Maine Spruce Budworm Task Force

Executive Summary

2023 Update

About this Report

In 2013, leaders of the University of Maine's Cooperative Forestry Research Unit, Maine Forest Service, and Maine Forest Products Council formed a joint Spruce Budworm Task Force with leading experts on the insect and various aspects of Maine's forest resource to address key aspects of an outbreak. The Task Force is broken into seven teams:

- Wood supply & economic impacts
- Monitoring & protection
- Forest management
- Policy, regulation, & funding
- Wildlife habitat
- Public communications & outreach
- Research priorities

The full report published in 2016 describes the complete findings of the original Spruce Budworm Task Force, and is available at www.sprucebudwormmaine.org. The report includes an initial risk assessment for a spruce budworm outbreak and makes recommendations for how Maine's forestry community can begin preparing for and responding to a growing outbreak.

Current Task Force Priorities

In late 2021, each of the seven task force teams were asked to discuss the priorities for action or research generated by the original SBW Task Force convened in 2013, consider accomplishments made since then, and establish current priorities based on that discussion. The groups were asked to consider the original recommendations in the context of an Early Intervention Strategy and encouraged to include new priorities emerging from that discussion. This resulted in an additional emphasis on some priorities from the original effort, as well as some novel recommendations. Our hope is that these priorities will be taken up by members of the teams, within the agencies and companies, or by scientists as potential research questions. Overlap between the priorities of different task teams is a reflection of the mutual dependence of the various elements of a response strategy. Bullet points under priorities emphasize research outcomes or current efforts to address the issue, or concerns that may make it difficult to move forward on the priority.

Spruce budworm larvae on new balsam fir foliage. Photo: N. Thompson, UMFK

Executive Summary

Spruce budworm is a native insect that has reached outbreak levels in Maine's spruce-fir forests at irregular intervals over the past three centuries. An outbreak is an event, often lasting several years, where insect populations escape their natural limiting factors (such as weather, predators, parasites, and pathogens) and reach population levels that damage or kill trees over a wide area.

Spruce budworm larvae damage trees by chewing their needles off, often starting inside the bud as it swells in spring. This feeding process is often deadly to balsam fir and white spruce during an outbreak, and may damage or kill red and black spruce.


Spruce budworm damage. Photo: R. Smith, CFRU

The last outbreak in the 1970s-80s killed trees across more than seven million acres of spruce-fir forests and motivated extensive salvage and pre-salvage clearcutting that contributed to long-term changes to Maine's forest composition, ecology, regulatory structure, and economy.

An ongoing outbreak of spruce budworm in Quebec has affected more than 33.5 million acres since 2006. This outbreak has also affected New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador.

In recent years, traps baited with attractive pheromones in northern Maine have documented increases in local populations and captured moths flying from outbreak centers.

Average Spruce Budworm Pheromone Trap Capture at Long Term Sites 1992-2022
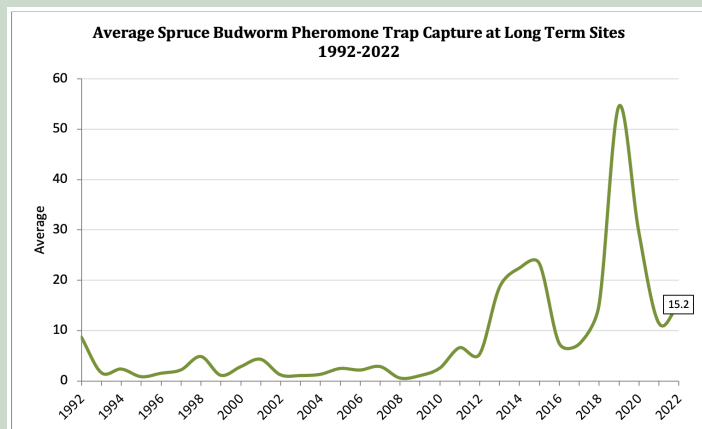
Moth catches from pheromone traps are counted by the Maine Forest Service. Since 1992, baited pheromone traps have been used for monitoring SBW in spruce-fir forests of Maine. Photo: M. Parisio (MFS)

After a concerning population increase in 2013 and natural decline in 2016, two flights of moths from Quebec in July 2019 established populations of high concern to the forestry community and to Christmas tree growers in northern Aroostook County. In 2021, localized defoliation by feeding caterpillars caused damage visible from the air for the first time since the early 1990s. This "hot spot" prompted an Early Intervention Strategy response and has successfully reduced populations.

Early Intervention Strategy

Spray programs in the 1970s-80s Maine outbreak were focused on keeping trees alive by reducing feeding, a practice called foliage protection. The original Task Force report (2016) came from a foliage protection perspective, while mentioning the ongoing development of an Early Intervention Strategy (EIS) in Canada. EIS is a publicly funded program focusing on monitoring, detecting and treating small areas of relatively low but growing populations, also known as "hot spots", of spruce budworm before epidemic levels occur. This strategy also relies on proactive public communications, education, and engagement for broader success, much like the Maine Spruce Budworm Task Force.

Some Maine landowners are following the EIS strategy for the monitoring, detection, and response to spruce budworm populations on the landscape. Many of the updates in this report reflect an approach based on EIS.

Table of Contents

Spruce budworm larvae feeds on white spruce foliage. Photo: N. Thompson, UMFK

A log landing for harvested spruce-fir in Cross Lake, Maine.
Photo: N. Thompson, UMFK

Wood Supply & Economic Impacts

Priority 1: Map the location, condition, and concentration of high-risk stands in Maine's forestlands.

- The Center for Research on Sustainable Forests has been developing the ForEST tool https://forestapp. acg.maine.edu/ which includes risk mapping according to forest types and their vulnerability in a spruce budworm outbreak (Hennigar et al. 2011).

Priority 2: Identify the best approach for wood supply impact monitoring and management response planning during the outbreak.

Priority 3: Track the annual progress of the infestation by monitoring spruce budworm population levels and distribution. Coordinate spruce budworm monitoring efforts with Maine Forest Service, private landowners, and other organizations so that sampling and reporting are done efficiently.

Priority 4: Update and improve spruce budworm management decision support tools such as regional-scale timber supply models and spruce budworm cost calculator to help landowners identify cost-effective and efficient ways to manage their land to mitigate impacts of spruce budworm and maximize management objectives.

Priority 5: Conduct new wood supply and economic impact analysis to assess how spruce budworm risk and management scenarios align with other major statewide objectives such as FOR/Maine timber sector growth and Maine Climate Action Plan.

Monitoring & Protection

Priority 1: Evaluate the feasibility and develop an approach for a coordinated response (prevention, protection, and mitigation) to building spruce budworm levels across the patchwork of ownerships and objectives in vulnerable areas.

Priority 2: Maintain L2 monitoring capacity within the state to allow for responsiveness to building populations.

- The newly constructed Spruce Budworm Lab at the University of Maine has allowed for a faster turnaround of L2 samples, in turn providing more time to strategize an early intervention response for the following spring if needed. However, it is necessary to continue with other strategies for sampling across the at-risk landscape, including conventional and automated pheromone traps, light traps, and defoliation surveys.

Spruce Budworm Lab staff begin processing branch samples for analysis.
Photo: Ron Lisnet, UMaine

Priority 3: With management of building populations becoming a reality, improved understanding and availability of products for licensed professionals to apply treatments/manage spray programs are critical. From a more agricultural side, Christmas tree growers would also benefit from updated information on monitoring and management options.

Concerns:
- Lack of for-hire companies with Maine category 11 (Aerial Pest Control) pesticide license holders and equipment to apply products from the air

has been identified as a potential concern in regards to emerging public health discussions and could similarly limit access to contractors for forest health applications.

- Lists of registered products for treatment can vary on a year-to-year basis. Those needing assistance to determine what is registered can reach out to the board of pesticides control and the Maine Forest Service.
- Anticipated need for product should be communicated to manufacturers by those intending to manage budworm populations ahead of that need to ensure supply.
- Public understanding of the safety, extent, and efficacy of spray programs.

Priority 4: Facilitate two-way communication between monitoring efforts and research needs and outcomes, where refined monitoring efforts (e.g., more frequent automated or manual trap monitoring) can validate hypotheses and models (e.g., the flight model), which may then help refine where and when future monitoring should be intensified.

Automated spruce budworm trap, New Canada, Maine.

Priority 5: Maintaining a public interface for the data for transparency, engagement, and understanding of what is happening with spruce budworm populations. Engage the public in participation in monitoring and reporting of suspected budworm damage and other measures of budworm population.

- Expansion of www.sprucebudwormmaine.org is suggested to address this point.
- Budworm tracker program was a point of engagement for landowners in Maine, but has subsided in this region. Setting up a similar program may be a way to improve public engagement. Other potential avenues for increased public engagement include harnessing birder interest in monitoring and reporting of budworm dependent or associated bird species and providing more information about other natural enemy components of the budworm system.

Forest Management

Priority 1: Continue to track annual progress of the infestation by monitoring spruce budworm population levels and distribution. Coordinate all spruce budworm monitoring efforts with MFS and other organizations so that sampling and reporting can be done efficiently. In particular, spruce budworm L2 monitoring may need to be intensified based on spatial location and ownership size.

Priority 2: Map the location, condition, and concentration of high-risk stands on forestlands. Identifying stands in the Level 1 to 4 (see pg. 39 of SBW Task Force Report for level definitions) conditions should be the highest priority. These maps can be used for risk analysis to determine where reduced growth and tree mortality are most likely to occur.

Foresters & researchers evaluate a stand impacted by the last budworm outbreak.

Priority 3: Continue "budworm proofing" stands through good silvicultural enhancement and management strategies. This may include continued precommercial thinning (PCT) and commercial thinning or pre-salvage harvesting methods.

Priority 4: Re-project and re-assess forest growth & yield using current available forest inventory under contrasting spruce budworm outbreak and forest management scenarios; especially quantifying small landowner risk and potential riparian zone impacts.

- A recent report by MFS examines the effect of a severe spruce budworm outbreak on Maine's spruce-fir resource.

Priority 5: Develop economic assessment decision-support tools for landowners with contrasting forest management strategies.

Policy, regulation, & funding

In the original report the Policy, Regulation and Funding section identified four key areas of concern. The current Task Force team reviewed progress since 2016 and established a new set of priorities.

Priority 1: Maine Spruce Budworm Management Act. In 2015 the act was modified by the unanimous approval of the Legislature in public law , Chapter 314, LD 870. Statute section §8423-C Pre-salvage and Salvage Harvesting outlines rulemaking for determining a credible threat of imminent budworm damage and the forest stand criteria for pre-salvage and salvage harvesting. Previous funding provisions of the original act were repealed to reflect the new reality that future spray project funding would not automatically assume State participation.

- The Maine Forest Service needs to initiate a major substantive rulemaking process for review by the Legislature. This will complete the legislative task of a streamlined approval process for adaptive harvesting and salvage cutting. Field implementation testing should be conducted to achieve appropriate process controls and procedures.

Priority 2: Resource needs for monitoring SBW populations and damage. The Maine Forest Service has a legislated mandate through its Division of Forest Health and Monitoring to protect forest tree resources from significant insect and disease damage. State government resources are constrained but several initiatives have been established:

- The cooperative pheromone monitoring program between the MFS and forest landowners and managers (via the Cooperative Forestry Research Unit) was expanded. A temporary agreement with the USFS allowed for purchase of supplies for a maximum of 450 sites. That has since been reduced to 350 sites due to funding. However, that number appears adequate to capture trends, especially with additional population measurements provided through L2 surveys.
- L2 lab established at the University of Maine in 2020 with funding from the Cooperative Forestry Research Unit.
- Development of an effective and cost-efficient process for mapping and reporting defoliation levels: Risk maps that incorporate L2 and pheromone data are included in the Maine Forest Ecosystem Status and Trends (ForEST) app. ForEST is the culmination of three years of research and software development that was generously supported by the University of Maine Research Reinvestment Fund, the USDA Agricultural Research Service, and the Center for Research on Sustainable Forests.

- We have worked closely with the Quebec and New Brunswick governments and forest industry to learn from and collaborate with their SBW monitoring programs. We continue to work closely with our Atlantic Canada partners through the group Healthy Forest Partnership.
- The most recent legislative budget (FY 2022) approved the MFS request for one additional professional entomologist and one of two requested field technician positions, indicating the state's recognition and concern of increasing forest insect and disease issues.
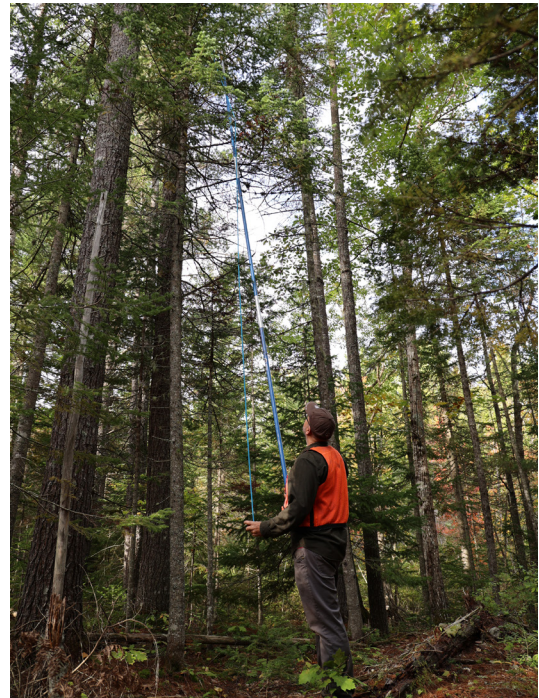
A forester collects a branch sample for the overwintering (L2) stage of spruce budworm. Branch samples are sent to the Spruce Budworm Lab for processing. Photo: R. Smith

Priority 3: Resource and regulatory needs for aerial insecticide program. The growing concern with invasive insect species from neighboring regions contributes to public recognition of the need for insecticide control of invasive as well as native pests (e.g., SBW). Recent legislative policy debates have centered on banning aerial application of glyphosate in forest management, but the need for aerial application of Bt in forest settings does not appear to be in dispute. However, open communication regarding

planned treatments, as exemplified in Atlantic Canada, are recommended to maintain transparency and foster continued support.

- Landowners in Maine agreed to support an independent third-party audit of the 2020 spray operations conducted by the Board of Pesticide Control with no identified concerns.
- A strong educational and communication program will be required to maintain the option for aerial treatments of insecticides.
- Aerial treatments of SBW hotspots have recently occurred in Maine and the landowner community continues to discuss collaborative treatment opportunities. These dialogs should continue and expand.
- Contamination of insecticides with PFAS chemicals found in containers has been a focus of the legislature. This came to our attention in Maine because of an incident in Massachusetts, where insecticides used to treat for encephalitis-carrying mosquitoes were found to have PFAS due to containers they were stored in.
- Manufacturers need to be prepared to certify containers to be PFAS free.
- Maine's general permit from the U.S. EPA continues to be in effect and based on best management practices for forest canopy pesticide treatment.
- Availability of for-hire companies with licensed pesticide applicators with aerial pest control categories and equipment to apply product from the air remains a concern should demand for services increase.

Spruce budworm larvae on the underside of fir foliage on a Christmas tree farm in New Canada, Maine. Photo: R. Smith, CFRU

Wildlife Habitat

Priority 1: Recommend a process for timely and efficient environmental review by state agencies responsible for protecting and managing natural resources of conservation concern (e.g., MDIFW, MNAP, MDEP, MFS), of areas proposed for spray or salvage, and strategies for reducing impacts of mitigation activities in sensitive habitats.

Priority 2: Revise the list of focal areas and species of concern, and develop a classification scheme identifying subject area of concern (e.g., spray vs salvage), level of concern, as well as uncertainty about potential effects and high priority knowledge gaps.

Photo: N. Thompson, UMFK

Priority 3: Compile geospatial data layers identifying sensitive habitats and areas of natural resource concern (e.g., State threatened and endangered species, rare natural communities, ecological reserves) relevant to evaluating potential negative effects of spray or salvage activities. Compare to tree species abundance maps to assess overlap with high vulnerability forest.

Priority 4: Identify species and habitats that could experience benefits from "natural" impacts without intervention (e.g., wood inputs to streams).

Priority 5: Establish monitoring program of treated and untreated sites to better understand ecological impacts of budworm outbreak and mitigation activities.

Public Communications & Outreach

Priority 1: Create a communications infrastructure to keep interested parties updated and educated on the most recent budworm populations, treatments, and emerging science. Resources should be developed (slide deck, presentation, brochures, videos, and other materials) that can be used by anyone for education on spruce budworm, regardless of their background. Use a designated point of contact within each task team to serve as a communications liaison. The public communications & outreach team should strive to distribute messages from the experts in each team to the appropriate channels.

- Sprucebudwormmaine.org was launched shortly after the comprehensive 2016 Maine Spruce Budworm Task Force Report. It is designed to serve as a platform for all who are interested in and would be affected by a spruce budworm outbreak including the public, NGOs, state entities, industry, educators, and those involved in research on SBW.

Visit sprucebudwormmaine.org to keep up with spruce budworm research, news, and to access educational material.

- The Maine Forest Service, Forest Health and Monitoring Division, releases a yearly spruce budworm report on pheromone trap data, light trap data, defoliation surveys, and L2 data provided by the Spruce Budworm Lab.

Priority 2: Produce video shorts and other materials that keep spruce budworm impacts in the public's view.

- CFRU has produced 3 educational video shorts that can be found on their YouTube page. Instructional and educational in nature, these videos aim to help identify budworm larvae in the field, assist individuals collecting L2 samples, and inform interested parties on developing technologies related to budworm, such as the automatic pheromone traps provided to Maine by Natural Resources Canada (NRCAN).
- Media materials have also been produced by NRCAN related to ongoing spruce budworm research, the Early Intervention System (EIS), and citizen scientist efforts to collect budworm data. Simply Science, NRCAN's online magazine, produced a podcast in 2020 titled *Digging Up Dirt on The Spruce Budworm.*

Dr. Tat Smith, Professor and Dean Emeritus (Forestry), University of Toronto, speaks to foresters on a field tour about the impact of spruce budworm in a spruce-fir stand that was last disturbed in the SBW outbreak of 1913. Educating newer generations of forest workers on past budworm outcomes provides a better framework for future responses. Photo: R. Smith

Priority 3: Develop a teaching curriculum around spruce budworm biology, impacts, and future strategies.

- [The curriculum has been developed and is available on the Task Force website.](#) Spruce Budworm Community Outreach Program was developed by Susan Linscott, a teacher at Lee Academy, for the MaineTREE Foundation, and focuses on complex ecosystem interactions and how spruce budworm affects the forest ecosystem in Maine. Preparing for the Next Spruce Budworm Outbreak was developed by Don Sprangers with Maine Project Learning Tree, a teacher at Washington Academy, and focuses on the value of Maine forests, budworm biology, previous outbreak responses, and future outbreak strategic planning. We are continuing to communicate with MaineTREE on applicable forest health lessons and education efforts.

Priority 4: Engage with traditional media through press releases and story leads. (BDN, PPH, local TV news). Keeping the public informed with clear, consistent, scientifically sound messaging is key to successfully implementing an early intervention strategy where spruce budworm populations merit treatment. The Spruce Budworm Task Force should strive to be transparent with all aspects of how an outbreak could affect the forest industry, environmental groups, recreation & tourism, and more. Media sources ought to be contacted as often as necessary to keep the public informed of the spruce budworm situation in Maine.

- In the fall of 2021, [The University of Maine reported](#) on the newly funded Spruce Budworm Laboratory.
- In the fall of 2021, Bangor Daily News ran the story *["One of Maine's most destructive pests is making a comeback".](#)*
- In March of 2022, Bangor Daily news reported on *["A Voracious Insect is Coming Back, but WWII Planes Won't Be Needed to Fight it This Time"](#)*

Priority 5: Develop a "brand" for the spruce budworm strategy.

- The Spruce Budworm Task Force is composed of multiple entities including the [Cooperative Forestry Research Unit (CFRU/UMaine)](#), [Center for Research on Sustainable Forests (CRSF/UMaine),](#) [Maine Forest Service,](#) [Maine Forest Products Council,](#) and [MaineTREE Foundation.](#) Our brand is a cooperative volunteer effort that depends on consistent engagement from all parties. Efforts should be made by all task teams to contribute to a seamless brand and effective messaging strategy. Each task team should designate a liaison to report their team's progress and news to the public communications & outreach team for dissemination to the spruce budworm task force website or relevant news outlets.

Research Priorities

Since the full spruce budworm task force report was released in 2016, a number of research objectives have been achieved. Advances include research in remote sensing of spruce-fir distribution and disturbances, carbon stocks before and after a spruce budworm outbreak, EIS, and more. [NEFIS, North East Forest Information Source,](#) and [UMaine's Digital Commons](#) provide accessible historical and up-to-date publications regarding spruce budworm research. This section includes refinement recommendations for current research areas as well as novel topics.

Priority 1: For effective defoliation mapping and risk assessment, continue efforts to create fine resolution maps of species composition and age classes. Combination of drone and satellite technologies allows fine-scale work with drones to inform landscape-scale analyses using satellite data.

Priority 2: Investigate how climate change might affect future spruce budworm outbreak occurrence, severity, and spread, as well as the impact on forest stands.

- What, if any, climate variables are affecting spruce-fir and spruce budworm? Can we predict starvation on the basis of degree days or other variables?

Priority 3: Establish BMPs for determining the presence of and avoiding non-target Lepidoptera species in areas to be treated with insecticides.

Priority 4: Develop short-range dispersal models that can predict when and where local moths adults are flying.

Priority 5: Re-evaluate the increased susceptibility of defoliation on black spruce in the face of a warming climate. Once protected by it's late budding phenology, [recent research](#) suggests higher temperature regimes will lead to budburst of black spruce becoming more synchronized with budworm's winter emergence.

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