Spruce Budworm (*Choristoneura fumiferana*) in Maine 2016

Maine Forest Service – Department of Agriculture Conservation & Forestry

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The Maine Forest Service (MFS) and its cooperators are closely watching spruce budworm in Maine in order to monitor and prepare for another epidemic of this native defoliator. Over the last several years, many indicators have pointed to the imminence of the next epidemic: pheromone and light trap surveys had shown a steady rise since 2011, defoliation in Quebec has increased year after year, anecdotal and confirmed accounts of defoliation in New Brunswick have cropped up over the past two years. 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 regions forests. Monitoring takes place using pheromone traps, light traps, overwintering larval samples, 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 recent years, that network has 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. In 2014, the pheromone trap monitoring program was significantly expanded, with 21 land owners and managers participating in setting and retrieving traps at more than 400 sites. A similar group of organizations has participated in 2015 and 2016.

Spruce budworm pheromone survey cooperators 2016

American Forest Management
Appalachian Mountain Club
Baskahegan Company
Baxter State Park
Forest Society of Maine
Hilton Timberlands, LLC
J.M. Huber Corporation
J. D. Irving Ltd.
Katahdin Forest Management, LLC
LandVest
Maine Forest Service
Orion Timberlands, LLC
Maine Bureau of Parks and Lands
Penobscot Experimental Forest
Penobscot Nation Department of Natural Resources
Prentiss & Carlisle
Rangeley Lakes Heritage Trust
Seven Islands Land Company
USDA Forest Service, Durham Field Office
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.

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. The catch was sent to the Maine Forest Service entomologist in Old Town for processing.

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 an impact (Figure 1). In the state as a whole and across each county, the average number of moths per trap dropped in 2016 compared to the previous several years (Figure 2). As in previous years, the vast majority of traps (91 percent) captured trace to 50 moths/trap (Figure 3).

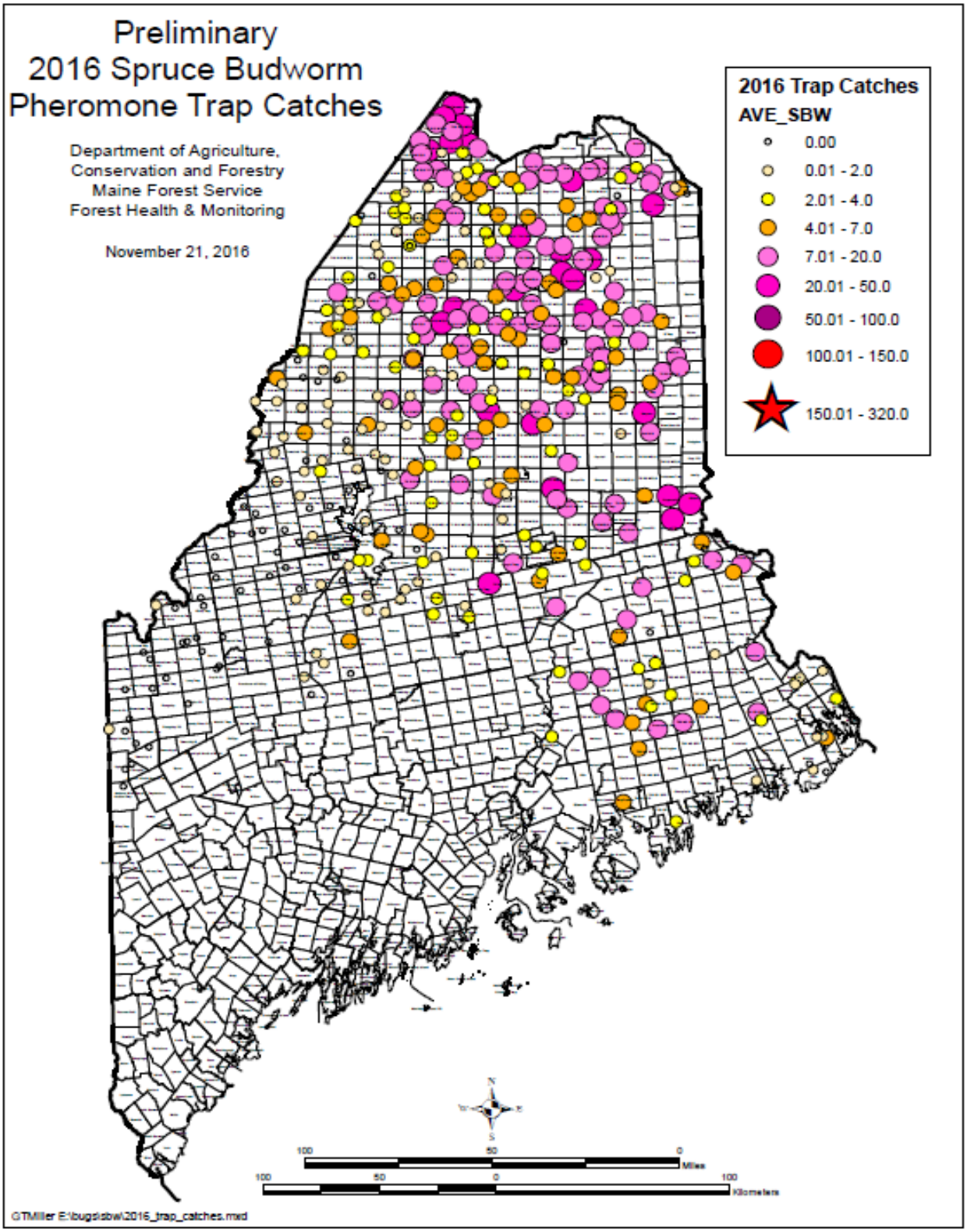


Figure 1. 2016 Distribution of spruce budworm pheromone traps and trap catches across Maine.

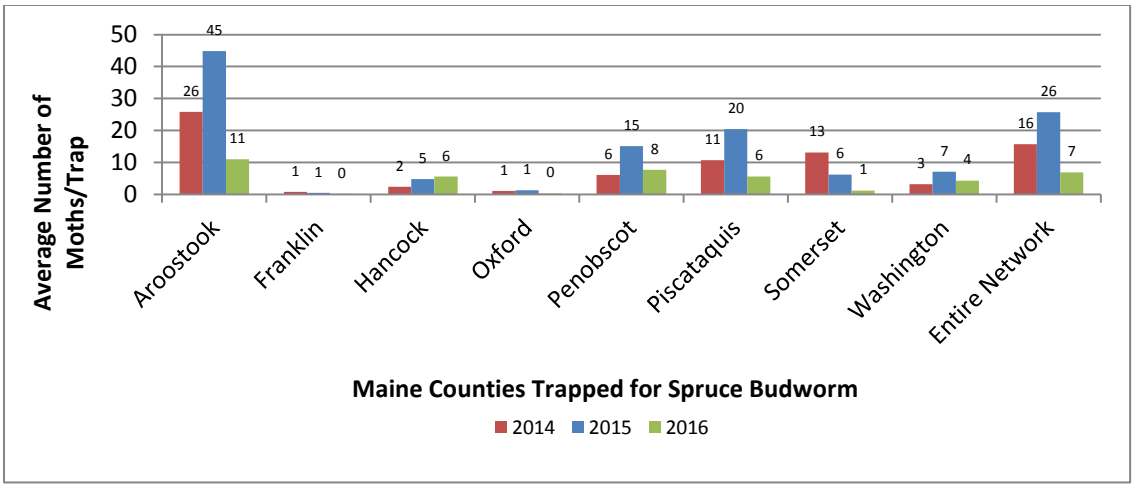


Figure 2. Average number of spruce budworm moths in pheromone traps by county in Maine 2014-2016.

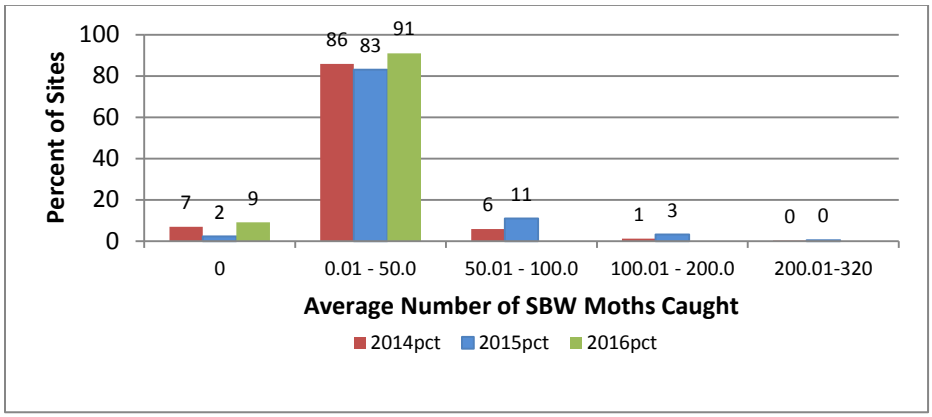


Figure 3. Percent of sites with spruce budworm in pheromone traps by catch 2014 -2016

As noted earlier, the Maine Forest Service has monitored collections at a set of longer term pheromone trap sites for the past 24 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. This year, average catches declined to seven moths/trap.

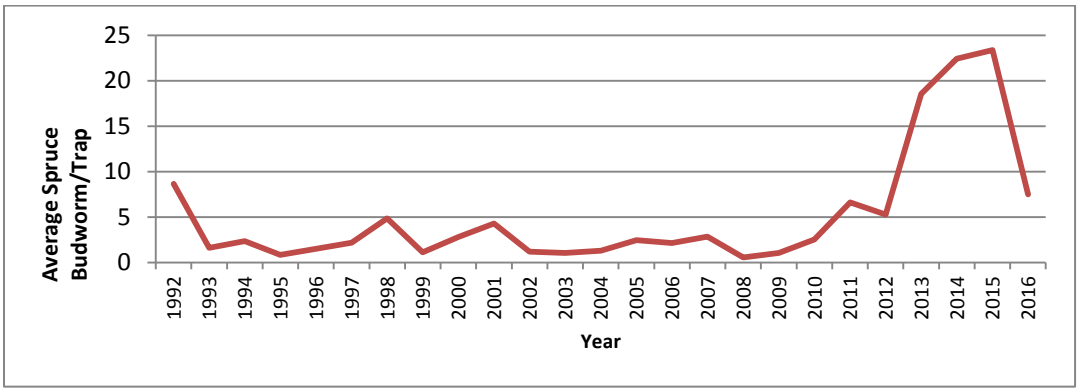


Figure 4. Spruce budworm pheromone trap average catch <u>long term sites only</u> (Maine Forest Service, J.D. Irving Ltd., Penobscot Nation DNR, USDA Forest Service).

Light traps have been used in Maine for decades to monitor spruce budworm populations and other forest defoliators and continue to be used today. This year 22 traps were run by Maine residents in their backyards. They are paid a small stipend for checking the traps daily. Budworm moth counts from light traps were up from previous years (Figure 5). To date, nine sites in the network caught a total of 148 moths (Table 1), samples and data are still being processed. A significant portion of this catch is likely attributable to the widely-publicized moth flights from Quebec in late July, and not to moths hatched and fed in Maine (Figure 6). In the 10 years before 2013 there were less than 10 spruce budworm moths caught in all the light traps combined. Therefore, the past years are a significant increase but not enough to see defoliation yet. At such low numbers apparently wide fluctuations are not surprising as there are only a few locations where the moths may happen to be caught.

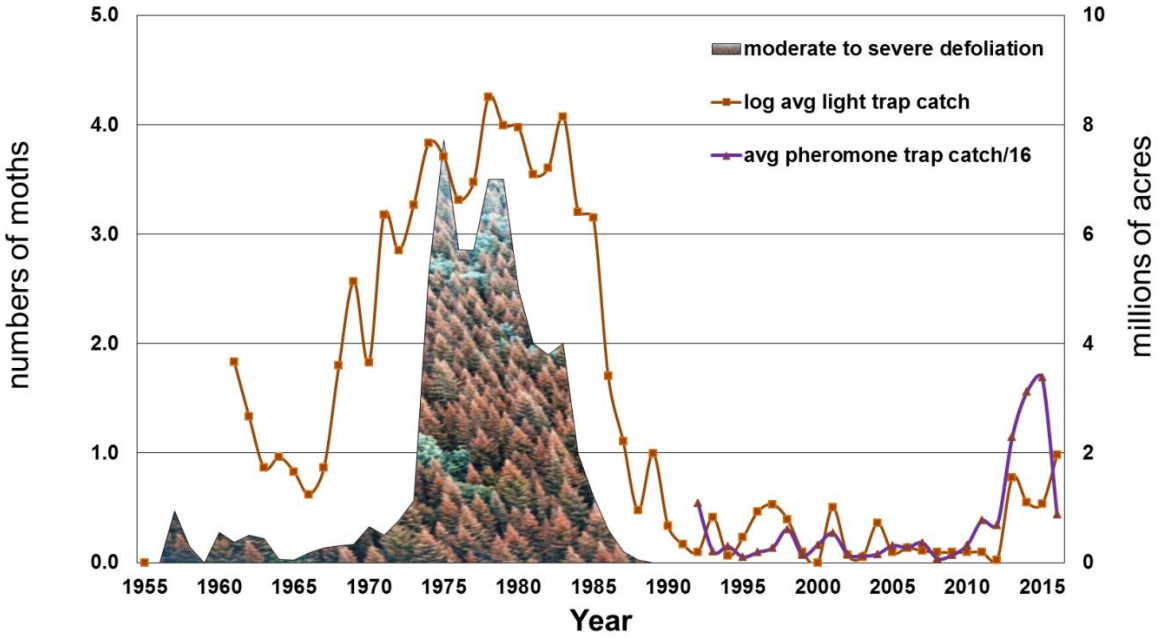
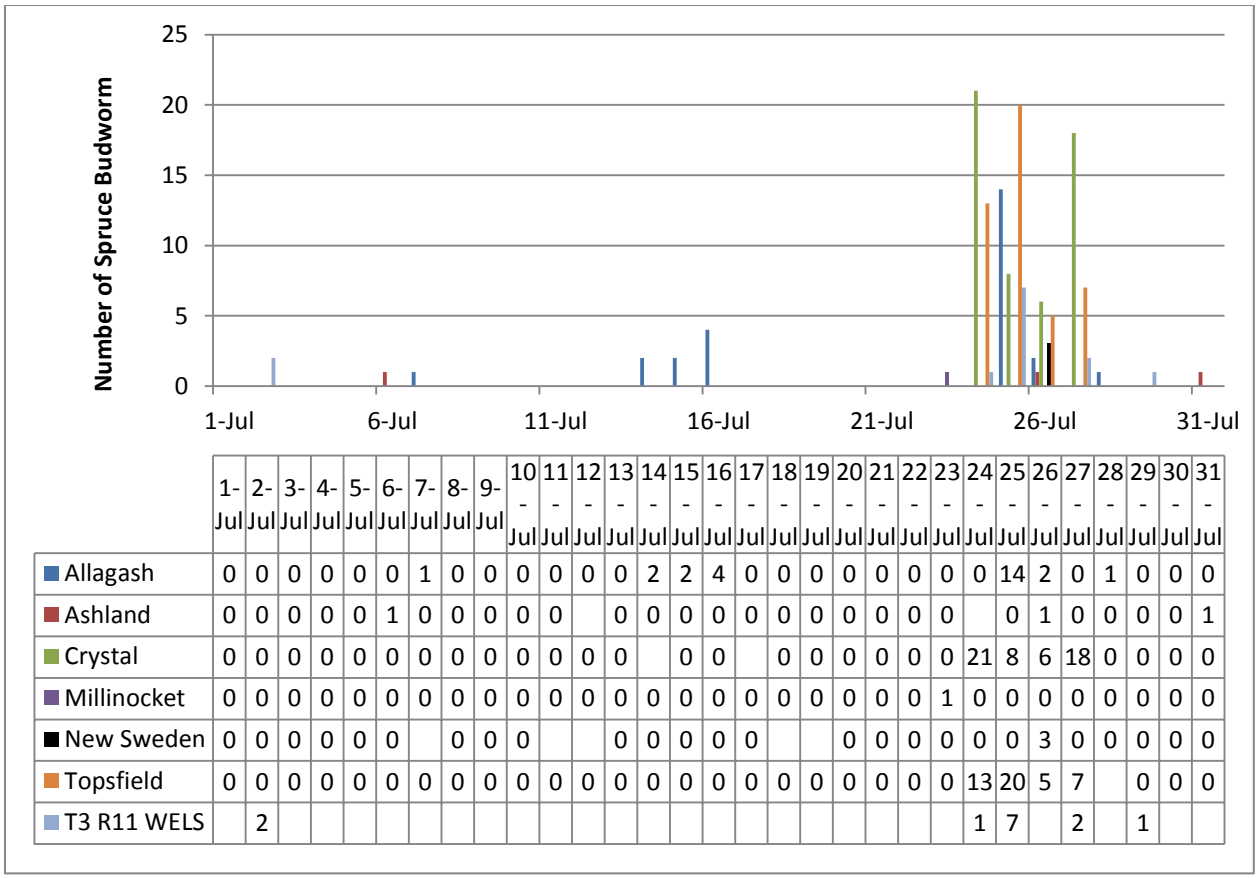


Figure 5. Composite graph of spruce budworm population indicators: defoliation, light trap and pheromone trap data 1955-2016 (2016 light trap data as of 1/4/2017).

Table 1. Spruce budworm caught in light traps in 2015 and 2016 (preliminary)

Town	County	SBW 2015	SBW 2016
Allagash	Aroostook	3	26
Ashland	Aroostook	0	3
Bowerbank	Piscataquis	1	1
Calais	Washington	2	0
Crystal	Aroostook	5	53
Millinocket	Penobscot	1	1
Mount Desert	Hancock	n/a	3
New Sweden	Aroostook	2	3
Rangeley	Franklin	1	0
Topsfield	Washington	0	45
T3 R11 Wells	Aroostook	17	13
T15 R15 WELS	Aroostook	2	0
Total number of moths		**34**	**148**



	1-Jul	2-Jul	3-Jul	4-Jul	5-Jul	6-Jul	7-Jul	8-Jul	9-Jul	10-Jul	11-Jul	12-Jul	13-Jul	14-Jul	15-Jul	16-Jul	17-Jul	18-Jul	19-Jul	20-Jul	21-Jul	22-Jul	23-Jul	24-Jul	25-Jul	26-Jul	27-Jul	28-Jul	29-Jul	30-Jul	31-Jul
Allagash	0	0	0	0	0	0	1	0	0	0	0	0	0	2	2	4	0	0	0	0	0	0	0	0	14	2	0	1	0	0	0
Ashland	0	0	0	0	0	1	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0	1	0	0	0	0	1
Crystal	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0	0	0	21	8	6	18	0	0	0	0
Millinocket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
New Sweden	0	0	0	0	0	0		0	0	0			0	0	0	0	0			0	0	0	0	0	0	3	0	0	0	0	0
Topsfield	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	20	5	7		0	0	0
T3 R11 WELS		2																						1	7		2		1		

Figure 6. Preliminary Number of spruce budworm moths caught in spruce budworm positive light traps by date in Maine in 2016. Notes: Millinocket and Topsfield traps ran from 17 of June, those data not shown, no spruce budworm were caught in that period. Samples from light traps are still being processed and data entered—thus data presented in this figure differs from Table 1 information.

More than 30 volunteers 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 will be reported at www.budwormtracker.ca.

The University of Maine Cooperative Forestry Research Unit headed up an "L2" sample program in conjunction with the Canadian Forest Service for a second year. Branch samples were taken during the fall and winter in areas where pheromone trap catches had been high or modeling predicted at-risk stands. Three branches were cut from the mid-crown at 241 sites in Winter 2015-16. Samples were sent to Canada for processing and were processed at the New Brunswick Province' lab. In 2015, a total of 33 larvae were found in samples across 14 sites (Table 2). Two hundred twenty seven sites had no larvae recovered.

Table 2. Number of overwintering spruce budworm larvae (L2) in winter and 2015–2016 samples.

Town	County	L2 Total	L2/Branch
Allagash	Aroostook	1	0.3
Dyer Brook	Aroostook	2	0.7
Perham	Aroostook	1	0.3
Portage Lake	Aroostook	1	0.3
T12 R9 WELS	Aroostook	15	5
T13 R11 WELS	Aroostook	1	0.3
T13 R7 WELS	Aroostook	1	0.3
T15 R11 WELS	Aroostook	1	0.3
T15 R15 WELS	Aroostook	1	0.3
T16 R4 WELS	Aroostook	2	0.7
T17 R5 WELS	Aroostook	1	0.3
T18 R10 WELS	Aroostook	1	0.3
T6 R8 WELS	Penobscot	1	0.3
T5 R20 WELS	Somerset	4	1.3

Both ground and aerial surveys were conducted in 2016 looking specifically for spruce budworm in northern Maine where damage would first appear. Field staff from the department including staff from Maine Forest Service (Forest Health & Monitoring, Forest Policy and Management and Forest Protection) and Public Lands as well as cooperators from Inland Fisheries and Wildlife, USDA Forest Service and New Hampshire Forest Health participated in a tour to become familiar with the visual signatures of spruce budworm defoliation. The tour, hosted by the Province of Quebec's Forest Pest Management Service, included several field sites with varying levels of defoliation and stand compositions/harvest history and a lesson on quantifying levels of defoliation. It took place in early July to increase the chances for recognition of spruce budworm defoliation within Maine during ensuing fieldwork.

No feeding damage from spruce budworm was apparent in either ground or aerial surveys in Maine. Feeding needs to be approaching a moderate level of damage before it is visible from the

air and moth counts are not high enough anywhere in Maine to expect that level of feeding yet. Ground surveys were very limited in their extent and not expected to pick up damage yet. It will take more time on the ground looking at more trees to begin to find defoliation at this level of budworm feeding. A focused observer is needed to see trace to light damage in the forest so casual visitors to the forest usually do not notice damage until it starts to get moderate to heavy.

Populations of spruce budworm in Maine remain low, but detectable. Maine is poised at the beginning of another spruce budworm outbreak. 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. Defoliation, which has spread to the south shore and into New Brunswick, currently covers more than 17 million acres. Current population levels in the state will allow more time to prepare before trees begin to experience growth-loss from budworm feeding.

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

Acknowledgements:
A big thank you goes out to all the folks who paid attention to details of the trap protocol and strove to get the traps out and samples back in for processing. From people in the woods to those who managed data from multiple surveyors in the office, a lot of effort went into the trap network. We appreciate their efforts and the support of the Spruce Budworm Task Force members.

Pierre Therrien with the Quebec Ministry of Forests, Wildlife and Parks coordinated with local ministry staff to organize and present a remarkable field tour with many learning opportunities in the Matapédia River valley.

Amy Ouellette, Regina Smith, Jeff Harriman, Bryan Way and Elicia Dionne of the Maine Forest Service helped sort through and count budworm samples that came into Old Town and the Augusta lab. Charlene Donahue grew the cooperator network from its base in 2013 to the current level of participation—her work provided the foundation for this report and the project.