



Spruce Budworm in Maine

2022 Summary Report

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www.sprucebudwormmaine.org and www.maine.gov/foresthealth

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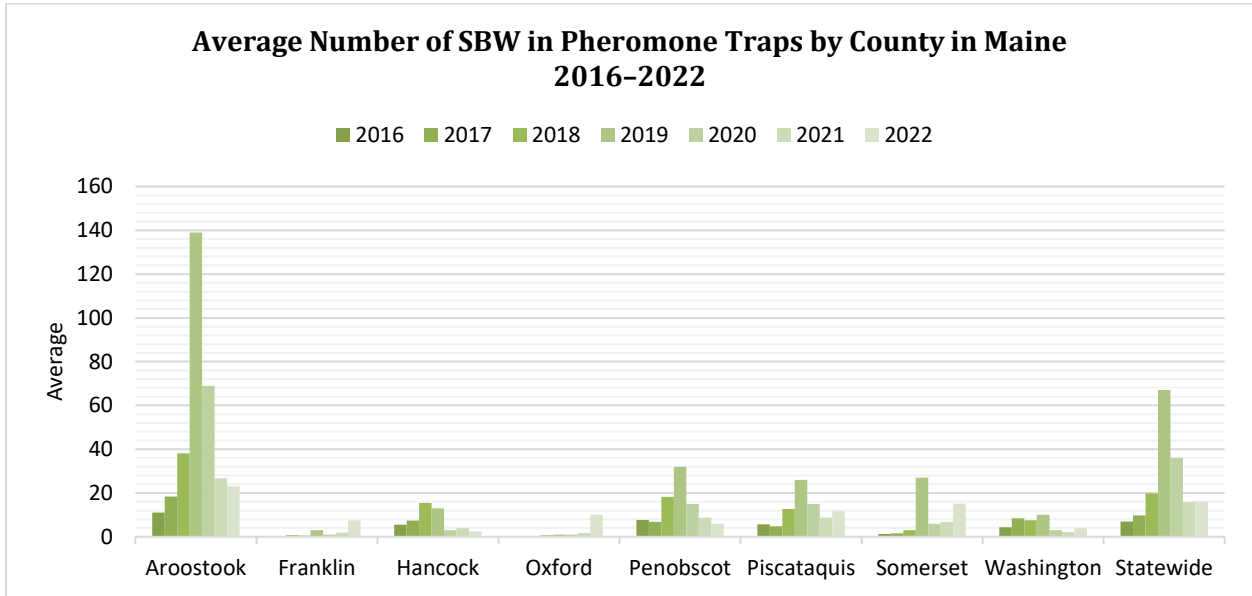
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Introduction to Spruce Budworm in Maine

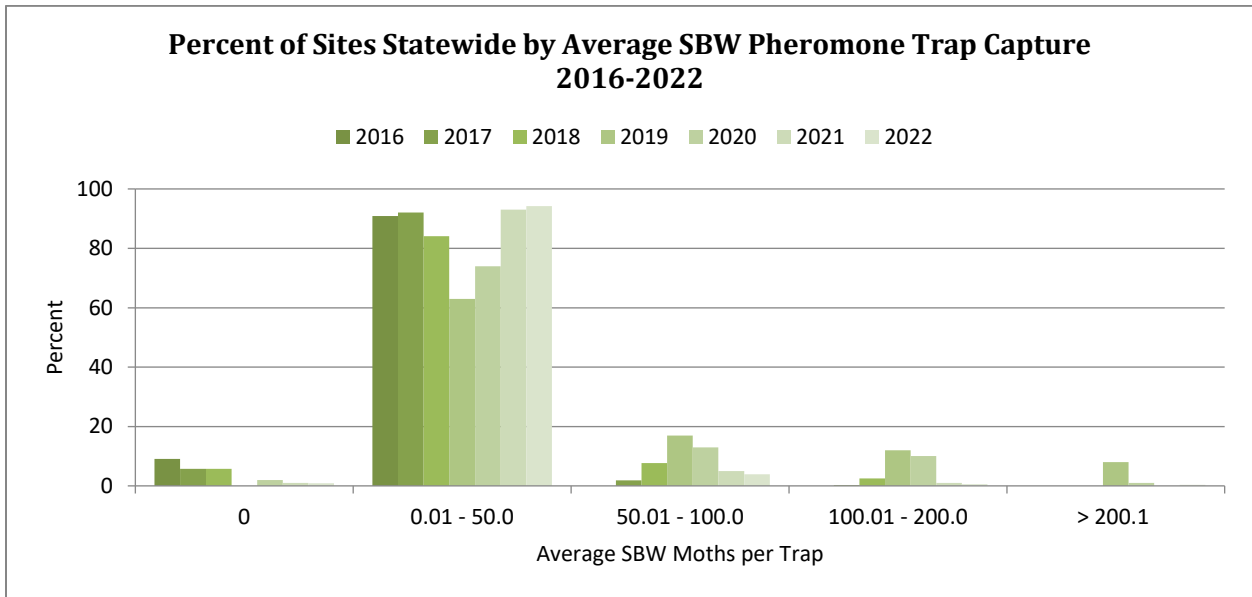
Spruce Budworm (SBW) is a native insect whose outbreaks cover vast regions and spread through massive dispersal flights as moths migrate from heavily impacted areas to new ones. In northeastern North America, SBW outbreaks tend to return on a 30-60 year interval and the last major SBW outbreak to directly affect Maine occurred during the 1970s-80s. Historic data tell us that Maine is due for another SBW outbreak. Monitoring efforts illustrate that over roughly the last decade, SBW population levels appear to have left the endemic or “stable” phase experienced between outbreak events. During this period, pheromone trap and light trap catches have sometimes been well above the numbers expected during the endemic phase. Millions of acres of defoliation in neighboring Canadian provinces continue to encroach on the Maine border. Large in-flights of moths from outbreak areas in Canada into northern Maine were well-documented in 2019. The potential impacts of these migration events on Maine’s forests are still unfolding.

Statewide Spruce Budworm Pheromone Trapping Network (2016 - 2022)

The Maine Forest Service Division of Forest Health and Monitoring coordinates a network of roughly 350 SBW monitoring sites using pheromone lures (Distributions Solida Inc.) in spruce-fir forests across Maine. In 2019, pheromone trap captures peaked at an average of 67 moths per trap following a mass migration event from Canadian SBW outbreak areas. In the years following, the statewide average decreased to 36 in 2020 and 16 in 2021. The statewide average remained at 16 moths per trap in 2022.



Following a peak in 2019, statewide average SBW capture has fallen or remained stable for three seasons. Much of this statewide trend is driven by trap capture in Aroostook County, which has fallen for three consecutive years. Several other counties have decreased, while some continue to fluctuate.



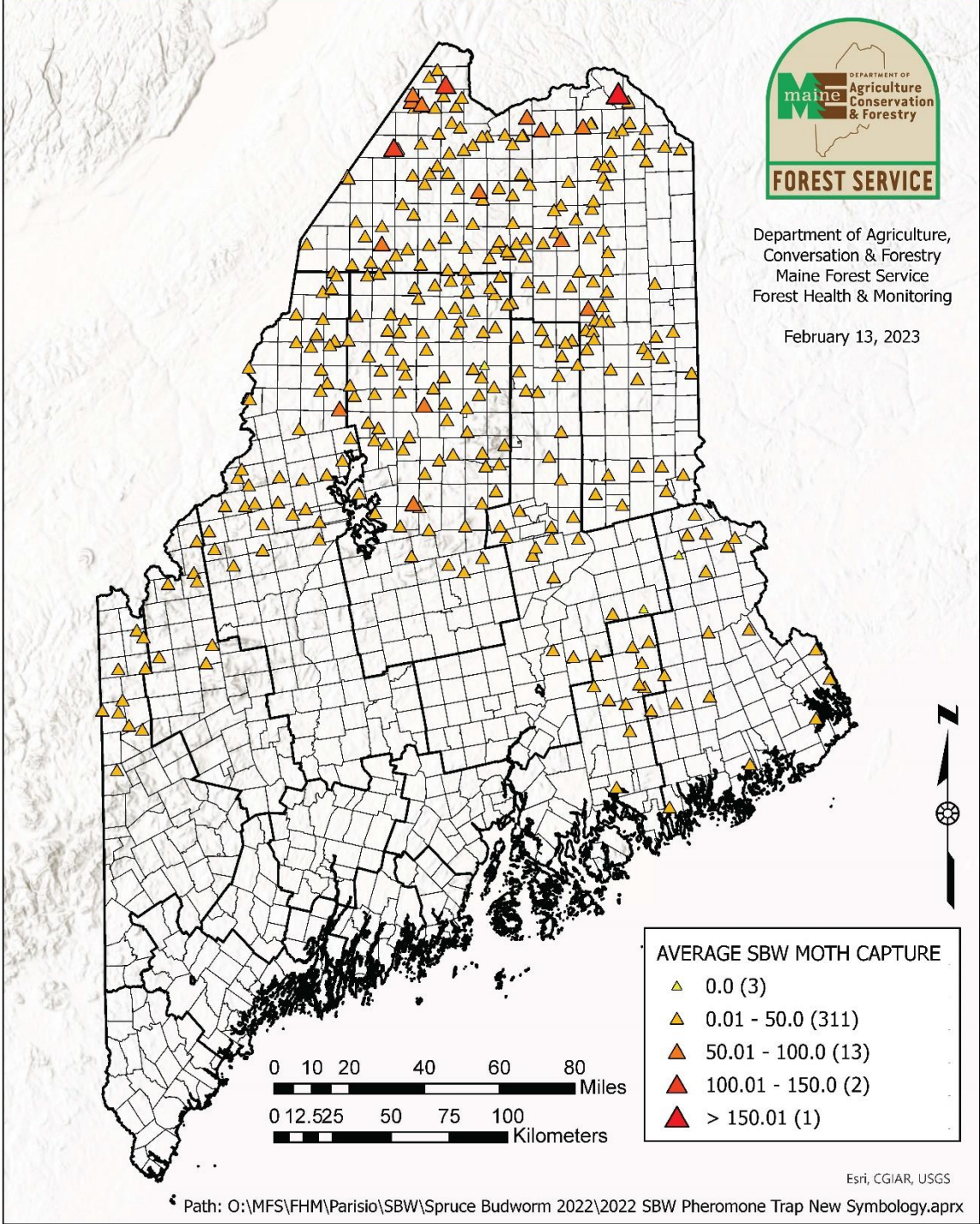
The proportion of sites capturing large numbers of moths has decreased substantially since 2019, with a clear peak in those sites averaging more than 200 moths per trap. Most sites in 2022 averaged fewer than 50 moths per trap.

2022 Spruce Budworm Pheromone Trapping Network Results



Department of Agriculture,
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Forest Health & Monitoring

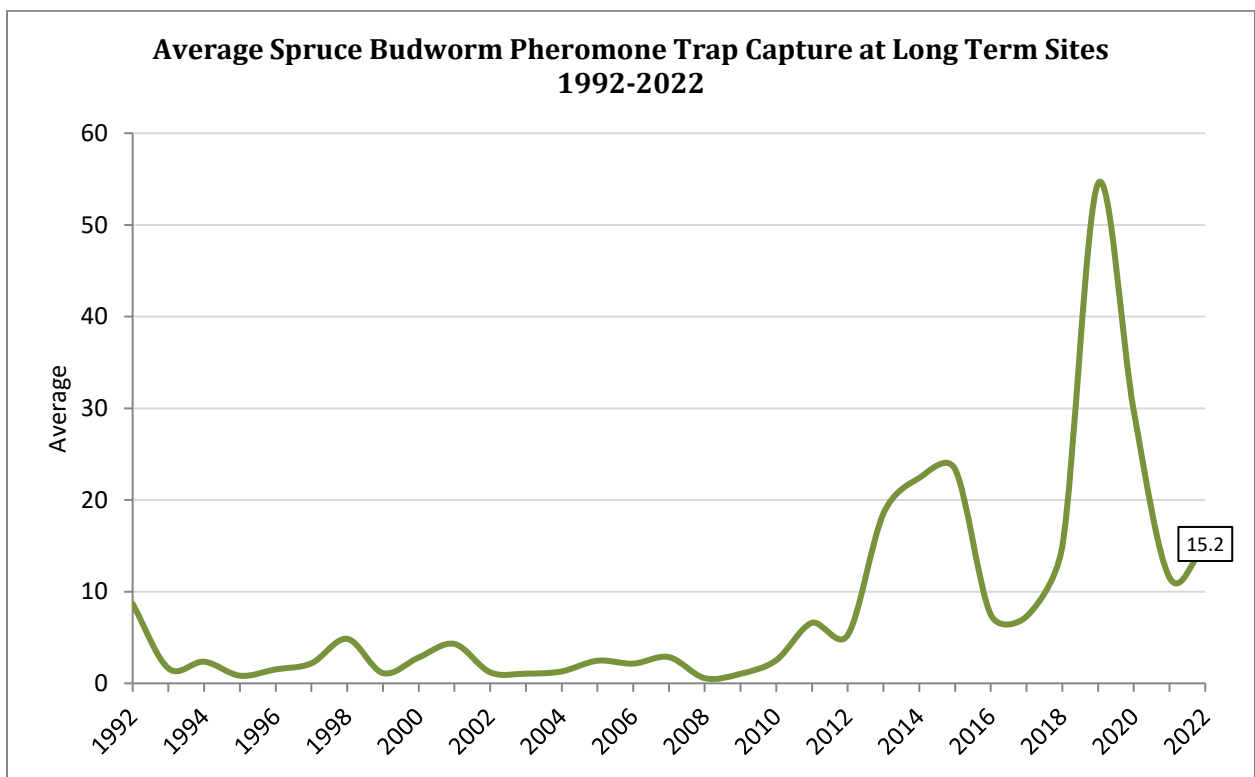
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Statewide pheromone trap captures were mostly low in 2022, with elevated numbers evident at just a few locations in northern Aroostook County that have consistently shown greater SBW activity. The site in Madawaska that captured the most SBW in 2021 also captured the most SBW in 2022, increasing from an average of 174 to 221.

Spruce Budworm Long-term Pheromone Trap Monitoring Sites (1992 - 2022)

A subset of long-term pheromone trap sites has been monitored since 1992 and revealed the first significant increase in SBW populations since the last major SBW outbreak in Maine during the 1970s and 1980s. From 1992 to 2012, the average number of SBW captured was below 10. This average rose to 18 in 2013, 22 in 2014, and 23 in 2015, resulting in the expansion of the pheromone trap network to its current size. Average capture fell to seven moths per trap in 2016 and 2017, then rose to 15 in 2018. In 2019, the average capture rose dramatically to 55, again influenced by the mass migration events from Canada. The average capture fell again to 30 in 2020 and 12 in 2021, followed by a slight increase to 15 in 2022. Samples from several long-term sites in Washington County that traditionally return low numbers of moths could not be used this season. The long-term site average might be artificially higher with these sites absent in the 2022 data.



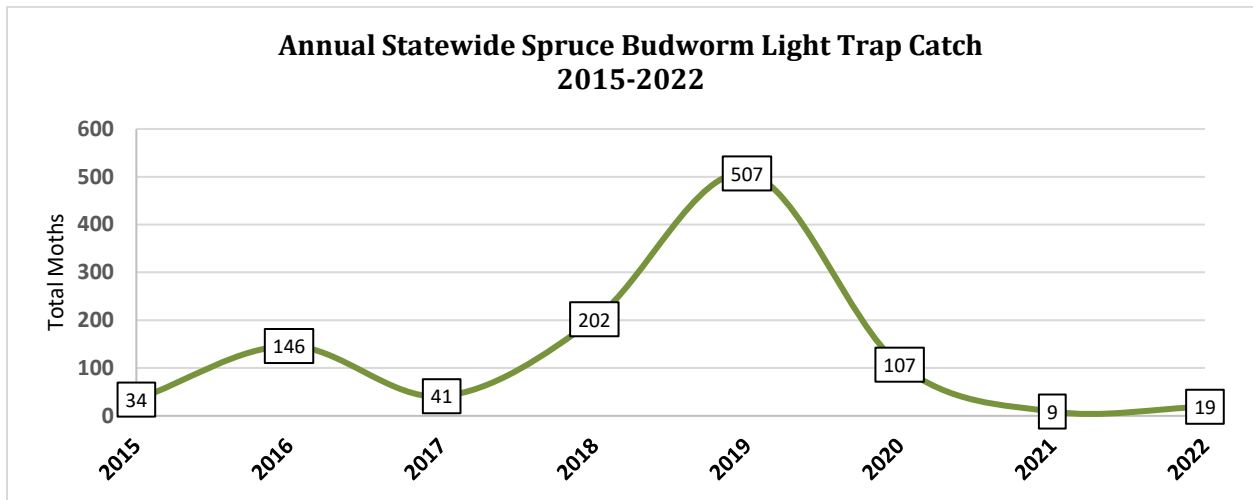
Despite a slight increase in 2022, average trap captures at Maine’s long-term pheromone monitoring sites remain substantially lower than 2019 levels.

Automated Pheromone Traps in Aroostook County (2021 - 2022)

Since 2021, Maine has operated two automated pheromone traps in cooperation with Natural Resources Canada as part of a network throughout Quebec and the maritime provinces. These traps provide daily information on flight phenology and are located in Aroostook County in New Canada and Stockholm. In 2021, the first flights of SBW recorded by these traps were on the night of June 21 and the morning of June 22. The New Canada trap documented the first moth flight of the 2022 season on the night of June 28. Due to a malfunction, the Stockholm trap did not provide any data in 2022.

Spruce Budworm in Maine's Light Trapping Network (2015 - 2022)

Light trapping has been used in Maine since the 1940s to monitor forest defoliators and remains a valuable tool for monitoring SBW moths. Like the pheromone trapping network, the light trap network saw a dramatic increase in moth catch in 2019, with 507 SBW moths captured statewide. This was immediately followed by a substantial decrease in capture to 107 moths in 2020 and again in 2021, with just nine moths recorded statewide. Statewide light captures rose slightly in 2022 to 19 moths. All 19 moths recovered in light traps in 2022 came from three sites: Estcourt Station, Millinocket, and Rangeley.



Although there was a slight increase in SBW moths recovered in light traps in 2022 versus 2021, the overall number remains relatively low compared to 2018 through 2020.

Overwintering Larval Monitoring – Statewide Sampling Sites (2019 - 2021)

Spruce budworm overwinters as larvae, and branch samples collected from spruce-fir forests across Maine are now analyzed for the presence of overwintering SBW larvae at the University of Maine Spruce Budworm Lab, funded by the University of Maine Cooperative Forestry Research Unit and the USDA Forest Service. An average of seven larvae per branch is the recommended management threshold set forth by the SBW Early Intervention Strategy (EIS) guidelines employed in Atlantic Canada (<https://healthyforestpartnership.ca/what-we-do/targeting-and-treating/>). Sites exceeding the threshold are identified as potential hot spots and may undergo additional sampling.

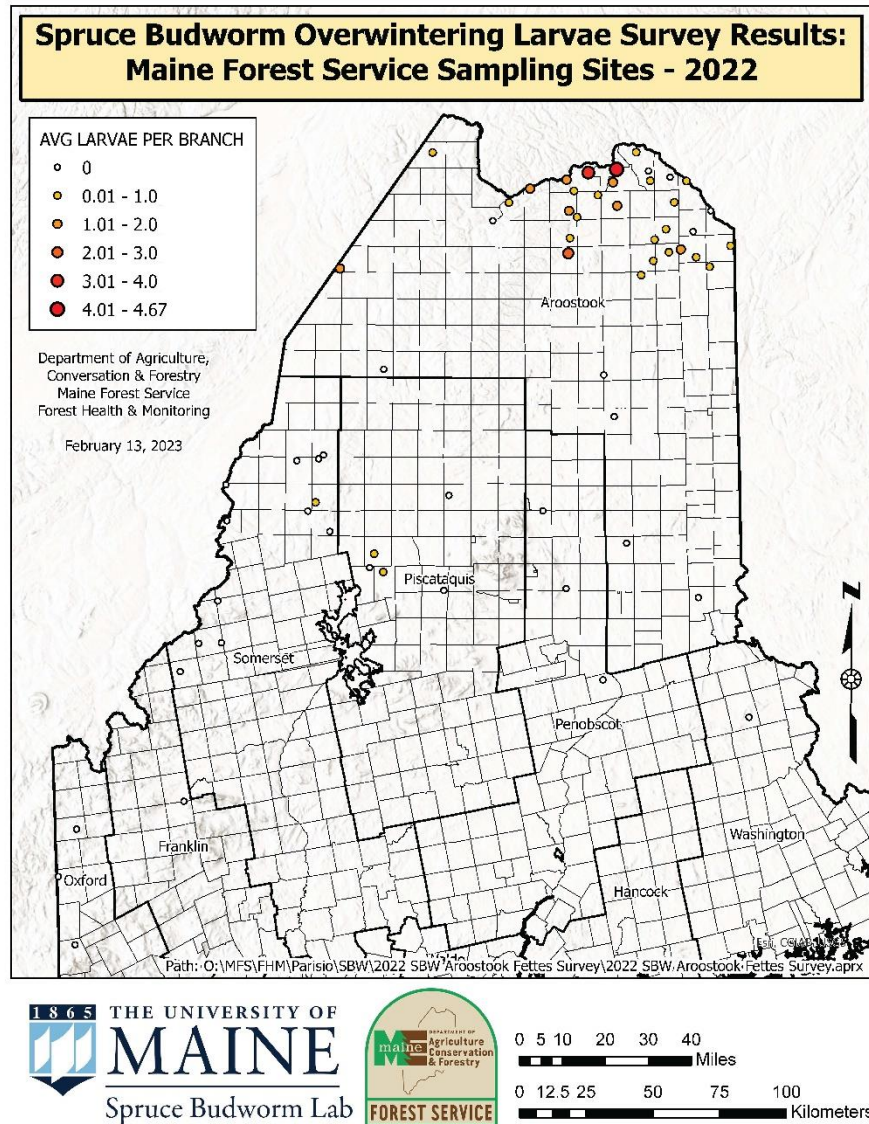
Following the events of 2019, the statewide overwintering larval survey recovered an increased number of larvae, with 309 larvae collected from 328 sites statewide in 2020 versus 70 larvae recovered from 317 locations statewide in 2019. The larvae collected in 2020 were distributed among 99 sampling sites versus just 29 sites in 2019, indicating a more widespread distribution than the season before. In 2020, a single location in Cross Lake Township exceeded the EIS threshold with 7.66 larvae per branch. Samples were analyzed from 292 sites in 2021, indicating two sites achieved an average greater than seven larvae per branch. Following treatment in 2020, the Cross Lake Township site had a reduced average of 0.67 larvae per branch when resampled in 2021.

Both hot spots revealed during the 2021 overwintering larval survey were in Aroostook County. One was located on the border of T17 R13 WELS and T17 R14 WELS, and the second was located near the shared corner of the four towns of Sinclair Twp, Van Buren Cove Twp, Madawaska Lake Twp, and Stockholm. These hot spots received aerial treatments in 2022, described in the EIS section below.

Overwintering Larval Monitoring – Maine Forest Service Sampling Sites (2021 - 2022)

The Maine Forest Service submits branch samples from multiple ownerships each year. Samples were submitted from 46 sites in 2021, averaging 0.5 larvae per branch with a maximum of 4.3 larvae per branch. Samples were submitted from 65 locations in 2022, again averaging 0.5 larvae per branch and with a maximum of 4.7 larvae per branch. The University of Maine Spruce Budworm Lab provided the results featured on the map below.

Results from other cooperators in the 2022 statewide overwintering larval survey are currently being compiled and will be available from the University of Maine Spruce Budworm Lab.



Overwintering larval levels were comparable at sites monitored by the Maine Forest Service in 2021 and 2022, with a slight increase in the maximum average number of larvae recovered at any one site from 4.33 to 4.67. No Maine Forest Service sampled sites reached a recommended management threshold of an average of seven larvae per branch.

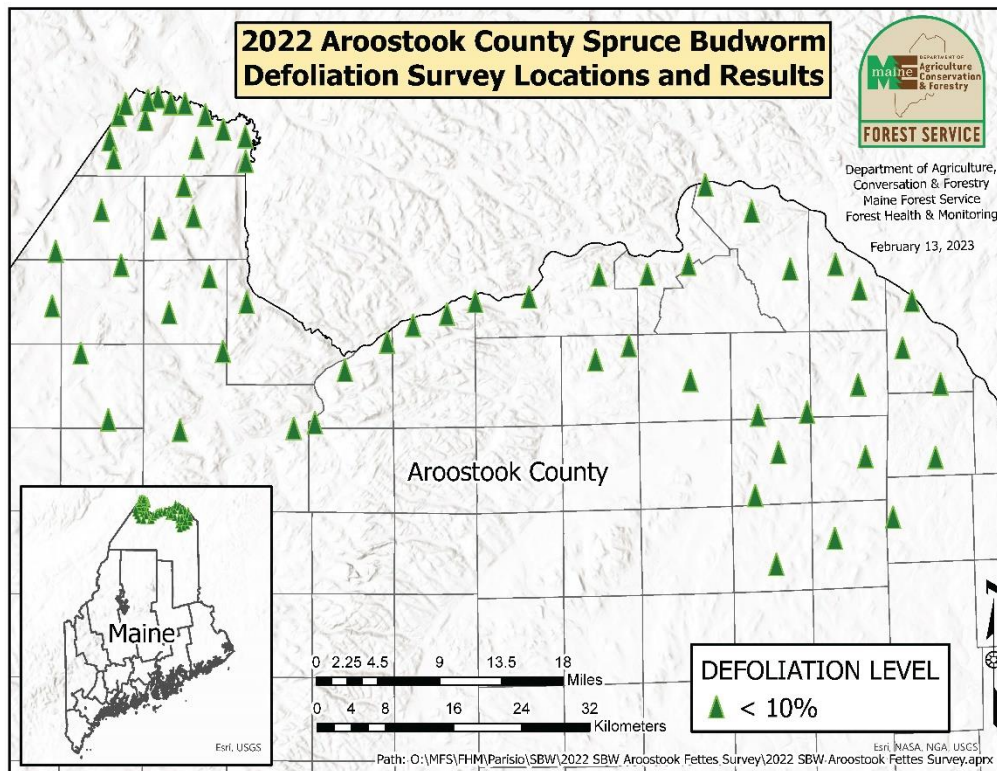
Early Intervention Strategy (EIS) Treatments in Maine (2021 - 2022)

In 2020, the overwintering larval survey indicated a single site in Cross Lake that exceeded the recommended management threshold of seven larvae per branch set forth by the SBW Early Intervention Strategy (EIS) guidelines being employed in Atlantic Canada (<https://healthyforestpartnership.ca/what-we-do/targeting-and-treating/>). A supplemental survey in surrounding areas led to the development of a roughly 5,000 acres spray block that a private landowner treated with an aerial application of Foray 76B (a formulation of *Bacillus thuringiensis kurstaki*). This was the first aerial treatment of SBW in Maine since the last major outbreak of the 1970s and 1980s.

Results of the 2021 overwintering larval survey identified two locations that exceeded the seven larvae per branch management threshold, resulting in the treatment of roughly 2,000 acres in 2022. One spray block was located on the border of T17 R13 WELS and T17 R14 WELS and comprised roughly 500 acres. A second larger spray block comprised roughly 1,500 acres and included portions of Sinclair Twp, Van Buren Cove Twp, Madawaska Lake Twp, and Stockholm. A private landowner treated both spray blocks with aerial applications of Foray 76B.

Aroostook County Ground Defoliation Survey (2020 - 2022)

Ground surveys using the Fettes Method for SBW defoliation have been conducted at 60 sites in Aroostook County since 2020. Compared to 2021, defoliation levels decreased at 43 of 60 sites, with an average decrease of 4.26 percent. At the 17 sites where defoliation increased, the average increase was 0.5 percent.



Spruce budworm defoliation observed during a ground survey at 60 Maine Forest Service sites in northern Aroostook County was minimal in 2022, with all 60 sites remaining below ten percent defoliation. In 2020 and 2021, many sites scored above ten percent, and one site scored greater than 30 percent defoliation in both years.

Statewide Defoliation Survey (2022)

Before being analyzed for overwintering larvae, all branch samples collected undergo defoliation assessment by University of Maine Spruce Budworm Lab staff to document missing needles from current-year growth. The 2022 statewide defoliation survey results are being compiled and will be available from the University of Maine Spruce Budworm Lab.

Aerial Defoliation Survey (2021 - 2022)

The Maine Forest Service performs an annual aerial survey for insect and disease issues affecting Maine's forests. 2021 marked the first time light SBW defoliation was visible during our annual aerial survey effort, and roughly 850 acres of damage were mapped. This low level of defoliation did not progress in 2022, and defoliation was not visible in 2022 in those areas mapped in 2021. No new areas of SBW damage were mapped anywhere in the state in 2022.

Remarks

Despite the recent downward trend in local Maine SBW populations and activity reflected in our monitoring program, we cannot conclude that SBW populations have returned to and will remain at endemic levels in the upcoming years. As historical knowledge tells us and as evidenced in our more recent long-term dataset going back to 1992, populations are likely to continue to fluctuate. For that reason, we will continue to carefully monitor the situation and provide timely updates to our stakeholders.

Acknowledgments

The Maine Forest Service extends heartfelt thanks to our large team of statewide cooperators and the hard work of all field staff on the ground that make this monitoring program possible. We also gratefully acknowledge the highly technical work done by the University of Maine Spruce Budworm Lab, and the funding for the lab provided by the University of Maine Cooperative Forestry Research Unit and the USDA Forest Service.

Spruce Budworm Monitoring Program Cooperators

American Forest Management

Appalachian Mountain Club

Baskahegan Company

Baxter State Park

Forest Society of Maine

Hilton Timberlands, LLC

Houlton Band of Maliseet Indians

J.M. Huber Corporation

J. D. Irving Ltd.

Katahdin Forest Management, LLC

LandVest

Maine Bureau of Parks and Lands

Maine Forest Service

Passamaquoddy Tribal Forestry Department

Penobscot Indian Nation

Prentiss & Carlisle

Rangeley Lakes Heritage Trust

Seven Islands Land Company

The Nature Conservancy

USDA Forest Service

Wagner Forest Management, Ltd.

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