Summary of Forest Pest Conditions 2022

Natural Resources and Energy Development

January 2023

Acknowledgements

Director..Chris Norfolk
Manager..Drew Carleton
Adaptation and Risk Forester..Luke Amos-Binks
Operations Coordinator..Andrew Morrison
Forest Technician...Catherine Desjardins
Forest Technician... Eric Knopf
Forest Technician... Doug Winter
Field and Lab Technician...Emily Boudreau
Field and Lab Technician.. Adam Connolly
Field and Lab Technician...Chris Durant
Field and Lab Technician... Mischa Giasson
Field and Lab Technician... Jeremy Hebert-Chesley
Field and Lab Technician...Robert Leger
Field and Lab Technician.. Merle Lewis
Field and Lab Technician... Elaine Moreau
Field and Lab Technician.. David Niblett
Field and Lab Technician... Anthony Sulpizio

List of Figures

List of Tables

Overview

This document is intended to provide an overview on the status of forest insect and disease pest conditions in New Brunswick (NB) in 2022; it highlights many of the activities carried out by the NB Department of Natural Resources and Energy Development (hereafter "the Department"), Forest Health Section (FHS), but it is not intended to itemize all details for all surveys. The reader may contact the Department to request additional information.

Monitoring for pest insect and diseases occurs in many ways. Numerous reports are received each year and several thousand field observations are conducted with samples collected in many cases. This report covers those pests considered to be a risk to NB forest values. These values may be economic (e.g., timber supplies), environmental (e.g., habitat loss, species at risk, loss of carbon sequestration) or societal (e.g., culturally significant species/location, recreational loss). This report includes invasive alien species that have been detected in NB, or that are believed to be an entry threat to NB. Often invasive species are the responsibility of the Canadian Food Inspection Agency (CFIA). The Department works closely with the CFIA on many of these files where applicable but may also monitor invasives independent of the CFIA where the species is not regulated.

Introduction

The Forest Health Section is tasked with providing accurate measures of the current state of forest pests as well as interpretation of the future state of forest pest conditions and their associated risks. This information allows the Department to better predict overall forest inventory conditions and develop more reliable forest stewardship strategies. To achieve these tasks, proactive surveys are conducted for a targeted number of pests of concern, while reactive surveys are also conducted on an as-needed basis for less predictable species. The techniques and survey intensity are reflective of the level of risk associated with a given pest at a given time. As an example, a species known to have the potential for severe, broad-scale impacts on conifer forests —such as spruce budworm (*Choristoneura fumiferana*) or hemlock looper (*Lambdina fiscellaria*)— are intensively monitored annually, with several large survey efforts conducted throughout the season, whereas an insect without a previous history of causing significant damage in our region (e.g., jack pine budworm, *Choristoneura pinus*) might only be surveyed if signs of significant damage were reported. For some pests, monitoring programs are well established and repeated annually with only minor changes in intensity or technology; for rare and/or novel pests, surveys are often conducted at a coarser level (e.g., aerial surveys, public reports). General surveillance of forest pest conditions is done in collaboration with members of the Department's regional staff, members of forest industry, and the general public; incidental observations are often reported through the Department's Forest Disturbance Reporting System (FDRS) which can be found online at: https://dnr-mrn.gnb.ca/ForestHealth/MaintainReportData/Details.aspx

Image: View of spruce budworm defoliation taken during 2021 aerial survey. Credit: Andrew Morrison

Forest Disturbances

Larger scale forest disturbances were detected via change-detection analysis of Sentinal2 satellite imagery and verified with ground surveys (Fig. 1). Forest tent caterpillar (*Malacosoma disstria*) (FTC) defoliation in the Miramichi region was the largest disturbance (~2100 ha) followed by spruce budworm (SBW) defoliation (~1200 ha). A small area of mature spruce (~100 ha) with evidence of spruce beetle (*Dendroctonus rufipennis)* damage was included in 2022 – it had been observed for several years but not previously mapped.
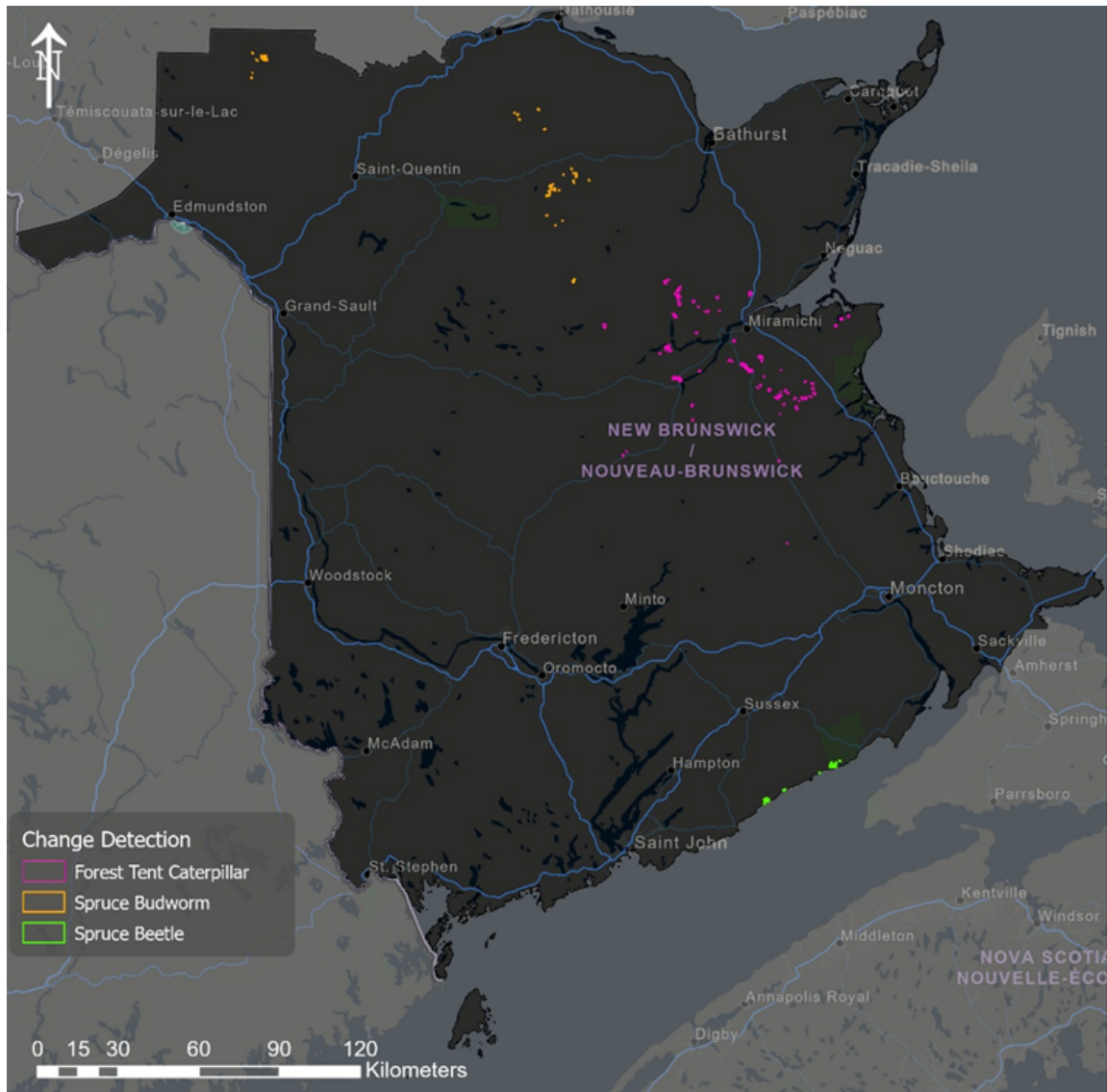

Figure 1. Defoliation detections via analysis of Sentinel2 imagery in 2022.

Native Species of Concern

Spruce Budworm (*Choristoneura fumiferana*)

Spruce budworm is currently the largest threat to the softwood dominant forests of NB. It is one of the most destructive forest pests in North America, feeding primarily on balsam fir (*Abies balsamea*) and spruce species (*Picea spp.*). With economic impacts to the forestry industry estimated to be ~$3 B under a moderate outbreak scenario, keeping populations under control is imperative to minimize both economic and environmental impacts of the insect. Since 2007, Quebec has been experiencing a significant outbreak of SBW. Current reports estimate ~9 M ha (down from ~12.2 M ha in 2021) of defoliation in Quebec. By comparison, NB has less than 7 M ha of forest (all types).

Since 2014, the Department has participated in research and monitoring in collaboration with the federal government, the Atlantic provinces, research institutes, the forestry industry, and NGO stakeholders. The goal of this collaboration, formally known as the Healthy Forest Partnership (HFP), is to avoid an outbreak from occurring through the implementation of an "Early Intervention Strategy" (EIS). This proactive approach to SBW management involves the early detection and treatment of small patches of source populations of SBW, thereby reducing those populations to levels below outbreak potential before it happens. Much of the data required for the implementation and analyses of the strategy are generated through the intensive monitoring conducted by the Department. This year marked the 9th year of the research program. For more information on the HFP and the EIS research projects, visit www.healthyforestpartnership.ca.

In 2022, ~15000 ha of spruce/fir forest were treated during the first week of June. The treatment block sizes and locations were determined using the results of the 2021 L2 sampling efforts.

The adult life stage of the SBW is a moth. The moth itself does not cause damage however it is still an important life-stage to monitor, as it can be an effective way to track immigration events or an indicate areas of interest for further monitoring. Typically, moth movement occurs over short distances (e.g., between patches of the same forest stands), on occasion large-scale migratory events can occur over greater distances, in some instances covering several hundred kilometers (e.g., from the north shore of the St. Lawrence River to the island of Newfoundland). These large migratory events can carry millions of moths, many of which are egg bearing females, to new forest habitat where they can deposit billions of eggs, thus leading to the potential establishment of new outbreak populations. Scientists are developing new and compelling ways to monitor for these events and have been successful in tracking populations via radar. Until these technologies are fully developed, the Department monitors changes in moth counts through a province-wide pheromone trap network.

Spruce budworm pheromone traps only attract male moths, so they are not a true measure of the population. However, they are a useful indicator of changes in population trends and can effectively identify migration events if enough traps are properly placed and monitored. In NB, the SBW pheromone

trap network consists of 155 sites established by the Department and forestry industry partners (Fig. 2). At each site, 3 traps placed ~40m apart are hung prior to moth flight and are collected after all moth activity has ended for the season.
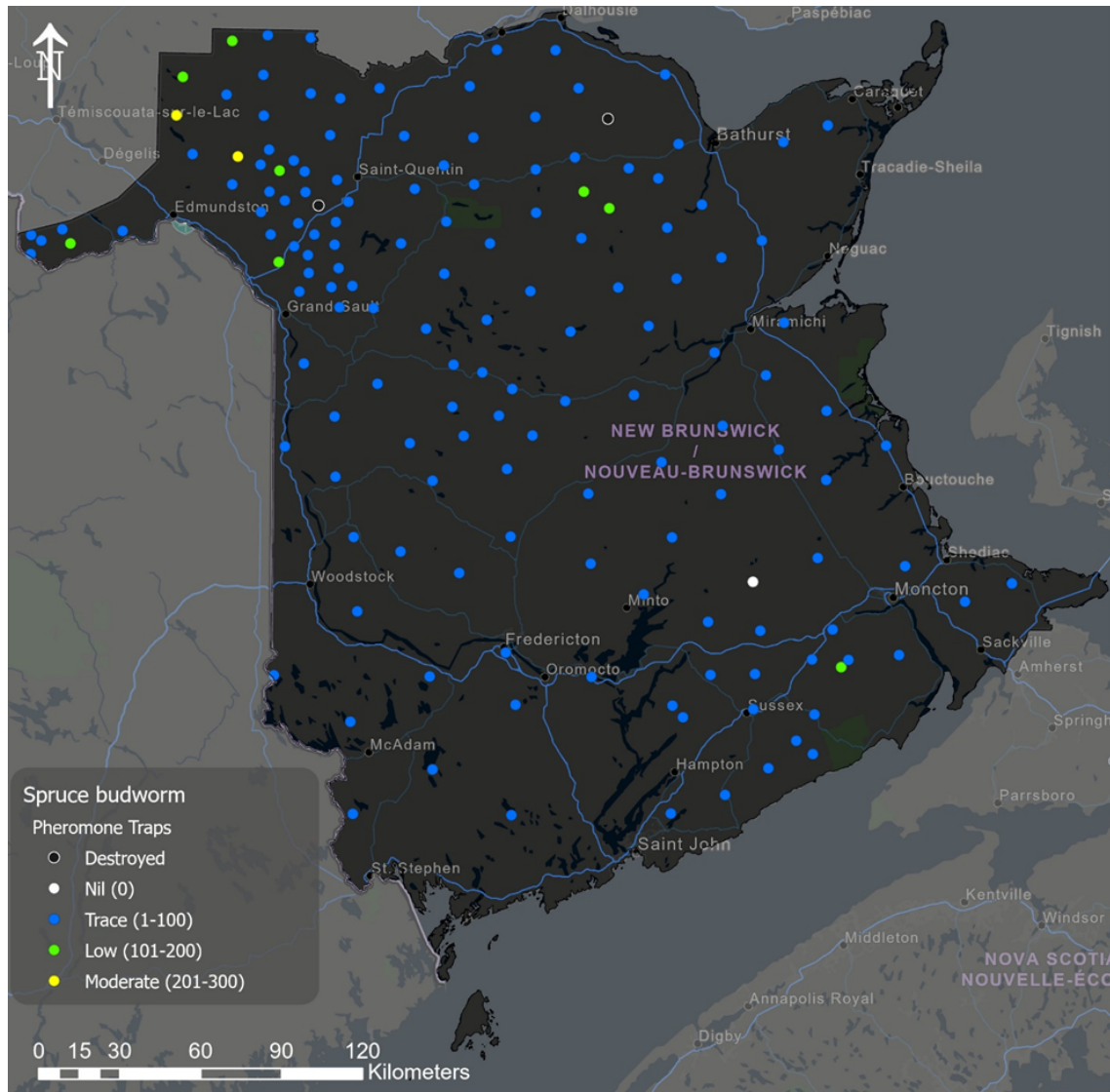

Figure 2. Results of the 2022 spruce budworm pheromone trap survey. Each plot (n = 155) value represents the average of three traps, unless traps were damaged/destroyed, then the average of remaining traps was used.

Since 2019, province-wide moth counts have dropped annually. In 2022, moth counts were the lowest on record since the start of the EIS program, with most traps having fewer than 100 moths on average. There were six plots (five in northern NB and one in southern NB) with low counts and only two plots (northwestern NB) with moderate counts (Fig. 2).

For the third year in a row there appears to have been little or no influence of moth migration, from Quebec, on NB pheromone traps.
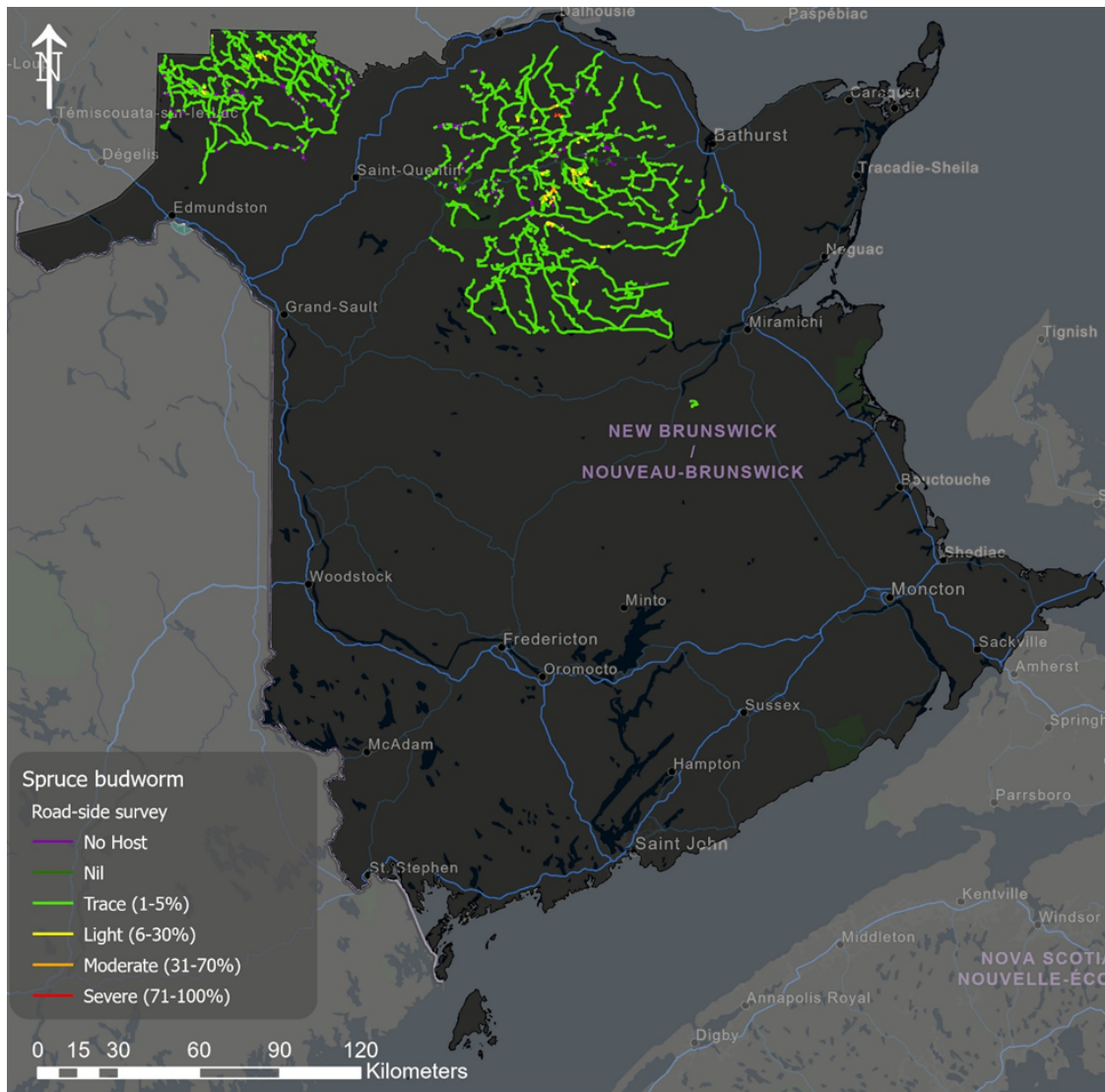

Figure 3. Results of the 2022 spruce budworm roadside survey.

Defoliation by the SBW can often be an indication of population growth because small populations do not typically create enough defoliation to be detected using traditional monitoring methods.

In 2022, DNRED used three methods to measure defoliation caused by the SBW. The first, was the Sentinel2 satellite imagery and change detection survey as described in the 2021 report, this survey has performed superior to its predecessor, the aerial survey, and as a result DNRED decided not to fly aerial surveys in 2022. The second survey was a roadside defoliation survey. This survey was used to support the Sentinel2 work and in 2022 it was concentrated on areas that required on the ground validation of the Sentinel2 observations. The third method involved collecting defoliation data during the L2 surveys. All three methods are described in greater detail in the 2021 report.
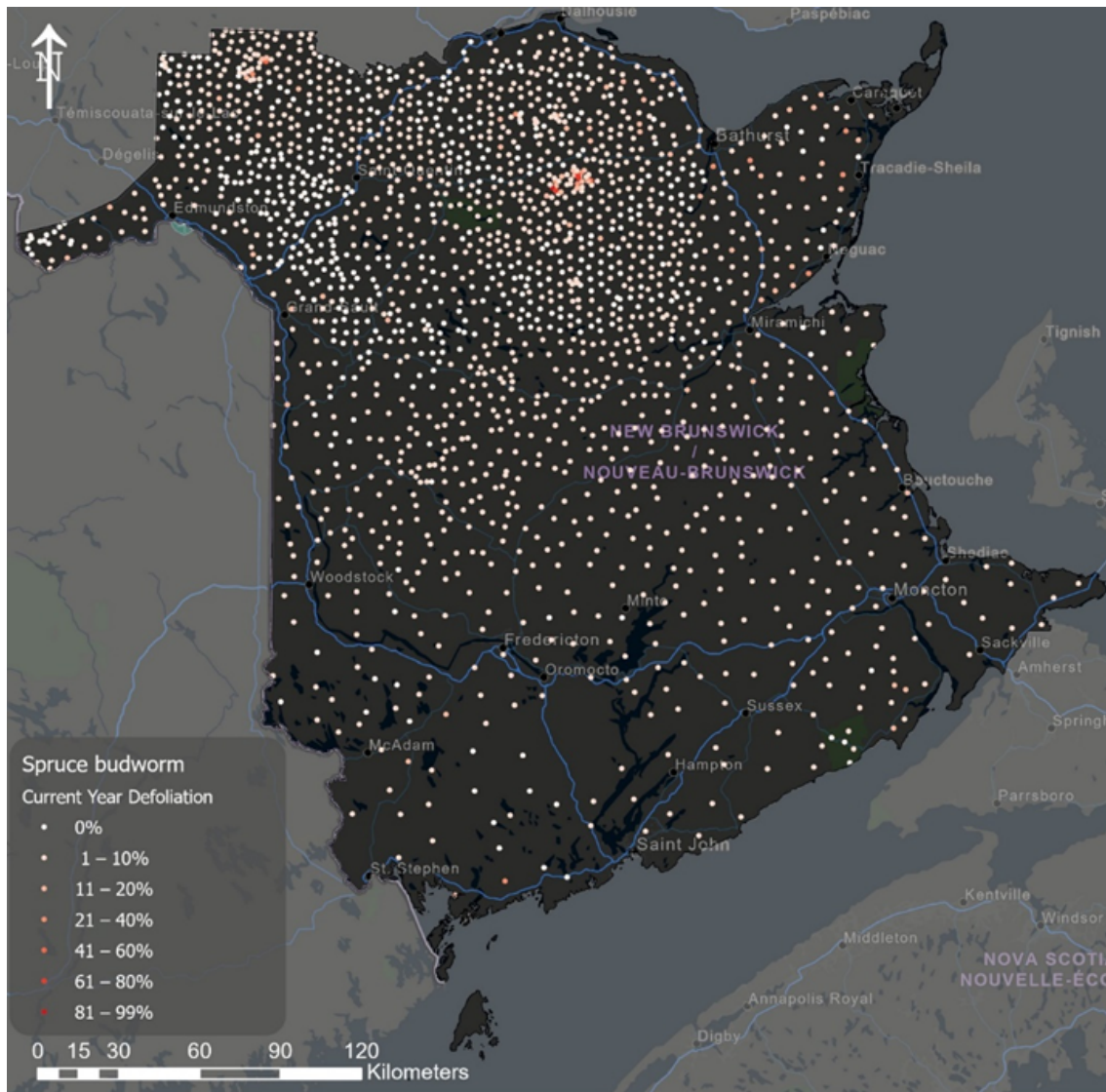

Figure 4. Defoliation estimates of current year foliage taken during 2022 L2 survey.

The Sentinel2 survey used imagery acquired between July 3-15, 2022. The survey identified ~1200 ha of mostly moderate defoliation (i.e., 30-70% needle loss) (Fig. 1). The roadside survey (Fig. 3) covered ~3300 km and verified the general locations of the Sentinel2 survey SBW defoliation detections (Fig. 1). Finally, the defoliation on current year foliage taken at the L2 sampling locations (Fig. 4) indicated a similar defoliation footprint as the roadside survey (Fig. 3). The overall interpretation of defoliation through these surveys was a significant reduction in the overall footprint and intensity of defoliation compared to 2021.

While defoliation is a clear indicator of budworm activity, significant mortality events can occur between the feeding stage that causes defoliation and the next generation that will feed the following season. Predation, parasitism, habitat loss, and pesticide treatments are all sources of population decline that can result in a heavily defoliated site having no further population to feed (or treat) the following year. Our primary source for SBW population data comes from the second instar larvae or "L2" survey. This immature stage of the SBW overwinters in a dormant state on host species branches. The L2 survey was conducted from mid-August through mid-November. Through collaboration with industry partners (Acadian Timber Corp, AV- Group NB Inc., Interfor Inc., J.D. Irving Ltd, and Twin Rivers Papers), Parks Canada (Fundy National Park), and the Department's regional staff, 5730 branches (from 1910 sites) were collected province-wide in 2022 (Fig. 5). Each branch was processed or "washed" to extract and count overwintering L2s. These counts were then used to forecast SBW populations for the following year, forming the basis of the EIS.

The 2022 L2 survey results indicate a sharp decline in budworm populations from 2021. A similar decline was observed in both 2018 and 2021 This decline was regional, with L2 counts falling province-wide as well as in parts of Quebec. Researchers within the HFP program are currently assessing data to determine the cause of this decline. Whatever the cause, the NB EIS program has benefited. Surviving populations are retracted and isolated to one cluster near Caribou Depot, one pocket near Moose Meadows First Nation and an isolated pocket near Edmundston. As a result, it is estimated that the treatment program will be ~1500 ha in 2023.

For more information on the products, application rates and treatment strategies, please follow the HFP weblink listed, in the introduction section, for updates.
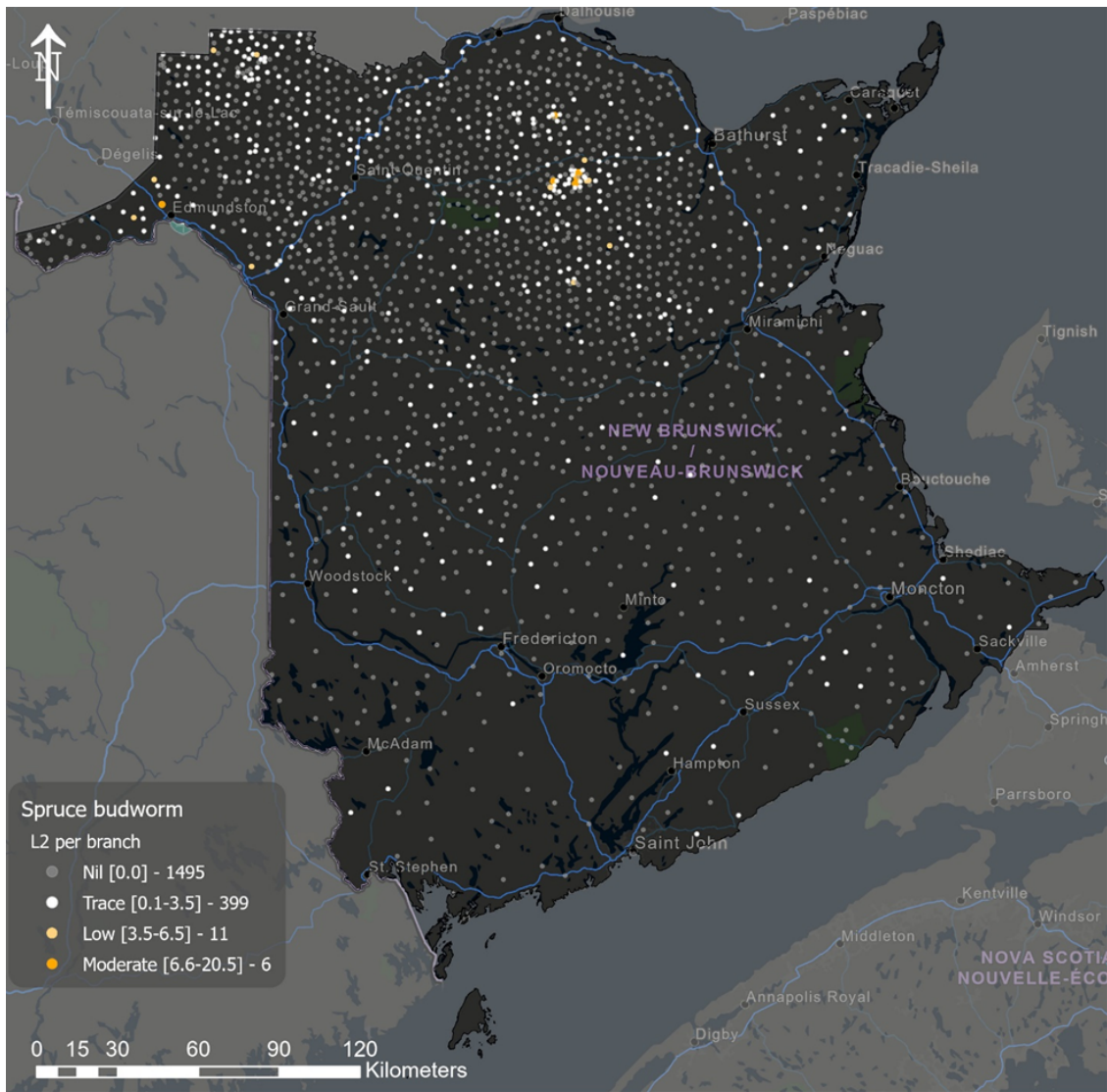
Figure 5. Spruce budworm second instar (L2) survey results, 2022. Each plot (n = 1910) value represents the average number of L2 found on three, 75 cm long, mid-crown branches of either balsam fir or spruce species.

Hemlock Looper (*Lambdina fiscellaria*)

Hemlock looper is primarily a defoliator of balsam fir in Eastern Canada. Outbreaks in NB have been rare; however, the insect has demonstrated eruptive outbreak cycles, rising in density quickly and causing significant tree mortality within 1-3 years before declining again rapidly. Using a similar approach for the looper as SBW, the FHS along with J.D. Irving Limited established a network of pheromone traps to monitor for changes in male moth populations.

In 2022 the network consisted of 51 trap sites (Fig. 6), a reduction of 138 traps, from the previous season, focusing only on areas where populations had historically been elevated. The decision to reduce monitoring efforts was made following a three-year downward trend in in average moth counts.

An average of 58 moths/trap was recorded, with the highest observed count of 221 moths in a trap north of Summit Depot. As stated in previous reports, looper counts of 700/trap should occur before follow-up surveys are triggered.

Populations of hemlock looper remain in an endemic state with no anticipated defoliation in 2023.
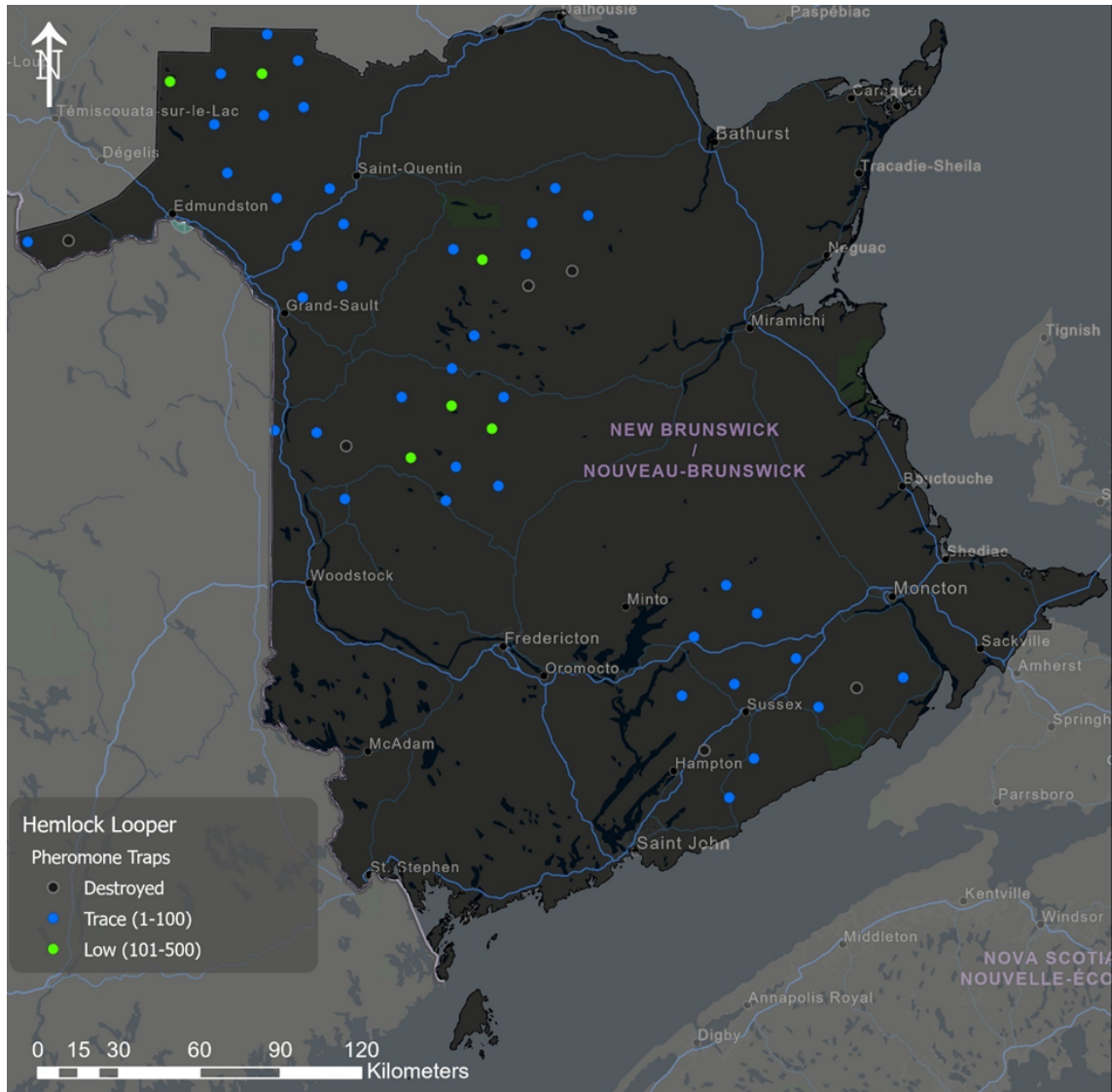
Figure 6. Results from the combined FHS and J.D. Irving Limited hemlock looper pheromone trap monitoring program. Compromised traps (e.g., damaged or found on ground) are reported as destroyed. Trapping efforts were reduced in 2022 to 51 traps – down from 189 in 2021.

Cedar Leafminer Complex *(Argyresthia spp.)*

Image: Declining cedar trees (reddish brown color) in an otherwise healthy, mixed-wood stand. Credit: Richard Hall

In 2020, numerous reports of declining health of eastern white cedar (*Thuja occidentalis*) were received by the Department. Roadside surveys and examination of branch samples revealed the presence of three micro-moth species: cedar leafminer (*Argyresthia aureoargentella*), Canadian arborvitae leafminer (*A. canadensis*), and arborvitae leafminer (*A. thuiella*). These moths are part of a group that feed on cedar and are typically referred to as cedar leafminer complex (CLM). This complex was last reported in NB in 1999, causing damage to ~40,000 ha of cedar at that time, primarily in southern NB.

A third consecutive year of roadside surveys was conducted in 2022 (Fig. 7). Early reports suggested that the amount of CLM damaged trees had increased since 2021, as a result, the 2022 CLM survey was expanded to levels similar to the 2020 survey.   Of the ~1900 km of road surveyed, cedar trees were present on ~16% of survey route and ~84% of those trees were damaged by CLM. The most obvious damage was reported in the southwest, but some damage was evident in most areas where cedar was present, an increase from the 2020 (51%) and 2021 (37.5%) observations. Monitoring for CLM will continue in 2023.
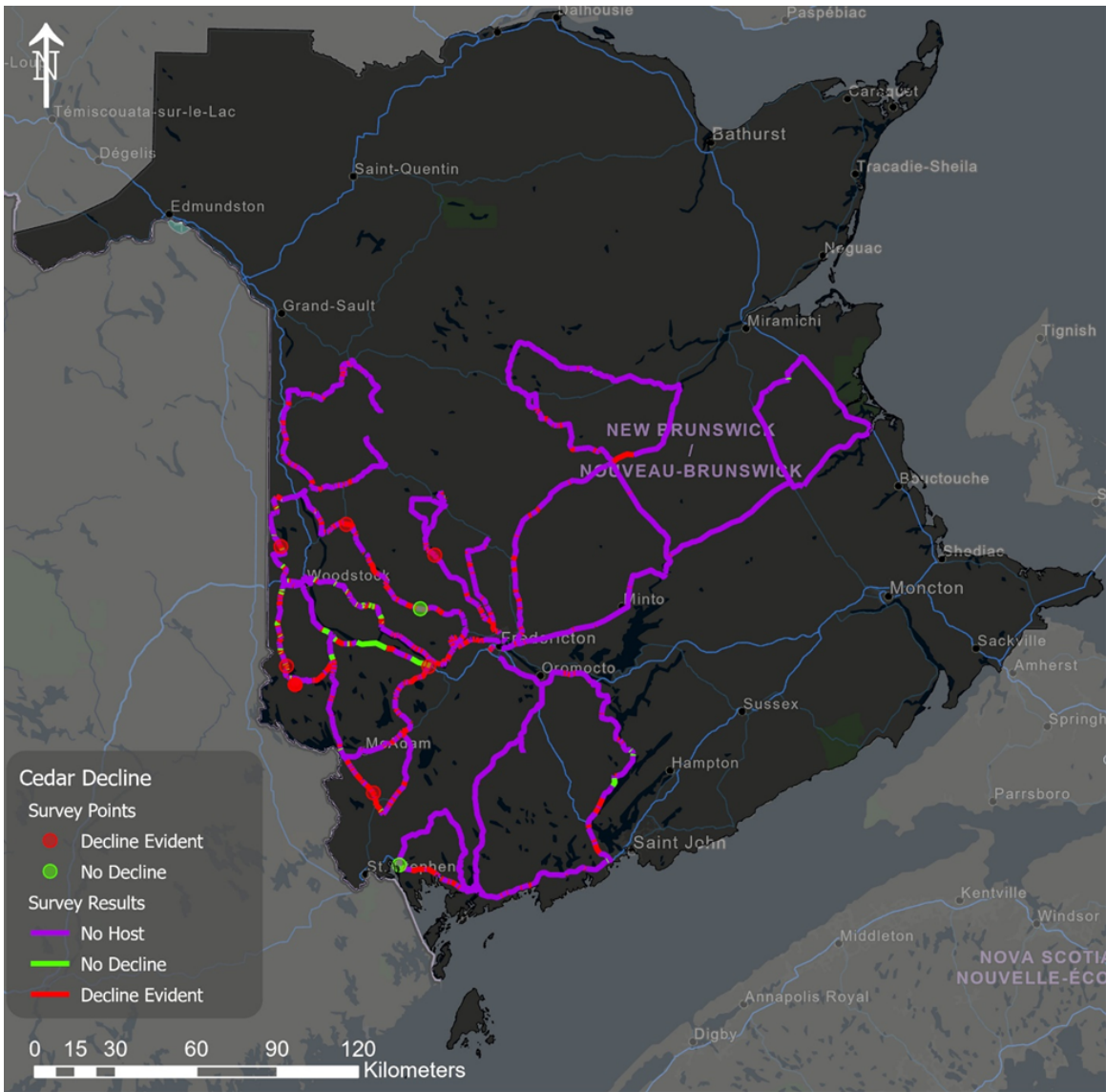
Figure 7. Results of the 2022 cedar decline roadside survey.

Forest Tent Caterpillar (*Malacosoma disstria*)

Image: Forest Tent Caterpillar defoliated hardwood trees in mixed stand. Credit: Dave Niblett

Forest tent caterpillar is a widespread defoliator of aspen (*Populus spp*.) and other hardwood trees and periodically defoliates millions of hectares in North America. The last two large outbreaks in NB (1979-1984; 1991-1996) covered 1.4 M and 0.4 M ha, respectively. These caterpillars are often referred to as "armyworms" because larvae become very mobile and move about the ground in massive numbers looking for more trees to attack. At times large numbers crawl up the sides of buildings and other property and become a nuisance.

In 2022, ~2100 ha of hardwood forest in the Miramichi region was defoliated by FTC (Fig. 1). While damage at this level is not currently a concern for mortality, the Department will continue to monitor FTC defoliation in the 2023 season when it is again expected to be a nuisance to landowners.

Alien (Non-Native) Species

Alien species are those found occurring outside of their natural range – they can also be referred to as "non-native". If one of these species is able to modify local ecosystems either as a pest (e.g., kills trees) or as competitors to local species, they are deemed to be "invasive". Their route of establishment varies, but often they are transported initially via human movement pathways, as such, the Canadian Food Inspection Agency (CFIA) has a lead role in the monitoring and establishment of regulations surrounding many of these species.

Emerald Ash Borer (*Agrilus planipennis***)**

Image: A green prism trap hanging in the canopy of an ash tree. These traps are used to help monitor for emerald ash borer. Credit: Eric Knopf

Originating from Asia, the highly destructive emerald ash borer beetle (EAB) was first detected in North America in Michigan and Ontario in 2002. It has since spread across the continent, killing millions of ash trees (*Fraxinus* spp.). Emerald ash borer was first detected in NB in May 2018 near Edmundston. In 2019 it was confirmed in both Oromocto and Moncton. A regulated zone has since been established that includes the counties of Victoria, Carleton, York, Sunbury, Queens, Kings, Westmorland and Albert (see "CFIA – EAB" for the latest information on regulated areas and regulations). Once a county is regulated, the CFIA no longer actively monitor for the pest in that area as it is considered established. However, the Department continues to collaborate with CFIA to monitor for EAB in these areas in an effort to slow its spread and reduce its impacts. In February 2021, EAB was confirmed in the City of

Fredericton. This area was a previously regulated, therefore no new measures have been taken at this time.

In 2022, FHS staff deployed 39 EAB pheromone traps, primarily along the Saint John River Valley (Fig. 8). Also included in the survey locations were hardwood mills that process ash materials as well as sites of value for their educational awareness. Department staff conducted inspections of 59 hardwood stands throughout NB (Fig. 9). The Department found no new detections in 2022 as a result of either survey. Monitoring efforts will continue in 2023.
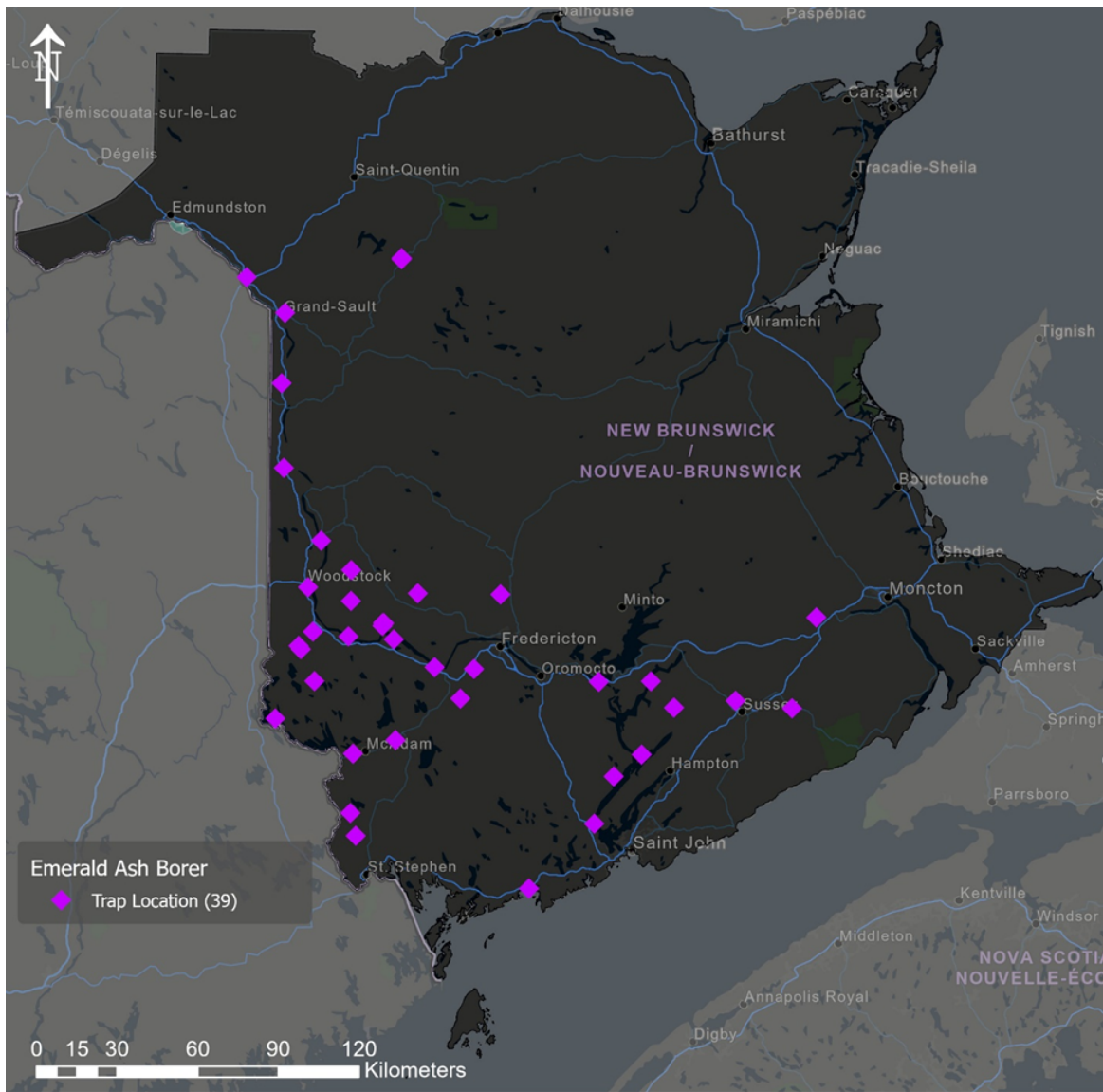

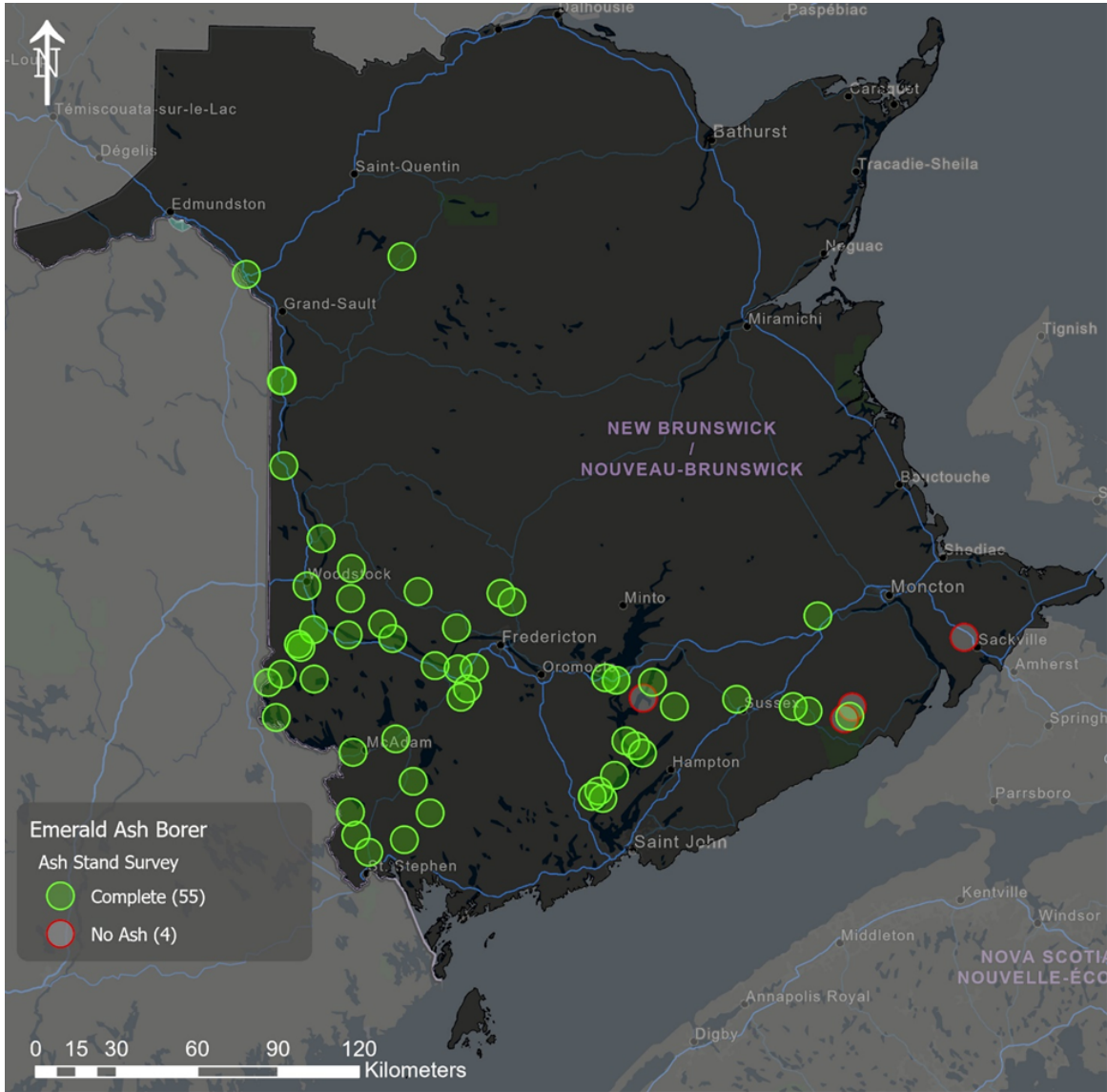**Figure 8.** Emerald ash borer pheromone trap locations in 2022.

Figure 9. Location of ash stand surveys in 2022. Sites are monitored for signs of decline/stress that might be attributable to emerald ash borer.

Browntail Moth (*Euproctis chrysorrhoea*)

Image: Browntail moth winter web. Credit: Doug Winter

The browntail moth (BTM), native to Europe, was introduced to Massachusetts in the 1890's. In the early 1900's during the peak of its outbreak, populations of BTM spread throughout NB. Since collapsing, populations have generally remained localized to coastal Maine however over the last decade they have been reported expanding north, and in 2022 surveys by the State indicated that populations were growing in size (~81,000 ha) and expanding further inland as well, in some areas as close as 60 km from the NB border. In its larval stage, the moth is covered in tiny hairs that contain a toxin. When these hairs contact the skin, they can cause severe skin irritation and dermatitis. The hairs become airborne easily and are very easily inhaled. When this occurs, severe respiratory distress is not uncommon. The larvae overwinter in a nest (winter web) at the top of hardwood tree and shrub species and can be readily seen on bright sunny days after leaves have fallen in fall and before leaf flush in spring.

Browntail moth had not been detected in NB since the previous outbreak, but in 2018, a single moth was photographed near Cormierville, NB. This sighting was reported by a member of the public on the "iNaturalist" website. A further review of the website by FHS staff found BTM sightings in NB starting in 2017. Since then, additional sightings of BTM adults have been made in NB as follows: Fundy National Park, Alma (2017); Cormierville (2018); Midland, Seal Cove (2019); Hartland (2020); Salisbury, Cormierville, Rothesay and Fredericton (2021); and Fredericton (2022). Sightings of BTM moths have also been reported in Nova Scotia and in eastern Maine near the NB border.

Monitoring for BTM by the Department consisted of visual, roadside surveys for winter webs. Surveys are conducted the fall and following spring to coincide with the overwinter stage of BTM. The fall survey was conducted in November 2021 (Fig. 10) covering 2100 km of roads and the spring survey in April 2022 (Fig. 11) covering 635 km of roads. The spring survey was limited in duration due to COVID-19 restrictions at the beginning of 2022. No winter webs were observed during either survey, but the continuing detection of adult moths (via iNaturalist) indicates the possibility of viable BTM populations in NB.

The 2022 fall survey, for the next generation of BTM, began in November of 2022. This survey will be included in the 2023 report.
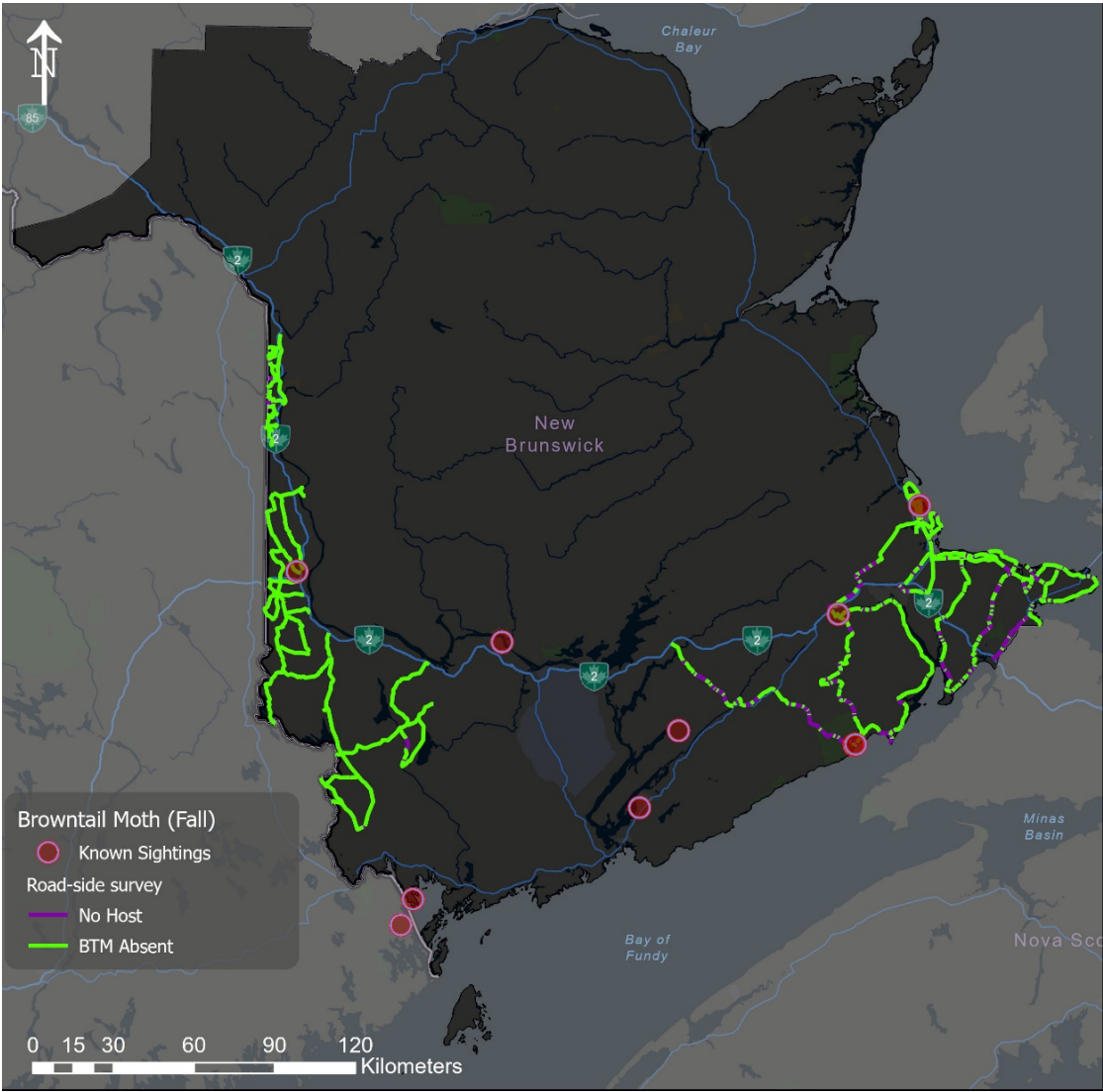

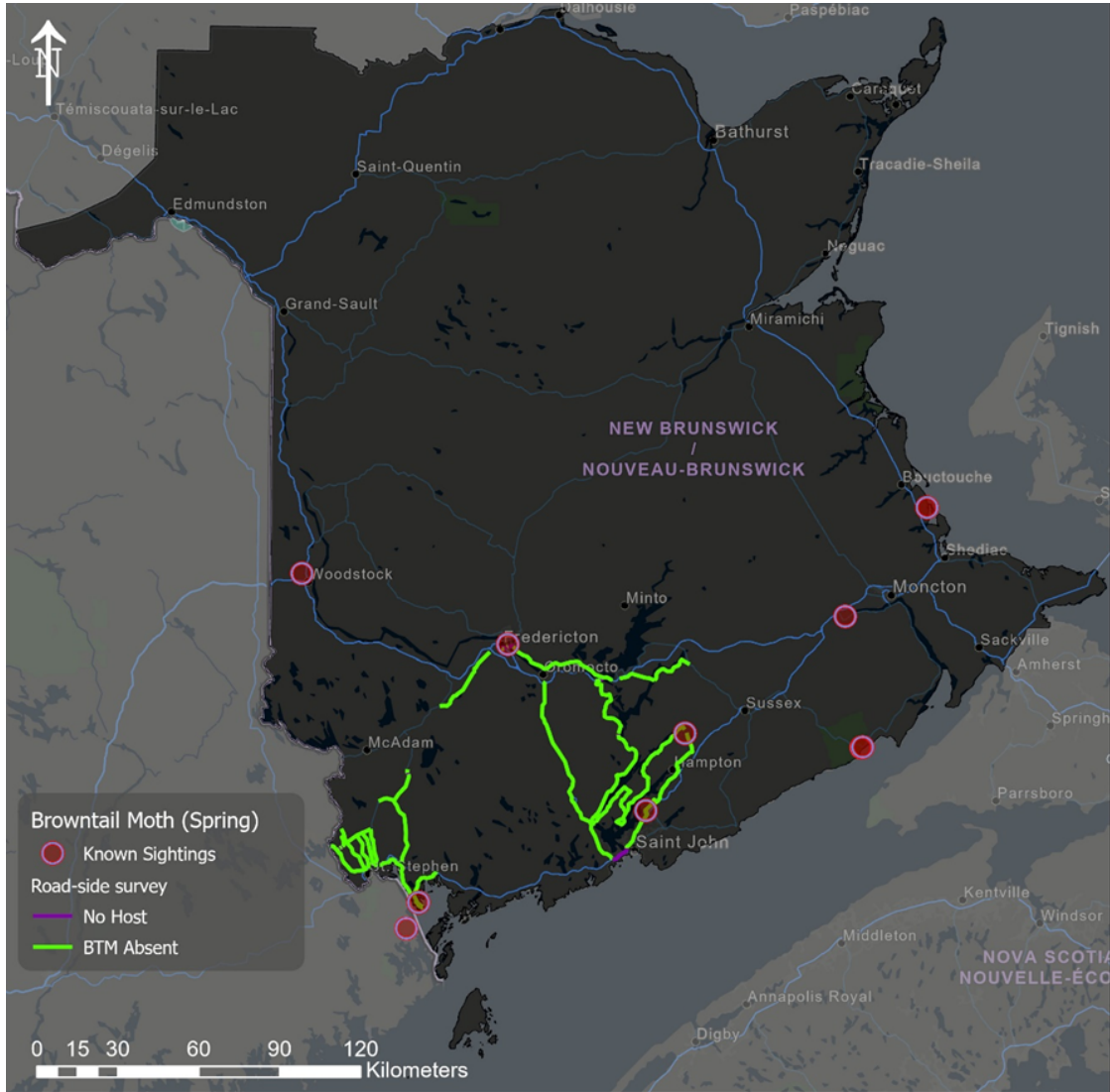**Figure 10**. Browntail moth roadside fall survey 2021.

Figure 11. Browntail moth roadside spring survey 2022.

Other Non-Native Species of Note

Beech Leaf-Mining Weevil (*Orchestes fagi*)

The beech leaf-mining weevil (BLMW) is a pest of beech (*Fagus spp.)* trees. First detected in Canada in 2012 in Halifax, Nova Scotia, the beetle has since spread with detections in Cape Breton, Digby, and Bridgewater. It was first found in PEI in 2021 and has since spread to multiple locations on the eastern side of the province. It is native to Europe where it is common and of minor concern. In North America it causes severe defoliation on American beech (*Fagus grandifolia*). In September 2020, presumptive beech leaf-mining weevil was reported for the first time in Sackville, NB. No further detections have been made in NB since then. CFIA continues to monitor for BLMW in NB. The insect currently remains on our watch-list.

Hemlock Woolly Adelgid (*Adelges tsugae*)

Hemlock woolly adelgid (HWA) is a serious invasive pest of Eastern hemlock (*Tsuga canadensis*). It is well established in the Eastern United States and in recent years, Nova Scotia has seen a population establish and proliferate in the southern part of the province. To date it is not known to be in NB. In early 2022, FHS staff visited 39 hemlock stands, primarily in the south-western part of the province (Fig. 12). All sites visited were negative for HWA, although six sites were not fully surveyed due to lack of suitable host material. Monitoring efforts will continue in 2023.
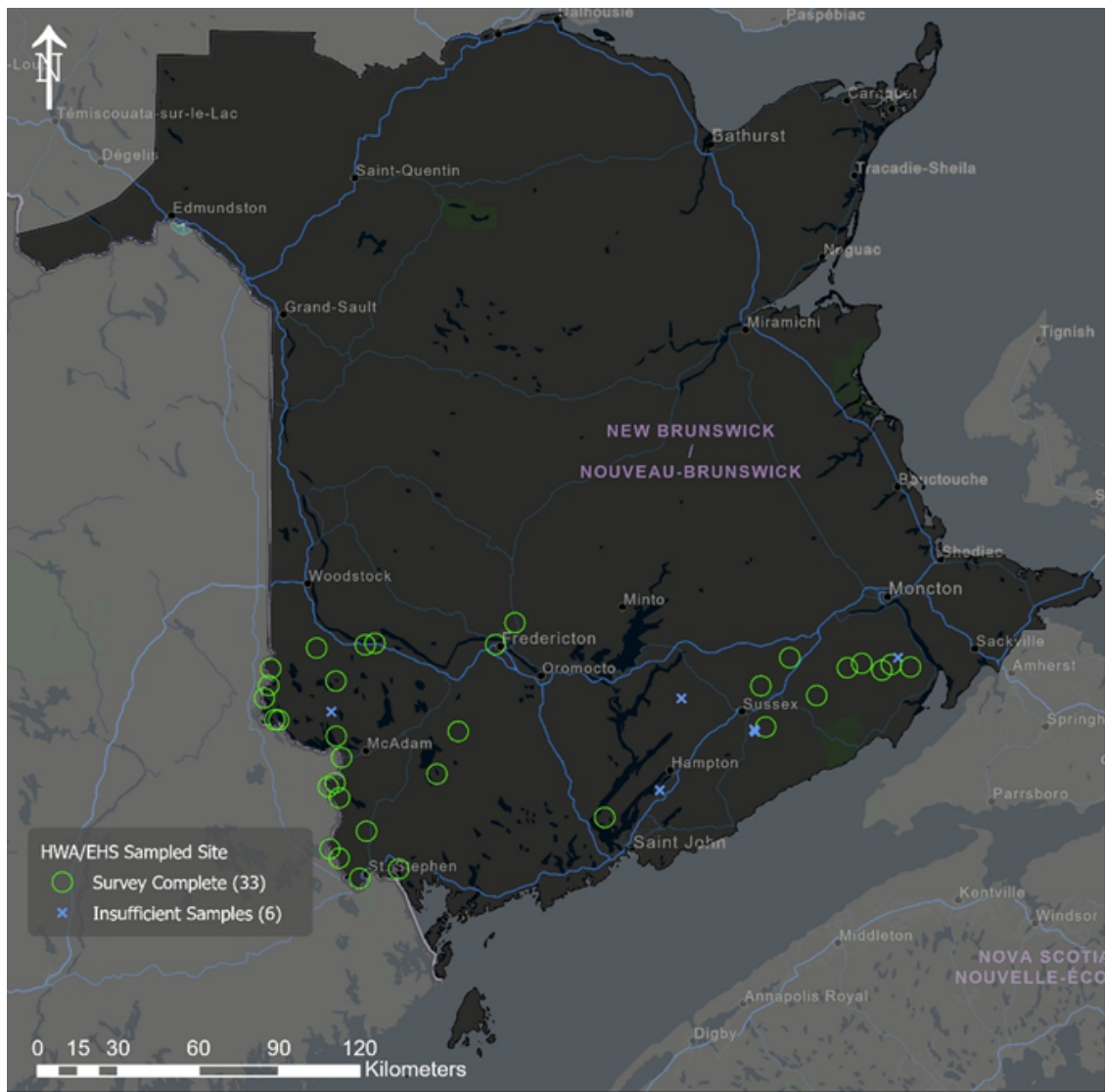
Figure 12. Location of 2022 hemlock woolly adelgid surveys in New Brunswick.

Southern Pine Beetle (*Dendroctonus frontalis*)

Southern pine beetle (SPB) is a bark beetle that infests pine trees and is one of the most destructive pests of southern pine forests.

SPB is native to the southeastern United States but has been expanding its range up the east coast in recent years and has recently been detected in the state of Maine. Warming of extreme winter temperatures has most likely contributed to this expansion.

In collaboration with CFIA, SPB pheromone traps were placed in ten locations in southwestern NB (Fig. 13) in 2022. No SPB were detected but monitoring efforts will continue in 2023.
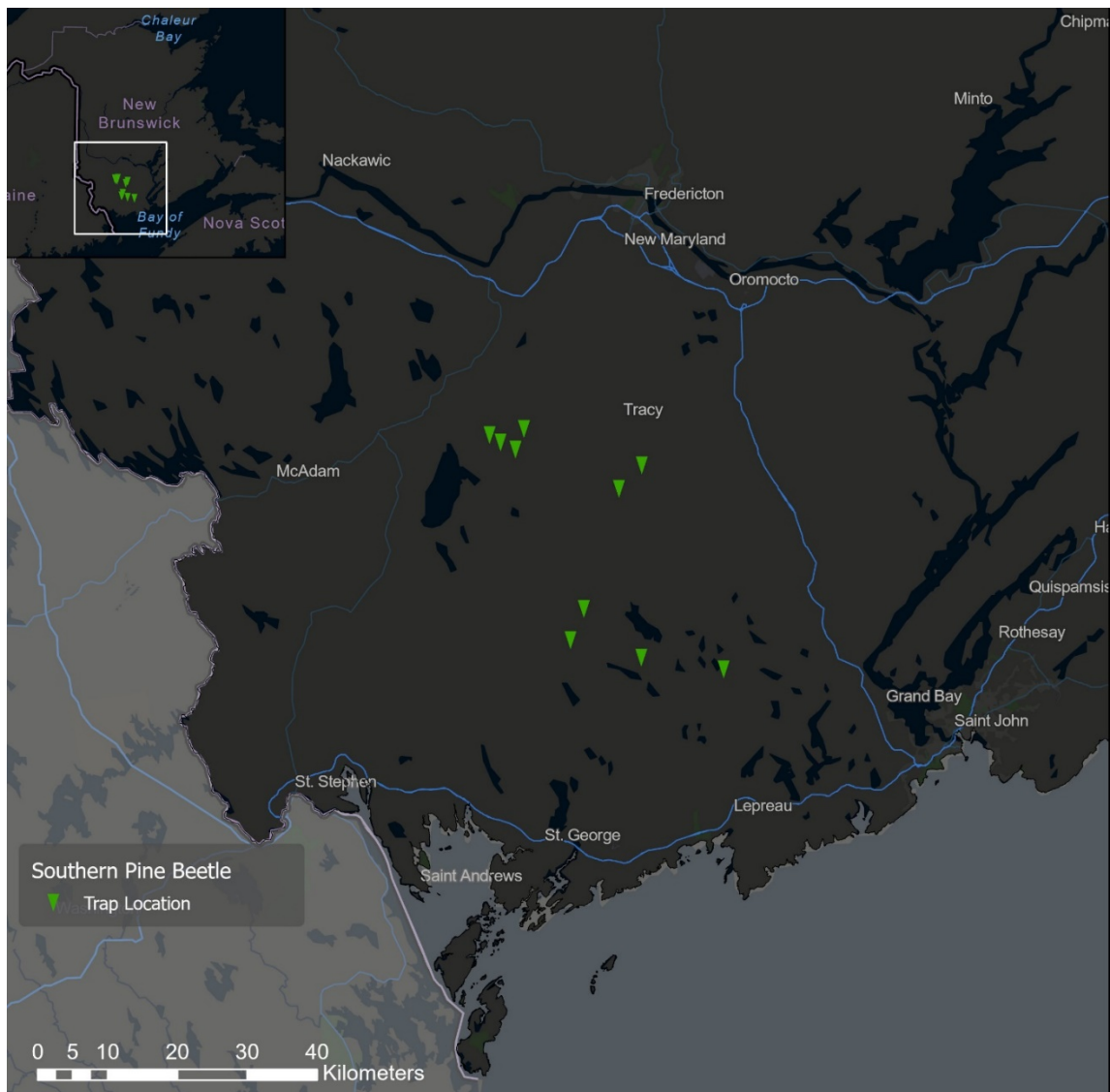

Figure 13. Location of 2022 southern pine beetle pheromone trap locations in New Brunswick.

Forest Disturbance Reporting System

The Forest Disturbance Reporting System (FDRS) is an important monitoring tool used to identify emerging and potential threats to NB's forest resources. It consists of two components - a public reporting website and an internal web-based Departmental reporting system. Summary statistics of reports by region, date, land type, and disturbance types reported are presented.

In 2022, 905 reports were submitted - the majority generated by regional officers with most reports logged between May and September (Fig. 14). Phone calls and e-mail inquiries were not logged through this system.

The majority of reports submitted were from Crown land (73%) followed by private (17%) and industrial freehold (10%) (Fig. 15). Most reports were from softwood stands (51%), followed by mixed-wood (33%), hardwood (15%) and "other" (1%).
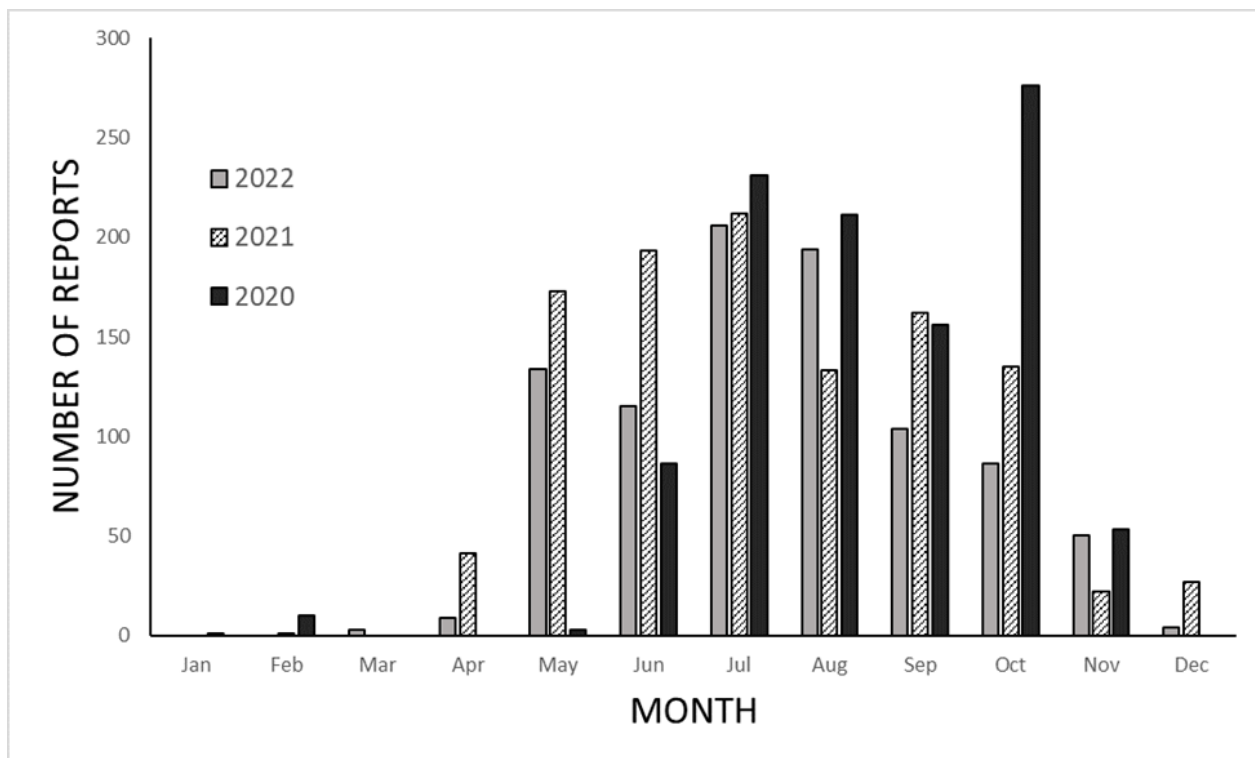

Figure 14. Forest disturbance reporting system reports by month, 2020-2022.
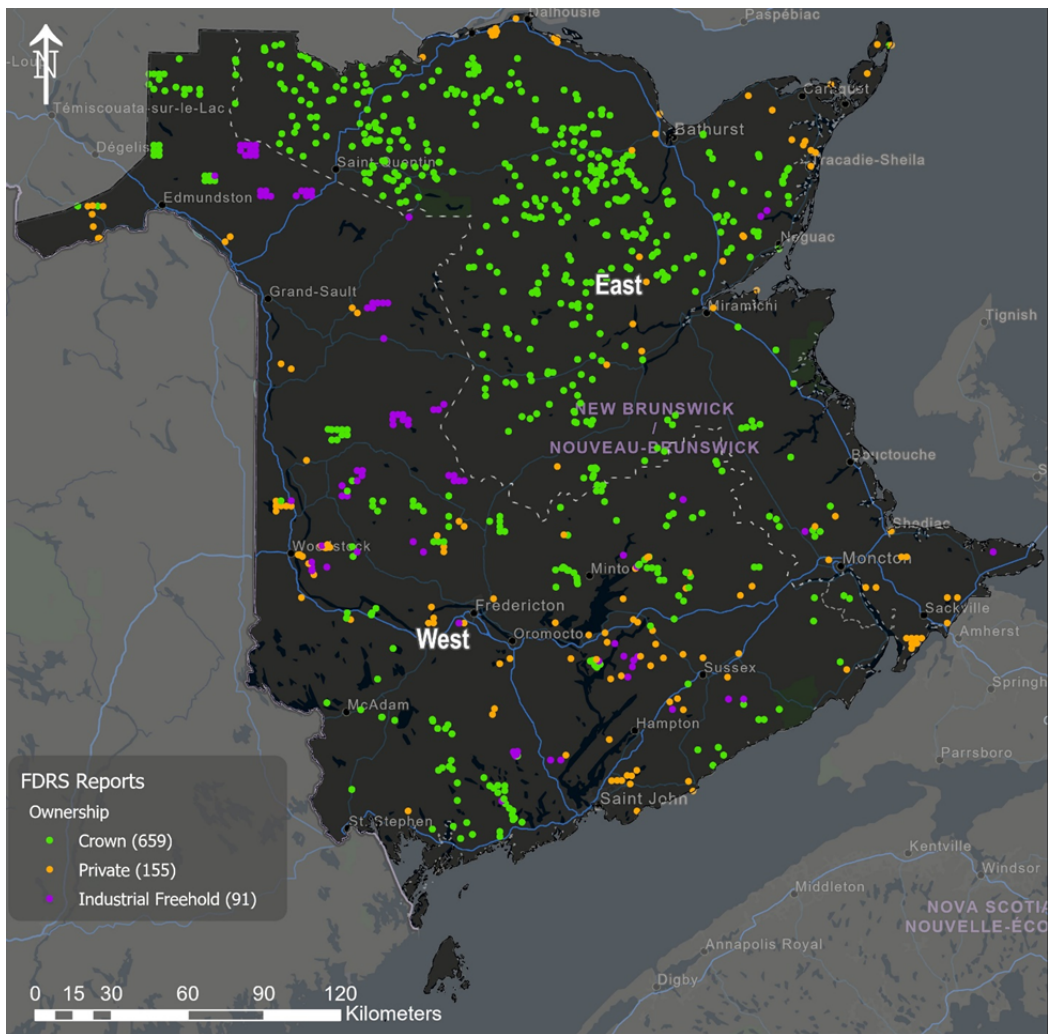
Figure 15. Distribution of 2022 forest disturbance reports (n = 905) observed between November 26, 2021 and November 30, 2022.

Reports were predominantly of healthy stands with no disturbance observed. Staff were instructed to generate a report whenever possible in the course of their duties and not solely if they observed an issue. Reports that did contain pest issues were categorized as: abiotic (e.g., weather related); animal (e.g., herbivore browsing, flooding from beaver activity); disease (e.g., fungal, bacterial or viral); human (e.g., branch tipping, harvesting, mechanical damage); insect and "other" (Table 1).

White pine weevil was the most frequently reported disturbance in 2022. This insect is common within plantations and damaged shoots have a characteristic shepherds crook, making it easily identifiable and a likely reason why it was so frequently noted. Moose or deer browsing was the second most frequent report followed by abiotic damage and disease. None of these reports were exceptional in volume or in area and there are not concerns for significant issues resulting form any FDRS reports logged in 2022.

Table 1. Reports according to disturbance type.

Disturbance Type	Number of Reports
No Damage	756
Insect	43
Animal	32
Abiotic	31
Disease	24
Other – not forest health concern	11
Human	8

Conclusion

Spruce budworm continues to be the predominant insect pest of concern in New Brunswick's forests. However, SBW populations in NB appear to be trending downwards and might be an indication of that the outbreak is subsiding.

Alien pests, such as the emerald ash borer, hemlock woolly adelgid and southern pine beetle will continue to be of significant and growing concern in NB while new, and potentially threatening species, are identified in the Maritimes annually. Continued support of the CFIA in monitoring and public education efforts are anticipated in the coming years.

We would like to thank everyone for their contributions towards protecting the forests of NB from insect and disease pests. We encourage the reader to contact the Department through our online reporting system should the have concerns regarding forest pest species.