

**2013 District of Lakeland and
Ministry of Parks Culture & Sport
Aerial Spray Program Against
Eastern Spruce Budworm**

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August 2013

Executive Summary

- In the spring of 2013, the District of Lakeland and the Ministry of Parks Culture & Sport (PCS) contracted BioForest Technologies Inc. to design and conduct a white spruce aerial spraying program against eastern spruce budworm.
- Spraying took place in the Emma Lake (234 ha) and Anglin Lake (26 ha) areas.
- Of the 260 ha sprayed, 175 ha were District lands and 85 ha were PCS lands.
- The 260 ha were treated twice with the biological insecticide Foray 76B (*Bacillus thuringiensis* var. *kurstaki* [Btk]) (Valent BioSciences Corporation) at a rate of 30 BIU/1.5L/ha.
- Spraying took place on the mornings of Tuesday June 4 and Friday June 7, 2013.
- One AT 502B aircraft, provided by Battleford's Airspray, flying out of North Battleford, was used for the spray program.
- The fact that actual 2013 defoliation in the spray blocks ranges from light to moderate is a good indication of spray program efficacy. It is fair to say that had protection efforts not occurred, these areas would have sustained higher levels of defoliation in 2013.
- Overall, there is less SBW damage on District and PCS lands in 2013 than in 2012, but budworm is still present in the area.
- In the fall of 2013, BioForest will conduct a SBW L₂ survey to determine overwintering populations and forecast 2014 defoliation. This forecast is one of the most useful pieces of information for deciding whether or not spraying is needed in 2014.

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Introduction

In the spring of 2013, the District of Lakeland (the District) and the Ministry of Parks Culture & Sport (PCS) contracted BioForest Technologies Inc. (BioForest) to design and conduct a white spruce aerial spray program against eastern spruce budworm (*Choristoneura fumiferana*, Clem) (SBW) on 260 hectares of forest in the Emma Lake and Anglin Lake areas.

In its role as coordinator, BioForest agreed to provide the following services:

- Obtain from Sask Water Security Agency, a Permit to Apply a Pesticide in or Near Surface Water.
- Prepare ArcGIS shapefiles of treatment blocks, and provide digitized information to the aerial applicator for accurate targeting of the biological insecticide.
- Make contact with, on behalf of the District and PCS, a reputable and experienced aerial applicator (Battleford's Airspray) to conduct two applications of Foray 76B with an aircraft meeting Transport Canada criteria for spraying over inhabited areas.
- Arrange a supply of the biological insecticide Foray 76B, with the active ingredient *Bacillus thuringiensis* var. *kurstaki* (*Btk*), from Valent BioSciences Corporation, and ensure the aerial applicator receives the *Btk*.
- Undertake a public awareness campaign that includes posting of spray program notice signs throughout the spray blocks, as well as providing information such as maps and *Btk* fact sheets for distribution to the general public.
- Utilize the BioSIM phenology model developed by the Canadian Forest Service to provide advance indication of probable spray program treatment start dates.
- Conduct in field surveys of white spruce host development and SBW larval development to determine the most effective timing for the spray program.
- Notify the applicator, the District and PCS contacts of anticipated spray dates.
- Initiate the spray program when optimum timing conditions occur. Spraying was to commence when white spruce shoots are flaring (Host Development Index = 3.8-4.0) and SBW larval development ranges between 3rd and 5th instar (Larval Development Index = 3.5-4.5).
- Initiate the second application 3 to 5 days after the first, weather permitting.
- Prepare a brief summary report of all activities.

Program Overview

In 2013 the District and PCS treated a total of 260 ha for SBW as part of an aerial spray program (Figure 1). Treatment areas were determined based on defoliation history, white spruce tree condition as a result of SBW damage, and overwintering SBW larval survey results from the fall of 2012. Of the 260 ha treated, 234 ha were at Emma Lake and 26 ha were at Anglin Lake. All 260 ha were treated with a double application of the biological insecticide Foray 76B at a rate of 30 BIU/1.5 L/ha.

The first Foray 76B application was done on the morning of Tuesday June 4, 2013 and the second was done on morning of Friday June 7, 2013. Battleford's Airspray was

contracted to perform the aerial applications and one AT 502B aircraft, equipped with six AU4000 Micronaire atomizers, Ace flow control, and SatLoc M3 GPS navigational system, was used to complete the program. The spray program aircraft was based out of the North Battleford Airport (YQW).

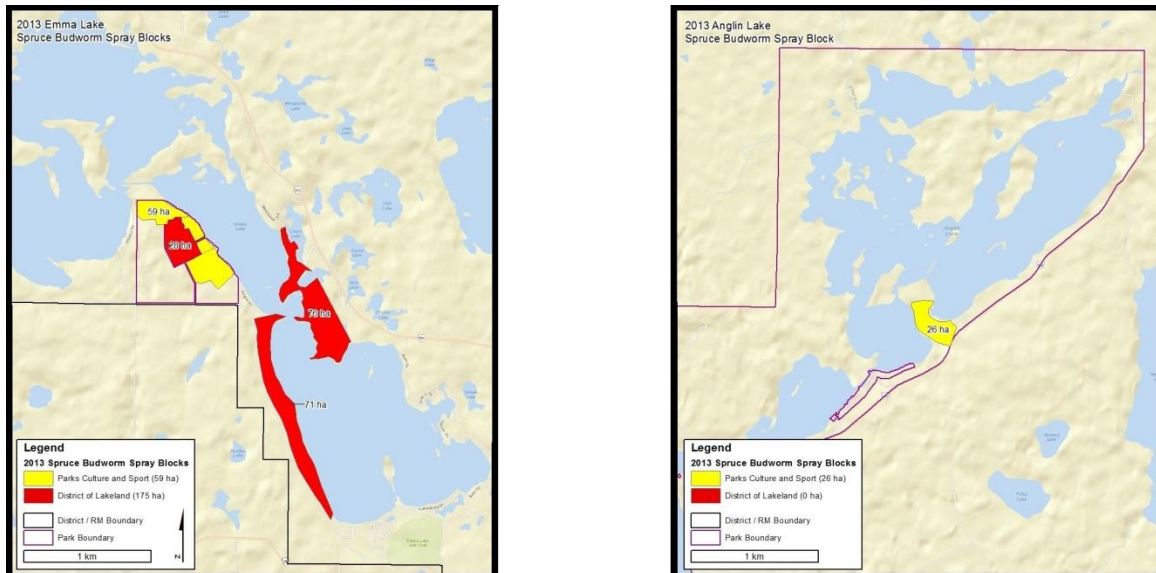


Figure 1. District of Lakeland and Ministry of Parks Culture and Sport spruce budworm aerial spray blocks in the Emma Lake and Anglin Lake areas, 2013.

Treatment Timing

BioSim Phenology Model

BioForest used the BioSIM phenology model to provide advance indication of probable spray program start dates. BioSIM is a software tool designed to assist in the application of temperature-driven simulation models in pest management. In this project BioSIM was used to forecast SBW larval development in areas scheduled for aerial spraying. First applications of *Btk* should target white spruce shoots that are flaring and elongating to provide an optimum deposit surface. At this stage of shoot development, SBW larvae are typically in the fourth and fifth instars. BioSIM was used to forecast when a larval development index (LDI) of 4.0 would likely occur in the areas to be sprayed. BioSIM forecasts supported the implementation of insect and host development field surveys and, coupled with field data, assisted in determining optimal treatment start dates.

Insect and Host Development

Larval and host development are critical factors in determining when to begin a treatment program. To be effective, spraying should occur when larvae are actively feeding, but have not yet caused significant defoliation, and foliage is developed enough to provide an adequate deposit surface to catch *Btk* droplets. The larval and host development targets for the 2013 spray program were an LDI between 3.5 and 4.5 and a host development index (HDI) between 3.8 and 4.0. A HDI between 3.8 and 4.0 indicates that the majority of trees sampled for host development in a stand or geographical area have new shoots that are elongating and all needles have emerged from the fascicle.

To monitor SBW and white spruce development before and during the spray program, BioForest established development plots within the spray blocks. Beginning on May 27, 2013, development plots were sampled, at the discretion of the field supervisor, until the spray program began. On average, HDI and LDI were assessed every three days.

On each sample date, SBW larvae (n = 50-60) were collected from a minimum of six host trees. Larvae were examined under a microscope to determine larval instar (Table 1). White spruce shoots (n = 120) collected from the mid-crown of six sample trees were rated for expansion, elongation and needle flare, and classified according to Auger's shoot classification system (Figure 2). Data from development plots were summarized and indices were calculated for SBW larvae and white spruce shoots. Development information was reported to the District and PCS so representatives would know the planned spray date 12-48 hours in advance. Weather permitting, the second application was planned for three to five days after the first.

Table 1. Spruce budworm larval head capsule widths for determining larval instar.

Instar	Head capsule width (mm)
2	<0.325
3	<0.500
4	<0.900
5	<1.500
6	>1.500



Figure 2. Auger's shoot classification system for white spruce foliage development.

Spray Signs and Pubic Information

Spray signs were posted at public access points in accordance with the *Permit to Apply a Pesticide in or Near Surface Water* (Appendix A). Twelve signs were posted at the Emma Lake blocks and two signs were posted at the Anglin Lake Recreation Site (Figures 3 and 4).

BioForest provided information handouts to the Emma Lake Campground office, the MOE office at Christopher Lake, and the District office for distribution to the general public (Appendix B).

BioForest's phone number was listed on the treatment signs and information handout for members of the public to request further information.



Figure 3. One of 12 aerial spraying notice signs posted at Emma Lake.



Figure 4. One of two aerial spraying notice signs posted at Anglin Lake.

***Btk* Deposit Assessment**

Spray deposit was assessed using a coniferous foliage Accurate Deposit Assessment Method (ADAM) field kit obtained from Valent BioSciences Corporation. Sampling occurred within 6 hours of the first *Btk* application on June 4. Branch-tip samples were collected from the mid-crown of three randomly selected white spruce at 8 locations. Samples were processed at BioForest's laboratory in Prince Albert on June 8. All samples tested positive for *Btk* deposit.

Defoliation Survey

On July 18 and 19 BioForest conducted a SBW defoliation survey in the Lakeland area (Figure 5). White spruce growing in the built-up areas around Emma, Christopher, and Anglin Lakes were carefully checked for SBW defoliation damage by driving every road through every subdivision, and also by boating on Emma Lake.

Discussion and Recommendations

Overwintering second instar larvae (L_2) surveys conducted in the fall of 2012 indicated SBW populations were present in the District and adjacent PCS lands. Moderate to severe SBW defoliation was forecasted for certain subdivisions in the District and at the Emma Lake and Anglin Lake Recreation Sites in 2013.

The fact that actual 2013 defoliation in the spray blocks ranges from light to moderate is a good indication of spray program efficacy. It is fair to say that had protection efforts not occurred, these areas would have sustained higher levels of defoliation in 2013.

Overall, there is less SBW damage on District and PCS lands in 2013 than in 2012, but budworm is still present in the area.

In the fall of 2013, BioForest will conduct a SBW L_2 survey to determine overwintering populations and forecast 2014 defoliation. This forecast is one of the most useful pieces of information for deciding whether or not spraying is needed in 2014. Because SBW does not observe administrative boundaries, BioForest recommends continued collaboration between the District and PCS when planning for 2014.

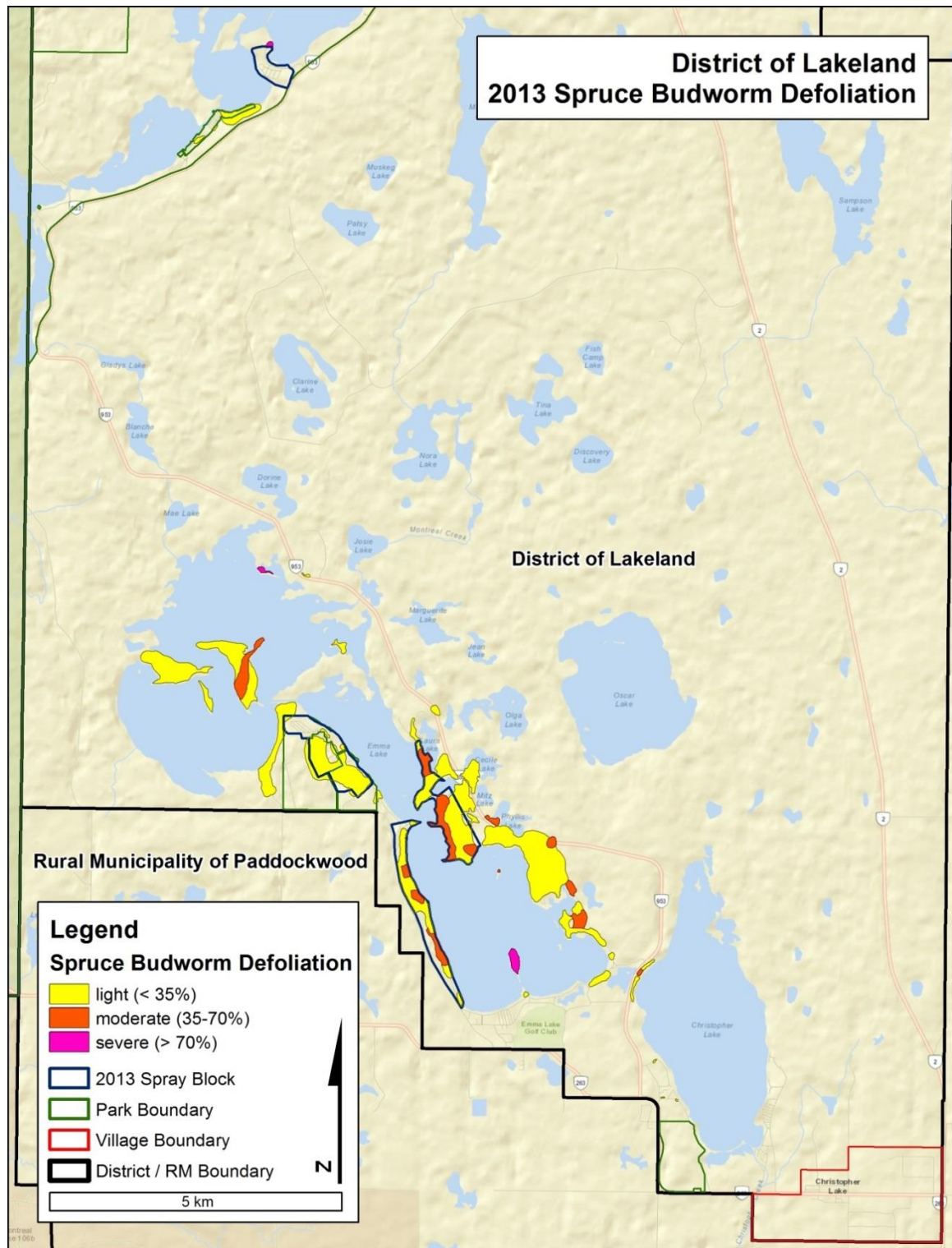


Figure 5. Spruce budworm defoliation mapped in the District of Lakeland and adjacent Ministry of Parks Culture and Sport lands following surveys conducted on July 18 and 19, 2013.

Appendix A – 2013 Permit to apply a pesticide in or near surface water

S A S K A T C H E W A N



May 7, 2013

3211 Albert Street, 4th Floor
Regina SK. S4S 5W6

Mr. Brian Poniatowski
BioForest Technologies Inc.
130-1061 Central Avenue
Prince Albert, SK S6V 4V4

Dear Mr. Poniatowski:

Permits for the Chemical Control of Aquatic Nuisances

We have reviewed your application for permit for the chemical control of Spruce Budworm by application of Foray 76B, and, in accordance with Section 35 of The Environmental Management and Protection Act, 2002, are issuing permit for the year 2013. Permit 13- 025 is included with this letter. If the product or its intended use changes, new applications will be required.

If you have any questions or require additional information regarding your permit, please contact my office by telephone at 787-9554, or by e-mail at Ondiveerapan.Thirunavukkarasu@gov.sk.ca.

Sincerely,

A handwritten signature in blue ink, appearing to read "Arasu", written over a horizontal line.

O.S. (Arasu) Thirunavukkarasu, Ph.D., P.Eng.
Senior Standards Engineer
Drinking Water and Wastewater Management Division
Facsimile: 306 787-0197



Permit to Apply a Pesticide in or Near Surface Water

Drinking Water & Wastewater Management Division

Issued Pursuant to Section 35 of The Environmental
Management and Protection Act, 2002

Permit No. 13-025

Page 1 of 2

To: Brian Poniatowski, BioForest Technologies Inc. (Permittee).

PURSUANT to Section 35 of The Environmental Management and Protection Act, 2002, a permit for application of the bio-pesticide Foray 76B (PCP#24976) to control Spruce Budworm in an area of approximately 260 hectares of forest adjacent to Emma Lake and Anglin Lake as outlined in your April 15 2013 application, is hereby granted. This permit is issued in accordance with the attached Terms and Conditions.

This Permit takes effect on May 7, 2013.

This Permit expires on June 30, 2013, unless cancelled or suspended before that date.

Issued:

A handwritten signature in blue ink, appearing to read "Arasu", is written over a horizontal line.

Minister of Environment
per
O.S. (Arasu) Thirunavukkarasu
Drinking Water & Wastewater Management Division
Water Security Agency
Acting for and on Behalf of the Minister of Environment

Permit to Apply Pesticide
Page 2

Terms and Conditions:

- 1) Product, label restrictions, directions and precautions must be strictly adhered to. If product is not newly purchased, applicant must obtain most recent product label before use.
- 2) The permittee is required to have a valid pesticide applicators license. Contact the Saskatchewan Ministry of Agriculture for more information.
- 3) Sites treated on public property should be posted at public access points for 48 hours after treatment indicating that a treatment has been made and providing a contact number for further information.
- 4) At permit expiry, the permittee shall submit to the Water Security Agency a summary of program activities (number of applications and efficacy of each).
- 5) Product is to be applied in the dosage and manner approved of in your application.
- 6) It is the permittee's responsibility to ensure all other regulatory requirements are fulfilled and follow the safety plan as outlined in the application.

These conditions must be strictly adhered to and if not met will result in immediate cancellation of your permit.

Appendix B – Spray program notice handout



The District of Lakeland and the Saskatchewan Ministry of Parks, Culture & Sport plan to conduct an aerial spraying program in June 2013 to control the eastern spruce budworm on 260 hectares of forest in the Emma and Anglin Lake area, with 175 ha being District lands and 85 ha located between two Provincial Recreation Sites: Emma Lake (59 ha) and Anglin Lake (26 ha).

The project will utilize the biological insecticide Foray 76B which contains the naturally occurring bacterium *Bacillus thuringiensis* var. *Kurstaki* (Btk). Foray 76B is not harmful to humans or animals.

Two applications will be conducted in June 2013.
As the program nears, actual planned application dates will be known.

Information on Btk and Foray 76B can be obtained at the following websites:

http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_fact-fiche/btk/index-eng.php

http://www.valentbiosciences.com/docs/pdfs/learning_center/LC_Foray.pdf



For further information contact:

BioForest Technologies Inc. 306-763-0577

District of Lakeland 306-982-2010

Emma & Anglin Recreation Sites 306-982-6250

