'élagage phytosanitaire : maîtrise de maladies des pins. Pages 17-20 dans Actes du colloque : Élaguer pour enrichir nos forêts. Colloque sur l'élagage forestier, 14-15 mars 2006, Maniwaki, Québec. 57 p.
- Lavallée, A. 1986. Les risques d'infection par la rouille vésiculeuse du pin blanc. Service canadien des forêts, Sainte-Foy, Québec. Feuillet d'information CFL 23.

Xylophagous insect species composition and patterns of substratum use on fire-killed black spruce in central Quebec

Abstract

Several xylophagous insect species have adapted to recurrent fires in boreal forests and use the high-quality habitats created by these disturbances. To characterize the xylophagous insect assemblages and their patterns of substratum use in fire-killed black spruce, 84 bole segments measuring 40 cm in length were cut in 2000 and 2001 based on tree diameter, segment height and fire severity criteria in an area burned in 1999 in the Grands-Jardins provincial park, Quebec, Canada. The segments were suspended in rearing cages, and neonates were collected until November 2001. The cerambycid Monochamus scutellatus (Say) and the scolytids Dryocoetes affaber (Mann.) and Polygraphus rufipennis (Kirby) were the most common beetles collected. For all common taxa, more neonates emerged from larger-diameter trees. Few neonates emerged from the upper parts of the trees, and none of the species were specialists of the upper parts of the tree. Fire severity had a drastic effect, and heavily charred trees yielded very few insects. The effect of fire severity on insect colonization density varies widely among tree species. This effect may be linked to varying bark thickness and to the bark's insulating potential against water loss during fire. The host's vigour before its death, measured from growth rings of the last 10 years, had a positive effect on cerambycid emergence, but no effect on that of scolytids.

Objective(s)

Understanding natural forest dynamics.

Comment(s)

Project status

Completed

Layout/design

Sampling was conducted in a 5197-ha fire that occurred from 30 May through 5 June 1999 in the Grands-Jardins provincial park (47°42' N, 70°45' W), 95 km northeast of the city of Québec, Quebec, Canada. Our study site is located on the Laurentian Plateau, averaging 800 m in altitude. The original landscape consisted mainly of black spruce stands of varying age. According to a reconstruction of local fire history by Payette et al. (2000), at least 40% of the area that burned in 1999 was populated by stands that originated from a 1922 fire. Some other stands originated from clearcuts made between 1958 and 1964, and between 1979 and 1981, just before the establishment of the park. Several fires occurred in the park or in its immediate vicinity during the 1990s: two in 1991, one in 1995, and one in 1997. In 2000, we selected five stands based on their age (80-100 years old), their natural origin, and the presence of large-diameter trees. The average distance between the stands was 2.82 km. One of the five stands contained a few trees that were not killed immediately by the fire; these trees were systematically rejected. In each stand, the four trees that were closest to a central point and met our diameter criteria were cut down. Two of the trees were in a 18-21 cm diameter at breast height (DBH) class, and two were in a 8-11 cm DBH class. Forty centimetre long bole segments were collected at the base of each tree (mean height: 1.17 m), in the lower part of the crown (mean height: 4.06 m for DBH 18-21 cm and 3.35 m for DBH 8-11 cm), and in the upper part of the crown (mean height: 10.05 m for DBH 18-21 cm and 5.22 m for DBH 8-11 cm). Overall, 12 segments per stand were collected for a total of 60 segments. In 2001, three of the five 2000 stands that contained charred and uncharred fire-killed trees and yielded higher numbers of neonates during the first year of rearing were retained. In each stand, four 18-21 cm DBH trees were cut down, two charred and two uncharred, from which two bole segments were collected: one at the base of the tree (mean height: 1.28 m) and one at the base of the crown (mean height: 4.44 m), for a total of 24 segments. Trees were considered charred when 100% of the bark of the first 4 m had been blackened by fire. Uncharred trees had been charred on less than 20% of their first 4 m. A total of 84 bole segments were collected during the 2 years of sampling.

Study leader(s)

• Saint-Germain, Michel
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Collaborator(s)	• Hébert, Christian - Canadian Forest Service, Laurentian Forestry Centre - E-Mail: chhebert@rncan.gc.ca - Tel. (418) 648-5896 Ext.
Species	
Treatment(s)	
Data activity	
Data stability	
Measurement(s)	•
Establishment year(s)	1999
Measurement year(s)	2001; 2002
Treatment year(s)	
Data location	
Contributor(s) to the creation of the metadata	• Canadian Forest Service, Laurentian Forestry Centre
Metadata creation date	2009-02-10
Metadata modification date	

Research site(s)

Site name	Nearby city	Long.	Lat.	Alt. (m)	Area (ha)	Canadian ecozone	Quebec bioclimatic subdomain	Quebec administrative region	Design status	Plot integrity	Plot type	Comments
	Saint-Urbain	-70.75	47.70	800		Boreal Shield	Eastern balsam fir-white birch	03	Actively Managed			

Publication(s)

• St-Germain, M. 2004. Xylophagous insect species composition and patterns of substratum use on fire-killed black spruce in central Quebec, Can. J. For. Res. 34:677-685.