

Summary of Forest Pest Conditions in New Brunswick in 2013 and Outlook for 2014

Prepared by

**New Brunswick Department of Natural Resources
Forest Pest Management Group**

February 2014

Forest Pest Management Group

Manager: Robert Dick
Forester / Analyst: Jeremy Gullison
Entomologist: Lester Hartling
Forest Technician: Ross Farquhar
Forest Technician: Eric Knopf
Forest Technician: Doug Winter

Field & Lab Technicians
Bob Leger
Merle Lewis
J. Elaine Moreau
Dave Niblett
Merle Stewart

Mailing Address: Hugh John Flemming Forestry Centre
P.O. Box 6000
Fredericton, NB
E3B 5H1

Regional Pest Detection Officers

Region 1

Gerald LeBlanc (Coordinator)	Joel Gauvin
Eric Blakey	Bernard Godin
Aime Drapeau	Jean-Charles LeBlanc
Patrice Edmond	Peter Urquhart
Robert Gaudet	Alvin Vienneau

Region 2

Mike Murphy (Coordinator)	Harvey Murray
Marc Comeau	Clarke O'Donnell
Stephen Coughlan	

Region 3

Eric McLellan (Coordinator)	Stephen Eldridge
Roger Collet	Paul Hogan
Kevin Comeau	Robert MacGregor
Ken Eagles	

Region 4

Benoit Bouchard (Coordinator)	Roger Jenkins
Yvan Cayouette	Daniel Soucy

Executive Summary

This report provides an overview of the status of forest insect and pest conditions in New Brunswick (NB) in 2013, and highlights many of the pest management activities of the NB Department of Natural Resources' Forest Pest Management Group (FPMG). It is not intended to itemize all details for each survey conducted, except where it is needed to provide additional context to a particular pest problem. Where required, the reader can contact FPMG for further information.

From the 1950s to the 1990s, **spruce budworm** was the most serious forest pest in NB, and across many jurisdictions in eastern North America. No defoliation has been detected in NB since 1995. Since 1997, there has been an irregular though gradually increasing trend of populations as indicated by annual changes in moth catches in a pheromone trapping survey, particularly in the northern part of the province. This trend has gained more attention in light of the increasing outbreak in Québec, with defoliation mapped approximately 25km from the NB border in 2012 and 2013. FPMG significantly increased its monitoring effort of spruce budworm in 2012. This was further increased in 2013 with a collaborative overwintering (L2) larval sampling program between FPMG and forest industry, whereby 1152 plots were sampled or resampled, representing 1136 unique locations. This sampling was conducted throughout New Brunswick, regardless of land ownership but was concentrated in the northern half of the province. Defoliation assessments were conducted at >500 ground plots and an aerial defoliation survey was flown. No defoliation was observed and spruce budworm was detected at trace to very low overwintering larval counts at 17% of 1152 plots sampled or resampled, representing 1136 unique locations. Positives (trace to very low counts) were concentrated in, but not exclusive to northern New Brunswick. In light of the proximity of the outbreak in Québec, and based on rising (but still low) L2 counts expectations remain that the first pockets of light defoliation will soon be detected in northern NB, the first time since the collapse of the last outbreak in 1995.

In 2011, a single **brown spruce longhorn beetle** was found in Kouchibouguac National Park, most likely transported to the park in a piece of firewood from Nova Scotia. In the fall of 2011, the Canadian Food Inspection Agency in collaboration with Parks Canada and the Canadian Forest Service collected logs from sixteen trees with symptoms of brown spruce longhorn beetle (BSLB) attack and placed them in facilities where scientists observed for beetles emerging from the logs. No BSLB were detected in these. In 2012, approximately 100 pheromone-based traps hung by federal agencies within Kouchibouguac National Park also failed to catch a single beetle. In 2012, FPMG conducted visual assessments of spruce trees at 282 locations throughout the province looking for signs and symptoms of BSLB attack (in conjunction with pheromone trapping surveys). In 2013, assessments were conducted at 259 locations by FPMG throughout the summer months. No suspect trees were found either year. As such, the current prevailing view is that the single BSLB found in Kouchibouguac back in 2011 was not indicative of an established population, but rather was merely intercepted when it emerged from a

piece of firewood.

In 2011, the NB Government conducted a limited aerial biological control program against **balsam fir sawfly** on 7,282 ha of the Crown forest using Abietiv™, a federally- registered biological insecticide that is based on a naturally occurring balsam fir sawfly virus. J.D. Irving, Limited also contracted (separately) to have control applied on some of their freehold land. Coincidentally, natural virus was attributed with causing a population collapse that same year. In 2012, a ground-based defoliation survey conducted in south-eastern New Brunswick reconfirmed the previous year's forecast of a population collapse, with only light scattered defoliation detected in a small geographic area between St. Martin and Saint John. As such, no forecast survey was required in 2012; nor was one required in 2013.

Sirococcus shoot blight is a fungal disease affecting primarily red pine. Years with wet weather in May and June often result in intensification of disease symptoms (branch dieback and, after successive attacks, tree mortality). In 2012, appropriate methodology was developed to evaluate the severity and distribution of the disease in red pine stands. Assessments by FPMG and Regional Pest Detection Officers revealed that Sirococcus is widespread and a large portion of assessed stands are at a high risk of experiencing tree mortality within the next five years. In 2013, further assessments were conducted, with an increased proportion assessed from the northern half of the province. Between 2012 and 2013, 455 red pine stands totaling 2819 ha have been assessed. Of this area, 656 ha (23%) were classed as at high risk.

Balsam gall midge has been in an outbreak phase in the Province for the last eight years. In 2012, 91% of locations assessed for balsam gall midge injury had detectable levels of damage. In 2013, this dropped to 58% suggesting this insect may now be in the declining phase of its outbreak cycle.

In 2013 many **other insect and disease pests** were monitored through targeted and/or general surveillance surveys. A wet spring and summer led to a higher than normal incidence of foliar diseases such as needle casts and needle rusts. Localized damage from the following pests was also observed in 2013: forest tent caterpillar, balsam gall midge, balsam woolly adelgid, balsam fir tip blight, satin moth, birch leafminer, white pine weevil, fall webworm and pitch nodule makers.

This report also describes the status on several **invasive alien species** that have not been detected in New Brunswick to date but have been found in other jurisdictions in north-eastern North America and which have the potential to cause significant damage to the forests of New Brunswick. While these species spread naturally, human assisted movement through transportation of infested wood commodities (e.g., firewood, logs, landscape nursery stock) is the most important pathway for the long-range dispersal of these pests.

Introduction

Outbreaks of minor and major forest pests occasionally occur and cause variable amounts of growth loss and tree mortality. Besides affecting the natural forest, outbreaks can adversely affect high-value reforestation and tree improvement programs, from nurseries to seed orchards, to plantations and thinned stands. Thus, long-term forest management plans are constantly under threat of possible compromise from unwanted pest outbreak. In addition to timber losses, major effects can be caused to non-timber values such as terrestrial and aquatic wildlife habitat, recreational sites and aesthetics.

Besides native pests, today's global economy brings increased risk from the accidental introduction of insects and diseases from around the world. Such introductions could not only cause direct impacts on natural forests and the environment, but also indirect economic impacts through regulations placed on domestic, national, or international movement of goods. These trade issues can negatively affect the ability of small and large companies to be competitive in local and global markets.

The Department of Natural Resources' (DNR's) Forest Pest Management Group (FPMG) has the mandate of protecting New Brunswick's forests from insects and disease. For regulated, non-native pests, DNR maintains liaison with the Canadian Food Inspection Agency (CFIA) which is responsible, under the federal Plant Protection Act, for preventing the introduction into Canada, spread within Canada, and spread from Canada, of non-native pests.

The first line of defense in any forest pest management program is an effective detection, monitoring and forecasting system. This system not only detects the presence of various forest pests, but it also measures changes in pest populations and damage levels over time. Monitoring and forecasting the status of forest pests requires the use of different techniques that reflect survey objectives, pest population levels, the pest's biology, and knowledge of relationships between numbers of pests and damage. For some pests these are well established; for others these are not. Aerial surveys provide the means to map damage in various categories to assess the extent and severity of outbreak over vast areas.

For some insects, surveys can be conducted to establish population levels by sampling appropriate locations for eggs or egg masses, depending on the female's egg laying habits. Surveys of larvae can be conducted during the insect's active feeding period, or during periods when they are inactive, such as in the over-wintering stage. Surveys of pupae to estimate insect population levels are less common.

Special odours or scents, called pheromones, are given off by female insects to attract males of the same species for mating. The identification and artificial synthesis of sex pheromones for a number of forest insects has led to the use of pheromone-baited traps as a technique to monitor these pests. This is especially true

when populations are very low and not detectable by traditional survey sampling intensity for other life stages.

Because these artificial lures are often very potent, they sometimes offer the opportunity to detect subtle increases that might not be as easily detected by the other means. In other instances, they might still be under development and results have to be interpreted with caution. Depending on trap catch thresholds or yearly trends, these surveys could trigger the implementation of other methods to forecast levels of damage expected the ensuing year.

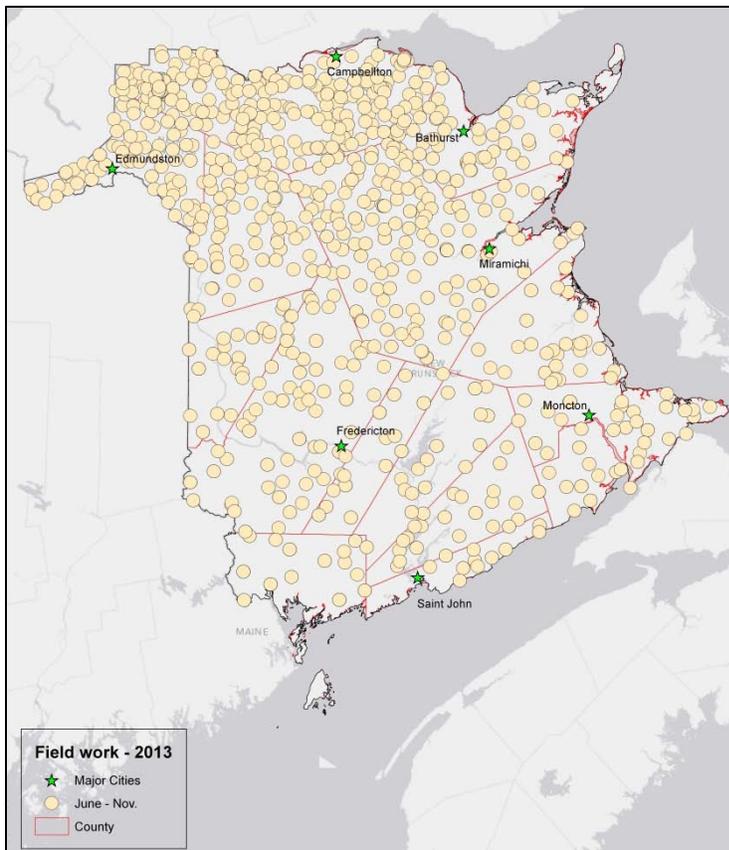


Figure 1. Distribution of locations assessed for forest insect and diseases in 2013 by FPMG. Field crews were also vigilant in watching for any signs of pest damage as they drove from location to location. Not depicted are the numerous assessments conducted by DNR Regional Pest Detection Officers and forest industry.

One of the cornerstones of the FPMG's pest monitoring program is the use of such pheromone traps for the early detection of changes in population levels of many softwood and hardwood forest pests, before they increase to potential outbreak status. It is important, however, to be aware that the number of insects captured in a trap is greatly influenced by the type of lure used, its concentration, the trap design and the insect species itself. Therefore, a moth count considered to be biologically significant for one species may be insignificant for another by several orders of magnitude. Consequently, the absolute number of insects in a trap is not as important as the trends between years and over time.

As a consequence of finite resources, formal monitoring and forecast surveys are only conducted for a limited number

of targeted pests on an annual basis. General surveillance of forest conditions while conducting targeted surveys, and collaboration with other DNR staff (e.g., Regional Pest Detection Officers), members of forest industry, and the general public greatly enhance FPMG's ability to detect pest outbreaks and respond as needed. These collaborative efforts are further facilitated by an improved process to log inquiries and observations from other agencies and individuals, including documentation of photos

and samples collected to aid in pest identification. This tracking system has enabled, where needed, the timely follow-up by FPMG staff. Worth noting is the fact that since insect and disease pests do not respect ownership boundaries, survey activities conducted by FPMG are done on crown land, industrial freehold and private woodlots (Figure 1).

This report provides an overview of the status of forest insect and pest conditions in New Brunswick in 2013, and highlights many of the pest management activities of FPMG. It is not intended to itemize all details for each survey conducted, except where it is needed to provide additional context to a particular pest problem. Where required, the reader can contact FPMG for further information.

Pests of Softwoods

Balsam Fir Sawfly (*Neodiprion abietis* [Harris]): Balsam fir sawfly is a native insect found in southern Canada and northern United States. Its main host is balsam fir. The larvae feed on older needles leading to reduced volume increment, weakened trees and sometimes tree mortality. A major concern is the loss of wood volume due to reduced growth increment from sawfly defoliation in balsam fir stands already thinned to maximize tree growth. In 2011, the NB Government conducted a limited aerial biological control program against balsam fir sawfly on 7,282 ha of the Crown forest using Abietiv™, a federally- registered biological insecticide that is based on a naturally occurring balsam fir sawfly virus. J.D. Irving, Limited also contracted (separately) to have control applied on some of their freehold land. Coincidentally, natural virus was attributed with causing a population collapse that same year. In 2012, a ground-based defoliation survey conducted in south-eastern New Brunswick reconfirmed the previous year's forecast of a population collapse, with only light scattered defoliation detected in a small geographic area between St. Martin and Saint John. As such, no forecast survey was required in 2012; nor was one required in 2013.

Balsam Fir Tip Blight (*Delphinella balsameae* [Waterman] E. Müller): This fungal disease kills the needles and current year's shoots, with generally only a few branches per tree affected. In 2012, balsam fir tip blight was common on scattered balsam fir trees throughout the province, with several isolated stands having more severe symptoms in northern New Brunswick. Symptoms could still be seen in scattered locations in 2013, especially in the north-west part of the province, with at least one Christmas tree grower experiencing severe damage symptoms on his trees for several years in succession.

Balsam Gall Midge (*Paradiplosis tumifex* Gagné): This insect is not considered a significant forest pest, but like the balsam twig aphid it can be a very serious problem for Christmas tree growers as it kills the current year's needles, causing them to drop off, rendering Christmas trees unsightly for sale. As such, FPMG annually evaluates the severity and distribution of this insect pest while conducting other

operational surveys. The insect was in an outbreak phase for 7 years, persisting into 2012 when 91% of the 281 fir plots assessed throughout the province had detectable levels of damage from this pest. In 2013, the percentage of fir plots with gall midge damage dropped to 58% at 309 plots assessed. Assuming this trend continues, gall midge populations have likely started the declining phase of the current outbreak.

Balsam Twig Aphid (*Mindarus abietinus* Koch): This insect is also not considered a significant forest pest, but like the balsam gall midge, can be a very serious problem for Christmas tree growers. Like the balsam gall midge, feeding damage by this insect pest renders Christmas trees unsightly for sale. Like the balsam gall midge, FPMG examines sampled branches for the presence or absence of symptoms of feeding damage caused by this insect. In 2012, only 13% of the 281 fir plots assessed throughout the province had detectable levels of damage from this pest. In 2013 this increased to 30% at 309 fir plots assessed throughout the province, suggesting populations may be once again increasing, after remaining relatively low for several years.

Balsam Woolly Adelgid (*Adelges piceae* [Ratzeburg]): This insect, of European origin, was first found in the Maritimes in the early 1900s and in Québec in 1964. It only attacks true firs of the genus *Abies*. Symptoms of attack on balsam fir, especially gouty tops, are noticeable in southern New Brunswick where local tree mortality, severe in some cases, has been reported. Although galling and distorted tops are common, stem attack – a condition that is more associated with tree mortality - has only been observed in one location (Kingsclear). A survey that rated adelgid damage at 83 stands in southern NB in 2002 was again repeated in 2010. Moderate-severe damage was found in only six of these stands, and in both years, only ~0.5% of balsam fir trees assessed had moderate-severe damage. FPMG field staff and DNR Regional Pest Detection Officers did not report any significant areas of damage by balsam woolly adelgid in 2012 or 2013.

Brown Spruce Longhorn Beetle (*Tetropium fuscum* [Fabricius]): This non-native insect was confirmed present in Nova Scotia in the spring of 2000 and it was subsequently revealed that it had been present at least since 1990, but had mistakenly been misidentified as a similar native species. In Nova Scotia, it has attacked red spruce, as well as white, black and Norway spruce. The CFIA manages this pest by reducing the risk of the beetle spreading outside of the area it now exists using a strategy that regulates movement of specified high-risk spruce materials along with annual surveys and research.

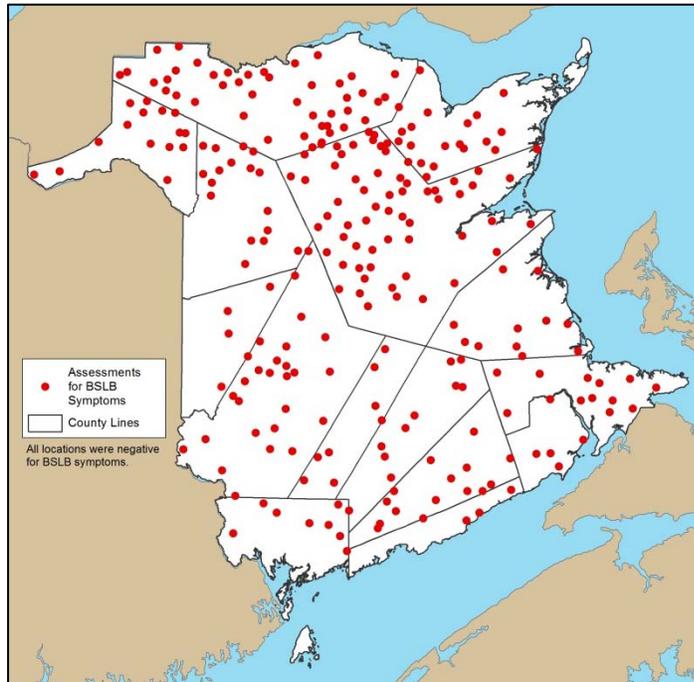


Figure 2. Distribution of FPMG plots assessed for symptoms of brown spruce longhorned beetle attack on spruce in 2013. All plots were negative for the beetle.

In 2011, a single beetle was found in a trap in Kouchibouguac National Park, most likely transported to the Park in a piece of firewood from NS. In the fall of 2011, CFIA in collaboration with Parks Canada and the Canadian Forest Service collected logs from sixteen trees with symptoms of brown spruce longhorned beetle (BSLB) attack and placed them in facilities where scientists observed for beetles emerging from the logs. No BSLB's were detected in these. In 2012 and 2013, approximately 100 pheromone-based traps placed within Kouchibouguac National Park by federal agencies failed to catch a single beetle. Also in 2012, FPMG conducted visual assessments of spruce trees at 282 locations

throughout New Brunswick for signs and symptoms of BSLB attack (in conjunction with pheromone trapping surveys). FPMG again conducted assessments in 2013 with 259 locations being inspected for BSLB attack (Figure 2). No suspect trees were found in either 2012 or 2013. As such, the current prevailing view is that the single BSLB found in Kouchibouguac back in 2011 was not indicative of an established population, but rather was merely intercepted when it emerged from a piece of firewood.

European Larch Canker (*Lachnellula willkommii* [Hartig] Dennis): This non-native disease was first found by the CFS in New Brunswick in 1980. It is capable of killing mature and immature larch trees. It is present mostly throughout the southern half of the Province and quarantine regulations are in place administered by the CFIA under the federal Plant Protection Act.

Flower crops and cone production: Some years, abundant flowering or cone production on conifers can at first glance appear to be insect defoliation. Given the heightened concerns about the current spruce budworm outbreak in neighboring Quebec, it was not unexpected that the number of such inquiries increased in 2013.

Hemlock Looper (*Lambdina fiscellaria* [Guenée]): This insect is a menacing pest primarily of hemlock and balsam fir. It can kill trees within a single year due to its wasteful feeding habits. Besides consuming entire needles, it also partially eats many needles causing them to die. Severe outbreaks are common in Newfoundland & Labrador and Québec. The only reported outbreak of hemlock looper in New

Brunswick occurred from 1989-1993.

A pheromone trapping network of 60 traps distributed throughout the province indicated that looper populations still remained low. However, while the average trap catch doubled over the previous year (145 vs. 70), populations are still not sufficiently high to expect any defoliation in 2014. J.D. Irving, Limited also maintains a 2nd pheromone trapping network on their freehold lands.

Jack Pine Budworm (*Choristoneura pinus* Freeman): This insect is a potentially significant pest of jack pine as evident by periodic severe outbreaks in Ontario and Manitoba. Defoliation by jack pine budworm in New Brunswick has not been reported since 1983; however, monitoring had been conducted annually at a network of pheromone traps since 1997. Overall, the survey results up to 2010 had indicated that jack pine budworm populations remained at very low levels throughout the zones being monitored. Since 2010, no pheromone trapping survey has been conducted due to other priorities, however, general monitoring efforts throughout the province in 2011, 2012 and 2013 indicated populations remain at undetectable levels.

Larch Casebearer (*Coleophora laricella* [Hubner]): Damage by this defoliator of larch includes the discoloration of newly flushed needles in late May and early June. Tree growth can be impacted, but risk of tree mortality from defoliation by this pest is low. Defoliation from larch casebearer was widespread throughout southern, and especially, southeast New Brunswick in 2012. No observations or inquiries were made about this insect in 2013.

Needle Casts, Needle Rusts and other foliar diseases: In 2013 there was a higher than usual frequency of reports of foliar diseases on conifers and deciduous trees, likely due at least in part from a wet spring and summer.

Red Flag of Balsam Fir (*Fusicoccum abietinum* [R. Hartig] Prill. & Delacr.): This fungal disease was observed at incidental levels throughout New Brunswick in 2012 and in 2013. The disease typically only attacks a few branches on isolated balsam fir trees, causing a constriction on affected twigs, resulting in red flags. From a distance, the symptoms look similar to that caused by white-spotted sawyer beetle (*Monochamus scutellatus* [Say]) feeding damage.

Scleroderris Canker of Pine (*Gremmeniella abietina*): The North American race (*var. NA* [Lagerberg] Morelet) of this disease causes cankers and mortality of seedlings of jack pine and red pine, and has been associated with plantation failures in other jurisdictions. It seldom causes mortality to trees over 2m tall, though branches up to this height are affected. On the other hand, the European race (*var. Eu* [Lagerberg] Morelet) is capable of causing mortality to red pine and Scots pine trees taller than 2m. The European race of Scleroderris has been confirmed at three sites in north-western New Brunswick within a few kilometres of each other. Two sites contain Scots pine and the other contains red pine. In 2008, dead trees and trees with dead and dying tops were easily seen at the second site (Scots pine).

At the third site, the red pine looked remarkably healthy. Quarantine regulations are in place under the federal *Plant Protection Act* administered by the CFIA. No specific surveys have been conducted in more recent years

Sirococcus Shoot Blight on Red Pine (*Sirococcus conigenus* [Dc.] Cannon & Minter): *S. conigenus* is a fungal disease affecting primarily red pine. Beyond contributing to the native biodiversity of NB forests, red pine provides the raw material for the creation of utility poles for electric power transmission, which are high value forest products. Years with wet weather in May and June often result in intensification of disease symptoms (branch dieback and, after successive attacks, tree mortality).

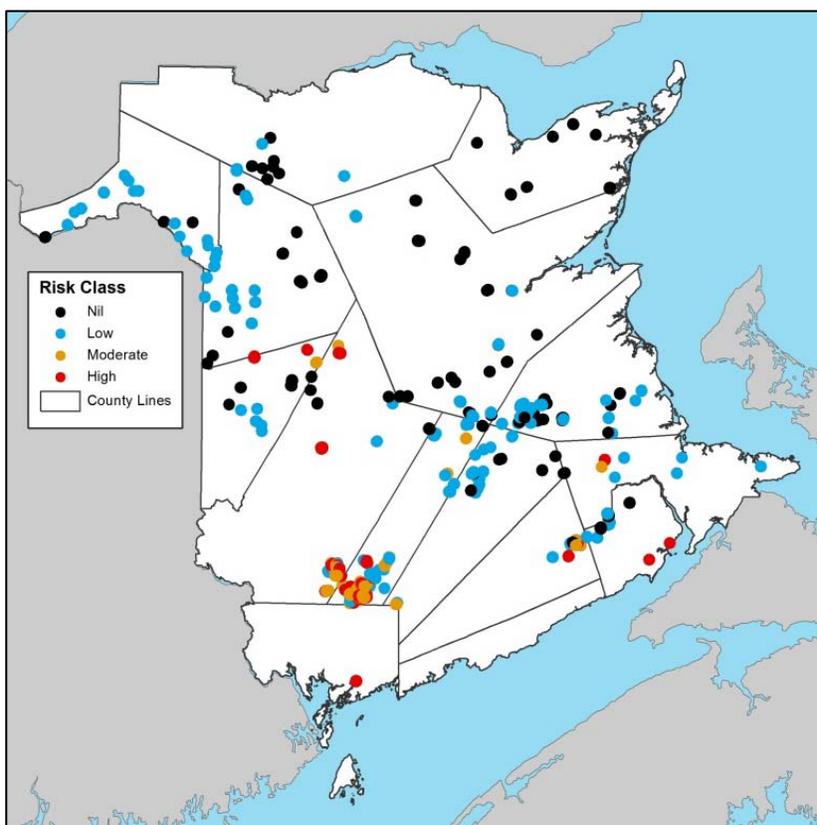


Figure 3. Risk of near-term tree mortality from *Sirococcus conigenus* in red pine stands assessed by DNR in 2012 and 2013.

In 2012 a survey methodology was developed to evaluate the severity and distribution of *Sirococcus* disease in the province, after a review of the scientific literature and many on-site visits to refine the approach. A two-person crew did a walk-through of red pine stands delineated on maps from forest inventory information, looking for symptoms of *Sirococcus* disease and its distribution in the stand, and rated the overall crown and tree condition. Digital photos were taken in each stand, to allow the option of revisiting a subset of stands in future years in order to monitor the progression of the

disease and rate of stand deterioration. Finally, each stand was categorized into a risk class, and identified as to whether it had a high risk of mortality within 3-5 years. Efforts were concentrated in southern New Brunswick, in those geographic areas where harvesting was planned or being conducted, in order to provide information to forest industry and DNR for prioritizing stands to harvest. Two hundred and eighteen (218) stands were initially visited, with stands low in red pine content removed from the analysis, leaving 190 stands for a risk rating provided to forest industry and DNR management foresters. Forty percent (40%) of these stands were rated as having a high risk of tree mortality within the next five years.

Regional Pest Detection Officers (PDO's) reported *S. conigenus* damage on an additional eight red pine stands scattered throughout southern NB. Sirococcus symptoms were widespread, particularly in southern NB.

In 2013, the same detailed methodology used in 2012 was again conducted. That year 371 stands were initially visited by PDO's and FPMG, with stands low in red pine content removed from the analysis, leaving 265 red pine stands, to rate risk. Based on the assessments from both 2012 and 2013, 455 red pine stands totaling 2819 ha were evaluated, with 656 ha (23%) classed as at high risk (Figure 3).

Spruce Budworm

(*Choristoneura fumiferana* [Clemens]): Spruce budworm is a notorious pest of balsam fir and various species of spruce. From the 1950's to the 1990s, it was a perennial pest of the softwood forests of New Brunswick and many other jurisdictions in eastern North America. The last year spruce budworm defoliation was detected in New Brunswick in 1995. Since 1997, there has been an irregular though gradual increasing trend of populations in New Brunswick as indicated by annual changes in moth catches in the pheromone trapping survey.

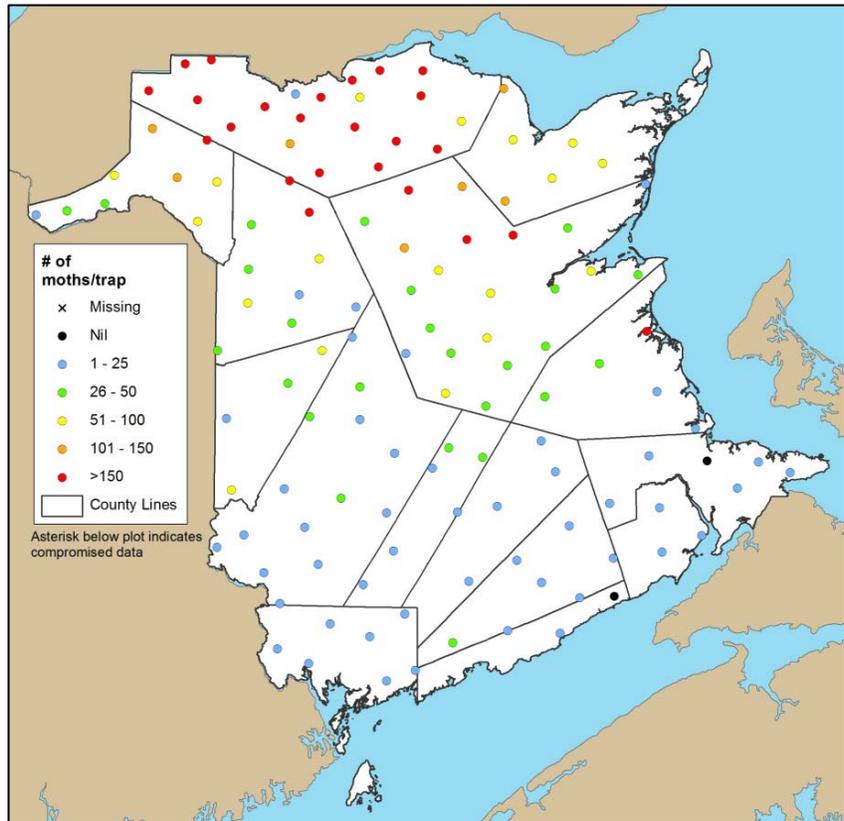


Figure 4. Distribution of spruce budworm pheromone traps and results of the 2013 survey conducted by FPMG.

One hundred and thirty-two traps were hung in 2013, with the tendency of annual trap catches to be highest in the northern part of the province (Figure 4) and this trend has gained more attention in light of the increasing outbreak in Québec, including light and moderate defoliation mapped in 2012 and 2013 on the south-side of the Saint Lawrence River as close as 25km to the NB border. J.D. Irving, Limited also maintains a 2nd pheromone trapping network on their freehold lands.

In response to growing concerns of an imminent outbreak in New Brunswick, FPMG annually increased its level of overwintering larval (L2) sampling in the province, going from 102 plots in 2010 to 169 plots in 2011 to 422 plots in 2012. The latter year

was a two-tiered sampling system, whereby an initial forecast was conducted at 303 plots, followed up by supplemental sampling at an additional 119 plots, concentrated in those geographic zones where spruce budworm was detected. All years, FPMG sampling was conducted throughout the province, regardless of land ownership; and further supplementary sampling was also conducted by J.D. Irving, Limited on its own freehold lands.

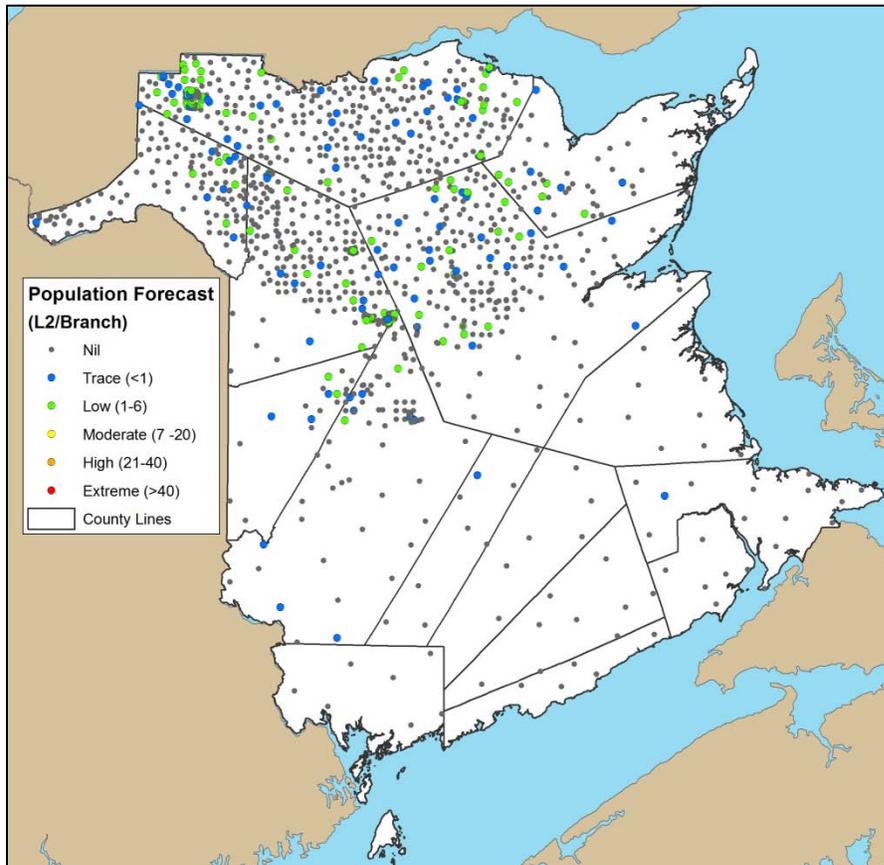


Figure 5. Distribution of plots sampled for overwintering spruce budworm (L2) larvae during the 2013 field season by FPMG and Crown licensee staff.

In 2013, over escalating concerns of a looming spruce budworm outbreak on the horizon, DNR and forest industry embarked on a highly collaborative spruce budworm overwintering (L2) survey with the purpose of not only generating a population forecast for 2014, but attempting to identify pockets of L2 counts, while still very low, sufficiently high to consider as candidate areas for research and development trials focused on an early

intervention strategy. Sampling protocol was to

remove one, 75-cm mid-crown branch from each of 3 trees/plot. Whenever the L2 counts averaged ≥ 2 L2/branch (a very low count) the procedure was to resample 3 more trees at the original plot, as well as sample additional plots throughout the area of interest. If the additional sampling detected anything further, another level of sampling was then initiated. This led to as many as four stages of sampling within any one geographic area. Ultimately, 612 plots were sampled (or occasionally resampled) by J.D. Irving Limited, AV Cell Inc., Fornebu Lumber Company Inc. and Acadian Timber; and another 540 plots sampled (or resampled) by FPMG. This resulted in 3,456 branches being collected during 1,152 plot visits, representing 1,136 unique locations (Figure 5). Foliage was then processed in the laboratory by FPMG, with assistance from staff of the Canadian Forest Service and Forest Protection Limited. Spruce budworm was detected at trace to very low overwintering larval counts at 17% of the 1,152 plot visits. Positive were concentrated in, but not exclusive to northern New Brunswick.

Also in 2013, foliage was assessed at more than 500 plots during 585 site visits and revisits, looking for any signs of defoliator feeding activity; and field crews looked for signs of budworm activity while conducting other survey activities throughout the province. Finally, FPMG flew 50 survey hours in an aerial defoliation survey across the province from June 25th to July 7th, coinciding with the time when reddish defoliated needles would be most evident from the air. Ground and aerial surveys did not detect any budworm defoliation in 2013.

Surveillance activities tentatively planned for 2014 include the continuation of a pheromone trapping network throughout the province, maintaining an enhanced overwintering (L2) larval survey, continued general monitoring for detection of feeding larvae (3rd-6th instar stages) or pupae, and aerial and ground-based defoliation surveys.

Whitemarked & Rusty Tussock Moths: Both of these pests feed on many species of hardwood and softwood. Most significant damage occurs on balsam fir, and under extreme populations, trees can be killed in a single season. The last outbreak of whitemarked tussock moth (*Orgyia leucostigma* [J. E. Smith]) happened in the 1970's when defoliated area peaked in 1976 at approximately 200,000 ha. In contrast, rusty tussock moth (*Orgyia antiqua* [L.]) outbreaks are usually small and of short duration.

A pheromone trapping network at 73 plots were maintained to monitor and analyze population trends of these two insects, and population levels are tracked through a general monitoring program conducted throughout the province. In 2013, not a single whitemarked tussock moth or rusty tussock mother were detected in pheromone traps. While detection of larvae or cocoons of either tussock moth species was infrequent over the field season, it was considered very unusual that moths of neither species were captured in a single trap. This unusual phenomenon raises the question of the quality of the lures purchased.

Pests of Hardwoods

Birch Skeletonizer (*Bucculatrix canadensisella* Chambers): The larvae of this insect pest produce oval-shaped white silken moulting webs on the leaves, and skeletonize birch leaves, causing them to turn brown, dry out and prematurely drop off the trees. The larvae then drop to the ground to pupate and spend the winter. Populations tend to build up fairly quickly and then decline within a couple of years. Since the insects are late (September) feeders, trees have already produced their food for the year and so the trees' general health is not threatened. In 2012, defoliation on white and other birch species was detected in southern New Brunswick in the Fredericton-Oromocto area. No damage from birch skeletonizer was reported in 2013.

Bruce Spanworm (*Operophtera bruceata* [Hulst]): This pest will defoliate many hardwood species, but sugar maple, aspen and beech are favoured hosts. Damage is observed in the spring and early summer. Damage by the Bruce spanworm rarely results in tree mortality. Regional Pest Detection Officers reported that several stands of sugar maple were defoliated by this pest in northern NB in 2012. No damage from bruce spanworm was reported in 2013.

Butternut Canker (*Ophiognomonia clavigignenti-juglandacearum* [N.B. Nair, Kostichka & J.E. Kuntze] Broders & Boland): This non-native disease is causing severe mortality of butternut trees throughout their range. It was first confirmed present in New Brunswick in 1997, and has since been found at 27 locations by the Canadian Forest Service, and is thought to be more widespread. Butternut is not a major component of our native forests, nor is it of major economic importance, but the disease could pose a threat to our natural forest biodiversity. In 2005, butternut was added to the List of Wildlife Species at Risk under the Canadian *Species at Risk Act*, partly because of the presence of butternut canker.

European Gypsy Moth (*Lymantria dispar* [L.]): The European gypsy moth is an exotic forest pest regulated by the CFIA under the federal *Plant Protection Act*. This insect is capable of feeding on several hundred different species of plants and shrubs ranging from ornamentals to forest trees. Many hardwoods, such as oak, 191poplar and birch are favoured hosts. The northern counties of Victoria, Madawaska, Restigouche, Gloucester and the north-western part of Northumberland County are the only parts of New Brunswick in which European gypsy moth has not become established and, therefore, are the only parts of the Province not regulated for this pest. There was no pheromone trapping network for this insect in 2013; however, general detection efforts by FPMG, as well as reports from industry, colleagues and the public suggest populations remained low in the regulated part of the province. A small isolated pocket of defoliation was reported in Rockwood Park, Saint John.

Fall Webworm (*Hyphantria cunea* [Drury]): This insect creates unsightly silken webs in the late summer on many species of hardwood trees including apple, ash, alder, beech, birch, cherry, elm and oak. However, because the damage is caused toward the end of the growing season, there is little long-term damage to the trees. Fall webworm webs were common throughout the Lower Saint John River Valley in 2012. Significantly less public inquiries were logged in 2013.

Forest Tent Caterpillar (*Malacosoma disstria* Hubner): This insect generally defoliates poplar, but will attack numerous hardwood species during an outbreak. The last two major outbreaks (1979-84 and 1991-96) of forest tent caterpillar in New Brunswick lasted about six years each and covered hundreds of thousands of hectares. Severely defoliated trees can produce another crop of leaves within the same growing season, and therefore can withstand the infestation fairly well. In 2011, the total area defoliated by forest tent caterpillar was ~7,500 ha in areas around Bathurst. Pheromone trap catches in 2011 suggest an increase in forest tent

caterpillar populations throughout most of New Brunswick, particularly in the eastern half of the province. However, ground surveillance in 2012 only detected defoliation mostly confined to the Bathurst area of north-eastern New Brunswick except for one small pocket near Escuminac, also in north-eastern NB. Aerial and ground surveillance in 2013 detected 4,000 ha of defoliation primarily on aspen, again in the areas of Bathurst and Escuminac. Elsewhere, monitoring efforts by FPMG as well as reports from industry, colleagues and the public suggest populations remained low. While average pheromone trap catch at the network of 85 plots was slightly elevated over 2012 numbers, expectations are that population status will not be significantly different in 2014.

Satin Moth (*Leucoma salicis* [L.]): This insect, originally from Europe and first observed in the Maritimes in 1930, primarily feeds on leaves of poplar and willow. Outbreaks are generally localized and of short duration and it rarely kills trees. In 2012, two pockets of satin moth defoliation were found on aspen in north-west New Brunswick. One of these pockets was first detected by Acadian Timber in an area north of Sisson Brook/Plaster Rock; the 2nd pocket (mapped and reported by J. D. Irving, Limited) was geographically adjacent to the 1st location and was ~250 ha in size. A 3rd pocket of satin moth defoliation was detected by FPMG on aspen and white birch in north-east New Brunswick, in an area east of Bathurst Mines. Four hundred hectares east of Bathurst Mines was again defoliated in 2013, as well as a 20 ha stand of trembling aspen west of Tracadie.

Hickory Tussock Moth (*Lophocampa caryae* Harris): This insect is found from Nova Scotia to the North Carolina Mountains, Ontario, Wisconsin, and Texas. The caterpillars feed on the leaves of several hardwoods, including: ash, elm, oak, willow and others; but hickories, walnut and butternut are preferred. Populations may occasionally cause local defoliation but do not persist long and control is usually not necessary; hence, the insect is not regarded locally as a pest of concern to the forest industry. The main concern is due to the numerous hairs on the caterpillar's body (and pupae) that cause allergic reactions such as itchy rashes to some people who handle them, especially children. Heightened media coverage on this insect in New Brunswick and the neighbouring State of Maine in 2011 and 2012 spurred FPMG to track the insect's status and provide factual background details to health and education professionals, who were receiving numerous inquiries from concerned parents in those school districts in southern New Brunswick where localized pockets of hickory tussock moth were observed. While the public and field crews did report seeing this insect in 2013, population levels were for the most part "incidental" when compared to the previous two years.

Large Aspen Tortrix (*Choristoneura conflictana* [Walker]): Outbreaks of this insect occur periodically throughout the range of its preferred host, trembling aspen. High populations are rare in the Maritimes and when they do occur they are usually associated with localized outbreaks of short duration. In 2010, small pockets of defoliation caused by large aspen tortrix were observed in western New Brunswick in the vicinity of Woodstock and near Florenceville. In 2011, the total

area of defoliation was mapped over 785 ha near Canterbury and Meductic in south-central New Brunswick. Light defoliation was detected on the tip of the panhandle (Glassier Lake) in north-west New Brunswick in 2012. Defoliation from the insect was not detected in 2013.

Seed Orchard Pests

Spruce Cone Maggot (*Strobilomyia neanthracina* Michelsen): As part of its nursery seedling production requirements, DNR was projecting a need for viable seed from its white spruce seed orchards in 2013. As such, staff of FPMG and Tree Improvement sampled and assessed spruce cones at Kingsclear and Queensbury for the presence of spruce cone maggot eggs. Based on forecasted seed losses, pesticides were applied to one field at Kingsclear to protect the white spruce cone crop.

Miscellaneous Observations

Most of the pest-targeted surveys conducted by FPMG, and much of the general surveillance activities conducted by FPMG, DNR's Regional Pest Detection Officers, forest industry and other collaborators are incorporated within this report. The benefit of many trained eyes in the woods greatly enhance the forestry community's ability to detect and where needed, respond to pest problems as they occur. Beyond their ongoing contributions to general pest surveillance, Regional

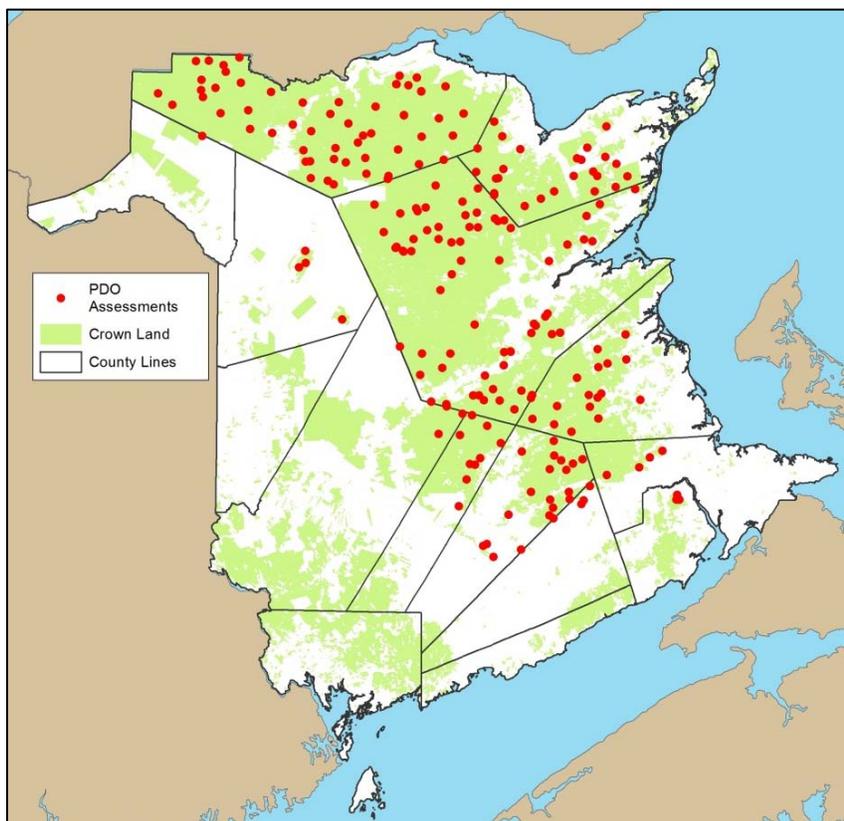


Figure 6. Plantations and thinnings assessed by DNR's Regional Pest Detection Officers in 2013. Note: this figure does not include red pine stands assessed by Region 3 staff as part of the Sirococcus risk rating survey.

Pest Detection Officers also specifically conducted pest assessments in 225 high-value plantations and thinned stands on Crown Land (Figure 6). Plantations and thinning remain generally healthy. The most common damage encountered was caused by white pine weevil (white pine, jack pine, Norway spruce, white spruce, black spruce), Sirococcus shoot blight (red pine, black spruce), and pitch nodule makers (*Petrova spp.*, jack pine). Sites damaged by these pests were distributed around the province. In Region 1 (Bathurst), snow and ice damage in softwood plantations and drought damage of sugar maple was often observed. In Region 2 (Miramichi), light damage from the collection of balsam fir branch tips for production of Christmas wreaths was commonly found. In Region 3 (Fredericton), balsam woolly adelgid symptoms were prevalent on a small percentage (<30%) of the fir trees in softwood thinnings. Venturia leaf blight of trembling aspen was reported from several sites in Region 4 (Edmundston).

Invasive Alien Species of Concern

There are several invasive alien species that have not been detected in New Brunswick to date but have been found in other jurisdictions in north-eastern North America and which have the potential to cause significant damage to the forests of New Brunswick. While these species spread naturally, human assisted movement through transportation of infested wood commodities (e.g., firewood, logs, landscape nursery stock) is the most important pathway for the long-range dispersal of these pests.

Asian Longhorned Beetle (*Anoplophora glabripennis* [Motschulsky]): This destructive wood-boring pest of maples and other hardwoods was first discovered in North America at Brooklyn, NY in 1996, likely transported in wood pallets or wood packing material from Asia. The ALHB was detected in Toronto, Ontario in 2003 which triggered an aggressive eradication effort led by the CFIA. Another detection was made near Pearson International Airport in 2013 where there are efforts underway to eliminate the pest. The closest US detection is the City of Boston as well as Worcester County, Massachusetts where control efforts are currently underway. The CFIA conducts annual monitoring for Asian longhorned beetle within New Brunswick.

Beech Leaf-mining Weevil (*Orchestes fagi* [L.]): This native insect of Europe was recently detected in Halifax, NS where it appears to have been causing severe defoliation of American beech for a number of years and some of the trees are beginning to die. Surveys by the CFIA in 2013 found it in several areas throughout Nova Scotia, but it was not detected in New Brunswick. In Europe, it is a common pest of beech trees but is rarely an important forest pest. The CFIA is currently assessing the significance of this pest to Canada.

Emerald Ash Borer (*Agrilus planipennis* Fairmaire): This beetle was first discovered in Canada and the USA in 2002 and has since killed millions of ash trees throughout Ontario, Quebec and the US. It poses a significant economic and environmental threat to urban and forested areas. The closest detection to New Brunswick within Canada has been near the City of Granby, Quebec (approximately 60km east of Montreal). The closest detection within the US has been in Concord, New Hampshire. The CFIA conducts annual monitoring for emerald ash borer within New Brunswick.

European Wood Wasp (*Sirex noctilio* Fabricius): This insect was reported as established in New York State in 2005 and has caused mortality of pines in several Southern Hemisphere countries, though it has not caused significant damage in north-eastern North American forests. It has been found in southern Ontario, western Quebec, southern Connecticut, western Vermont and northern Pennsylvania.

Hemlock Woolly Adelgid (*Adelges tsugae* [Annand]): This pest was introduced to eastern North America from Asia in 1950 and has since caused extensive mortality and decline of hemlock trees in the eastern US. Hemlock decline and mortality typically occur within four to ten years of infestation with stressed trees succumbing more quickly. The closest population of hemlock woolly adelgid to New Brunswick is currently within Maine where it has become established as far north as Lincoln County. In Canada, two detections of this pest have been made in southern Ontario within the last two years. Surveys of hemlock stands in southern New Brunswick conducted in 2005 and 2007 by FPMG failed to detect the adelgid. The CFIA also conducts monitoring for hemlock woolly adelgid within New Brunswick every two to three years.

Pine Shoot Beetle (*Tomicus piniperda* L.): First discovered in Ohio, US in 1992, this non-native insect has gradually spread into Québec and western Maine. In Ontario, it has been found in association with mortality in Scots, red, white and jack pines. It is considered a pest of quarantine significance and is regulated by the CFIA under the federal *Plant Protection Act*. The CFIA conducts monitoring for pine shoot beetle in New Brunswick.