Spruce Budworm in Maine 2018

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The Maine Forest Service (MFS) and its cooperators are closely watching spruce budworm in Maine to monitor and prepare for another epidemic of this native defoliator. Over the last several years, Spruce budworm populations in Maine have left the "stable" phase and appear to be building. Pheromone and light trap catches have been up above zero for a number of years, defoliation in Quebec has increased year after year, defoliation has been mapped in New Brunswick. This is an insect whose epidemics cover vast regions and flights of moths from heavily infested areas can migrate to new areas. That there will be another outbreak in Maine, soon, is undeniable. When, where, how severe, and what the specific impacts and reactions may be remain to be seen.

The Maine Forest Service, cooperators within and outside the state, and Canadian provinces are working together to monitor and predict the growth of the spruce budworm population and its potential impact on the region's forests. Monitoring takes place using pheromone traps, light traps, overwintering larval samples and ground and aerial surveys.

The most sensitive method of monitoring budworm is pheromone traps. Permanent pheromone trap locations were established in the early 1990's across the northern half of the State and have been run yearly for the past twenty years. In the past, that network had run about 80 sites set up by the Maine Forest Service, J.D. Irving Ltd, Penobscot Nation Department of Natural Resources and the USDA Forest Service. Since 2014, the pheromone trap monitoring program has been significantly expanded, with more than twenty land owners and managers participating in setting and retrieving traps at more than 400 sites (Figure 1).

Spruce budworm pheromone survey cooperators 2018

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 Public 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.
Weyerhaeuser

Cooperators were asked to place traps approximately one per township or every six miles in stands that were 25 acres or larger and at least 50% pole-sized or larger spruce/fir. These could be mature or pole sized stands, uncut or lightly cut spruce-fir dominated and could be pre-commercially thinned or shelterwood stands. Cooperators chose the sites based on where they had monitored in the past, with new sites established due to previous or planned management, change in access or other reasons.

The trapping method follows standardized protocol used by both Canadians and Americans since 1986. http://phero.net/iobc/montpellier/sanders.html.

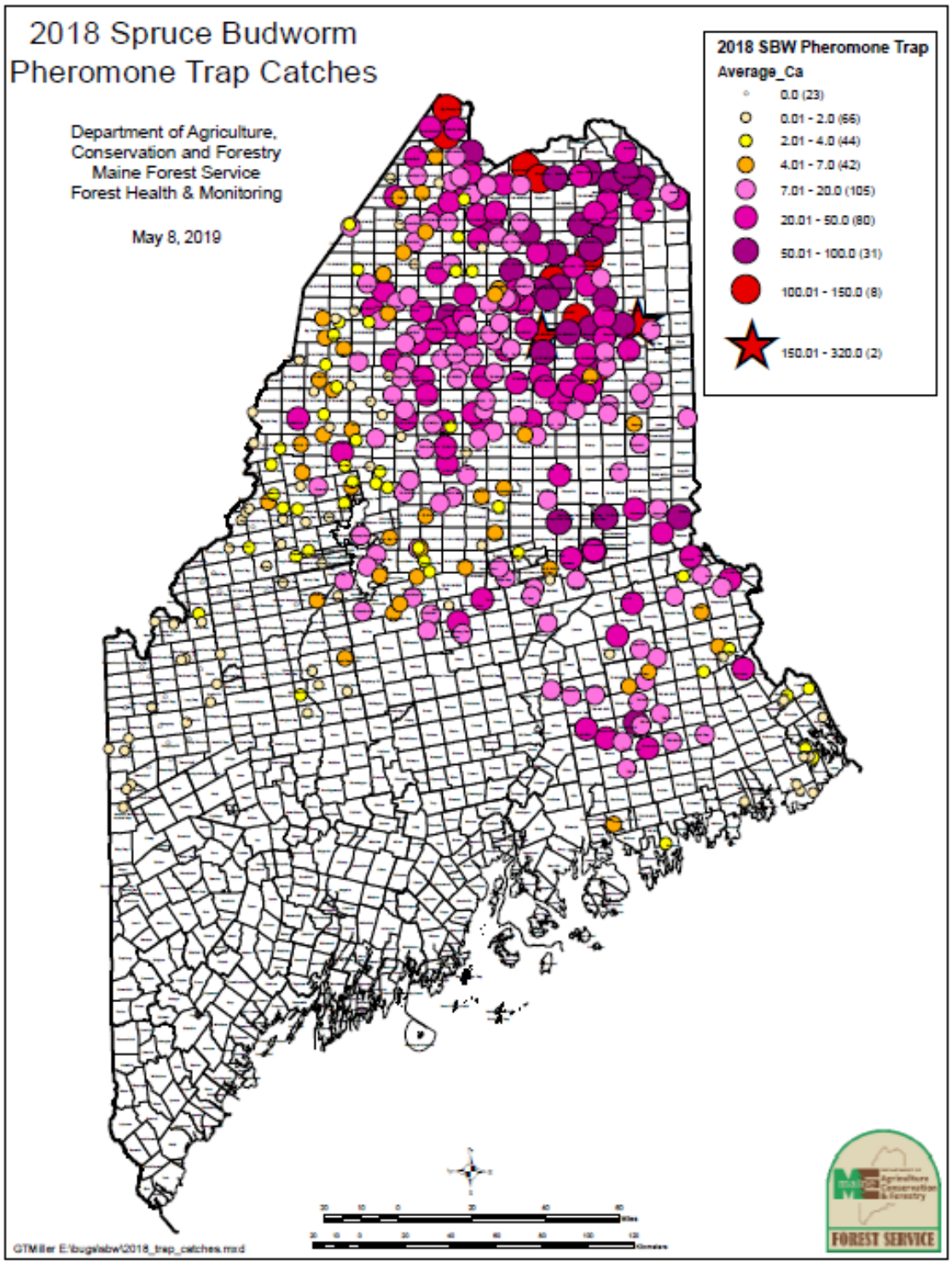


Figure 1. 2018 distribution of spruce budworm pheromone traps and trap catches across Maine.

Each site had a three-trap cluster with traps arranged in a triangle with approximately 130 feet between traps. Instructions were to place traps away from the road and at an average elevation for the area. Cooperators were asked to deploy traps during the first three weeks of June and retrieve them after mid-August. Joe Bither, our technician in Stockholm, managed the logistics of getting supplies to and samples from cooperators this year. The catch was processed by division technicians from across the state in Stockholm, Old Town and Augusta.

The traps used were high capacity re-usable Multipher traps capable of monitoring spruce budworm moth populations over a wide range of densities. Using the lure provided, catches will range from 0–20 at low population densities to over l000 at high densities. The SBW lure was made by ISCA Technologies and distributed by Solida. This is a change from 2014-2017 when the lure was manufactured by Synergy. The change was made to align with the product used by Quebec and New Brunswick. The insecticide used in the traps is a 1" x 4" strip (10% DDVP) brand Vaportape II.

The expanded spruce budworm pheromone survey shows spruce budworm is widespread but still at low numbers across the trapping range (Figure 1 and Figure 2). Trapping effort was heaviest in the northern third of the state, light across the middle of the state, with no trapping in the south where budworm is not expected to have a direct impact (Figure 1). Average county-wide catches in 2018 were at least double in Aroostook, Hancock, Penobscot

and Piscataquis Counties and as a whole vs. 2017. They approached values last seen in 2015. Captures were relatively stable in Franklin, Oxford, Somerset and Washington Counties. As in previous years, the majority of sites (84 percent) captured trace to 50 moths/trap (Figure 3). About two percent of the sites (10) had a per trap average of more than 100 moths.

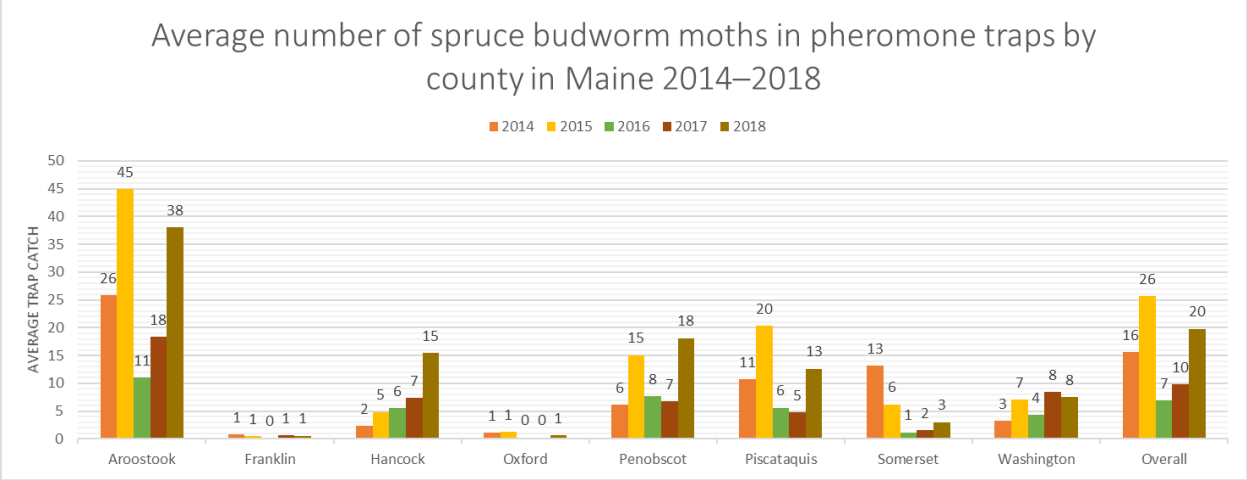


Figure 2. Average number of spruce budworm moths in pheromone traps by county in Maine 2014–2018.

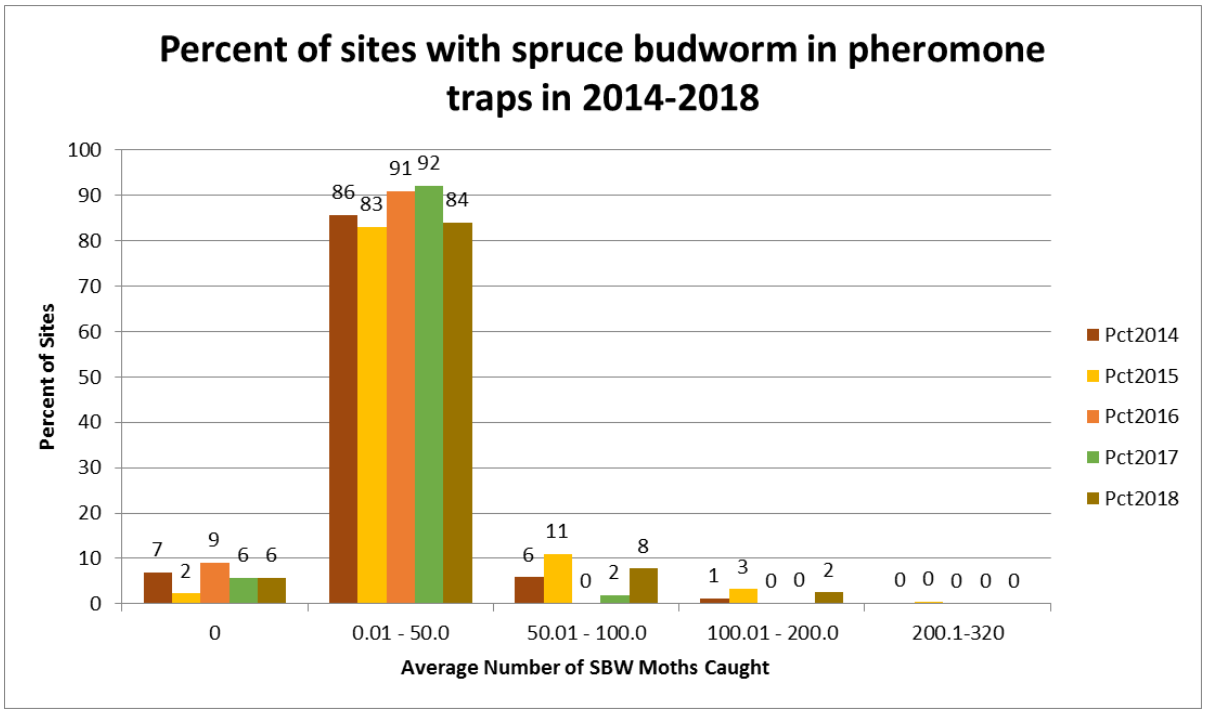


Figure 3. Percent of sites with spruce budworm in pheromone traps by catch 2014–2018.

As noted earlier, the Maine Forest Service has monitored collections at a set of longer term pheromone trap sites for the past 25 years. During that time, the average number of moths/trap stayed well below 10 until 2013 when the number jumped to 18 (Figure 4). In 2014 and 2015 it was above 20 moths/trap. In 2016, average catches declined to seven moths/trap, where they stayed in 2017. 2018 saw a return to double digit averages across these long term sites, with a rise to 15 moths per trap.

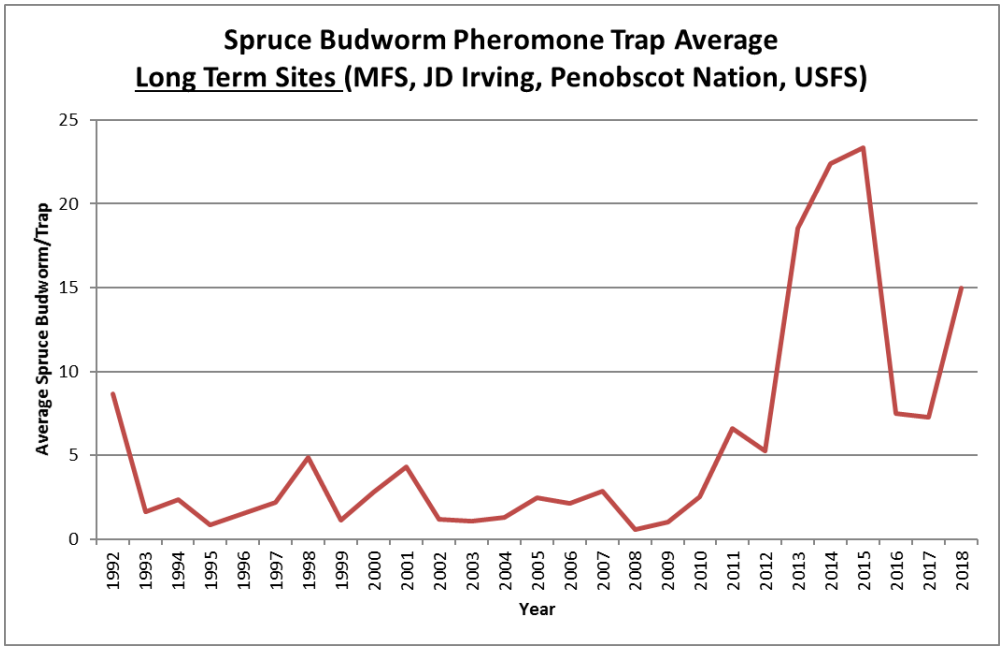


Figure 4. Spruce budworm pheromone trap average catch long term sites only (Maine Forest Service, J.D. Irving Ltd., Penobscot Nation DNR, USDA Forest Service).

Light traps have been used in Maine for more than seven decades to monitor spruce budworm populations and other forest defoliators and continue to be used today. In 2018, 21 traps were run by Maine residents in their backyards. Budworm moth counts from light traps were up, however 2 new sites were added in Northern Maine (Figure 5). Twelve sites in the network caught a total of 202 spruce budworm moths (

Table **1**). In the 10 years before 2013 there were fewer than 10 spruce budworm moths caught in all the light traps combined. Therefore, the past years are a significant increase. At such low numbers, apparently wide fluctuations are not surprising.

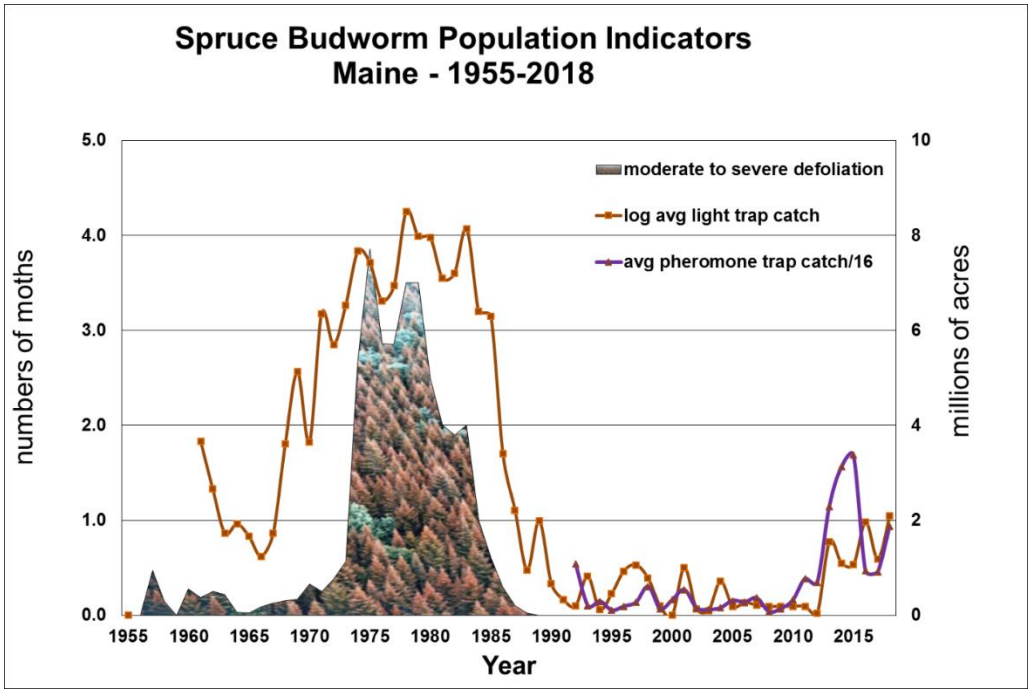


Figure 5. Composite graph of spruce budworm population indicators: defoliation, light trap and pheromone trap data 1955–2018.

Table 1. Spruce budworm caught in light traps in 2015 through 2018

Town	County	SBW 2015	SBW 2016	SBW 2017	SBW 2018
Allagash	Aroostook	**3**	**25**	n/a	**23**
Ashland	Aroostook	0	**3**	0	**29**
Big Twenty Twp	Aroostook	n/a	n/a	n/a	**54**
Bowerbank	Piscataquis	**1**	0	0	**2**
Calais	Washington	**2**	0	**6**	**2**
Cape Elizabeth	Cumberland	0	0	0	**1**
Clayton Lake Twp	Aroostook	**n/a**	**n/a**	**n/a**	**10**
Crystal	Aroostook	**5**	**53**	**7**	**42**
Exeter	Penobscot	**0**	**0**	0	**2**
Millinocket	Penobscot	**1**	**1**	0	0
Mount Desert	Hancock	n/a	**4**	n/a	0
New Sweden	Aroostook	**2**	**3**	0	**12**
Rangeley	Franklin	**1**	0	0	0
Topsfield	Washington	0	**44**	**18**	**22**
T3 R11 Wells	Aroostook	**17**	**13**	0	0
T15 R15 WELS	Aroostook	**2**	0	**10**	**3**
Total number of moths		**34**	**146**	**41**	**202**

Volunteers in Maine committed to collecting moths on a weekly or better basis at Maine sites. These sample locations were included in the Healthy Forest Partnership's Budworm Tracker Program. This project is managed by the Healthy Forest Partnership. Results can be requested at www.budwormtracker.ca.

The University of Maine Cooperative Forestry Research Unit (CFRU) continues to head up an "L2" sample program in conjunction with the Canadian Forest Service as part of the Healthy Forest Partnership. The L2 project goals are to assemble a broadly distributed long-term time series of budworm population monitoring data to: (1) enhance opportunities for management planning by identifying incipient local populations as early as possible and (2) add to a database that can be linked with vegetation data and information about natural enemies in the future to fill important knowledge gaps about how landscape conditions influence local outbreak dynamics. CFRU members have approved funding for support of this survey through 2019.

Since 2014, spruce budworm host branch samples have been collected during the fall and winters in areas where pheromone trap catches had been high, modeling predicted at-risk stands, or previous samples had been collected. One 30-inch-long branch is cut from the mid-crown of each of three trees at each sample site. Samples are sent to Canada for processing at the Canadian Forest Service lab in Fredericton. The data can be viewed on the healthy forest partnership research map at: http://www.healthyforestpartnership.ca/en/research/what-where-and-when/. 2017 samples from Maine yielded a total of 32 larvae across 13 sites. No larvae were recovered at 242 of the 255 sites sampled (Table 2). Data from branches collected in fall 2018 are being compiled by CFRU.

Table 2. Overwintering larvae recovered during L2 surveys in Maine 2014-2017

Year	Town	County	Site ID	L2/ 30 inch Branch
2014-2015 (N sites = 100, 6.0 percent positive)	Saint Francis	Aroostook	IRV-STF-59	1.0
	T12 R12 WELS	Aroostook	OT-1212	0.3
	T14 R13 WELS	Aroostook	OT-1413	0.3
	T14 R7 WELS	Aroostook	IRV-147	1.0
	T14 R8 WELS	Aroostook	IRV-148-15	0.3
	Westmanland	Aroostook	IRV-WES-30	0.7
2015-2016 (N sites = 241, 5.8 percent positive)	Allagash	Aroostook	IRV-ALL-32	0.3
	Dyer Brook	Aroostook	IRV-DRB	0.7
	Perham	Aroostook	IRV-PER	0.3
	Portage Lake	Aroostook	IRV-POL	0.3
	T12 R9 WELS	Aroostook	IRV-129-12	5
	T13 R11 WELS	Aroostook	IRV-1311	0.3
	T13 R7 WELS	Aroostook	IRV-137	0.3
	T15 R11 WELS	Aroostook	IRV-1511	0.3
	T15 R15 WELS	Aroostook	MFS-1515	0.3
	T16 R4 WELS	Aroostook	IRV-164	0.7
	T17 R5 WELS	Aroostook	IRV-175	0.3
	T18 R10 WELS	Aroostook	OT-1810	0.3
	T5 R20 WELS	Somerset	MFS-520	1.3
	T6 R8 WELS	Penobscot	MFS-68	0.3
2016-2017 (N sites = 219, 4.1 percent positive)	Lower Cupsuptic Twp	Oxford	SI-LCT	0.3
	New Canada	Aroostook	MFS-VOS	1
	New Canada	Aroostook	MFS-VOS2	0.3
	Portage Lake	Aroostook	IRV-POL	0.3
	Princeton	Washington	MFS-PRI	0.3
	T15 R12 WELS	Aroostook	IRV-1512	0.3
	T17 R5 WELS	Aroostook	IRV-175	0.3
	Topsfield	Washington	MFS-ltTOP	0.3
	Wallagrass	Aroostook	IRV-WAL	0.3

(**Table 2** continued)

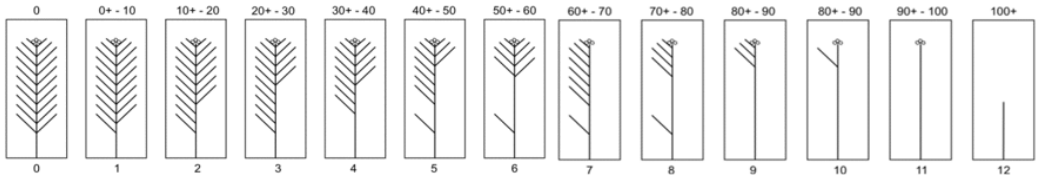
Year	Town	County	Site ID	L2/ 30 inch Branch
2017-2018 (N sites = 255, 5.1 percent positive)	Connor Twp	Aroostook	MFS-CON	0.3
	Cross Lake Twp	Aroostook	MFS-175	1.3
	Cross Lake Twp	Aroostook	MFS-175-ALT	0.3
	Fort Kent	Aroostook	MFS-FTK	0.7
	Fort Kent	Aroostook	MFS-FTK-2	2.3
	Hamlin	Aroostook	IRV-HML-48	0.3
	Madawaska	Aroostook	MFS-MAD	1
	Saint John Plt	Aroostook	MFS-SAJ	0.7
	T11 R8 WELS	Aroostook	SI-118	0.3
	T17 R4 WELS	Aroostook	IRV-174-56	0.3
	T9 R9 WELS	Aroostook	SI-99	0.3
	TC R2 WELS	Aroostook	IRV-TC2-05	2.3
	Wallagrass	Aroostook	IRV-WAL	0.3

Both ground and aerial surveys were conducted in 2018, looking specifically for spruce budworm in northern Maine where damage would first appear. This year defoliation was assessed by CFRU student employees on all L2 sites. The Fettes Method was used to quantify defoliation on current-year growth. This method provides a systematic approach to measuring defoliation. It was employed during the last budworm outbreak in Maine, and is currently in use in Quebec. CFRU staff received training on implementing the method in a September 2018 demonstration at the University (with the coordinator at U Maine Fort Kent attending via video conference. The Fettes Method captures defoliation from all causes and can be used to estimate both current-year defoliation and cumulative defoliation. Results will be available from the CFRU. A brief introduction to the Fettes Method is provided in this document: http://www.sampforestpest.ento.vt.edu/defoliating/spruce-budworm/pdf/montgomery-etal1982-sbw.pdf. A sample data sheet is shown in Figure 6.

No defoliation was detected during aerial survey. Feeding needs to be approaching a moderate level of damage before it is visible from the air. All population measures indicate that numbers are too low everywhere in Maine to expect that level of feeding yet.

Spruce budworm populations in Maine have left the “stable” phase and appear to be building. Outbreaks occur on a roughly 40-year cycle in response to maturing forest stands and reduced pressure from parasites; the last time budworm was a problem in Maine was in the 1970’s and 80’s. This native defoliator of balsam fir and spruce has been defoliating trees in Quebec north of the Saint Lawrence Seaway for more than 10 years and has now been mapped within 10 miles of our northwestern boundary. Defoliation, which has spread to the south shore and into New Brunswick, currently covers more than 20 million acres. Current population levels in the state will allow more time to prepare before trees begin to experience growth-loss from budworm feeding.

SBW Defoliation--Fettes Method, CURRENT YEAR: Examine 20 tips per mid-canopy branch and rate using graphic, multipy N*Value, Sum products and divide by Total number of tips to get percent defoliation by branch or site. Try to do 3 branches from 3 trees at each site.



Lat: _____ **Long:** _____ **Date:** _____ **Operator:** _____

Township: **No. Branches:** **Species:**

Tally													**TOTALS:**
N tips													**N:**
(Value)	0	5	15	25	35	45	55	65	75	85	95	100	100	
Product														**Σ:**

OWNER INFO (Optional) **Branch Defoliation (Σ/N):** _____

Figure 6. Sample data sheet (Excel file available upon request). Data were generally collected on hand-held tablets using DoForms, however paper data sheets were made available.

Overall, this project goes very well, considering the number of cooperators. However, each year, there are issues with data completeness and sometimes sample quality, which can affect our ability to use the data cooperators have put effort into collecting. We are open to suggestions from cooperators in improving directions and making sample collection easier.

Updates to this report will be posted to www.sprucebudwormmaine.org as well as www.maineforestservice.gov.

Acknowledgements:

Cooperators are such a big part of the success of this program. A big thank you goes out to all the folks who paid attention to details of the trap protocol and worked to get the traps out and samples back in for processing. A lot of effort goes into the trap network, from people in the woods to those in the office who manage data from multiple surveyors. We appreciate their efforts and the support of the Spruce Budworm Task Force members.

Thanks to the MFS field staff that helped with the surveys this year. A special thanks to Joe Bither, our Sr. Entomology Technician in Stockholm, who stepped up to coordinate supply distribution and be the MFS point person for the more than 20 cooperators. His assistance was invaluable in a year with more than one significant retirement and a raging browntail moth infestation in the southern part of the state. Patti Roberts was instrumental in procuring supplies for the survey and keeping us all on task. Special recognition to Amy Emery who sorted through most of the light trap samples. Many staff from both insect and disease management and forest inventory and monitoring pitched in to wash traps and count trap catches—putting to a test the axioms “misery loves company” and “many hands make light work.”