

# Spruce Budworm in Alberta

## Distribution and host trees

The spruce budworm (SBW, *Choristoneura fumiferana*) is a defoliating insect commonly found throughout Canada in spruce and spruce-fir forests. In Alberta, its larvae primarily feed on the buds and needles of white spruce and balsam fir; however they can also feed on larch and non-native spruces. The SBW plays an important role in Alberta's forests as a nutrient cyclor and as food for other insects and animals like birds.

## Life-cycle

Spruce budworm complete one lifecycle per year (Fig. 1). They spend the winter as tiny caterpillars (larvae) hidden in the crevices of the host tree. In early spring, larvae emerge from hibernation and move to new locations on the host tree to feed on old needles or pollen cones. Larvae switch to feeding on elongating shoots and new needles as the season progresses. They will continue feeding and maturing until late June – they stop feeding once they are fully mature (around 20-23 mm long). At this point larvae transform first into pupae and then into adult moths. The moths do not feed on the tree - their main goal is to mate and produce the next generation. Female moths lay eggs on the underside of needles in late July. Immature larvae hatch from these eggs in early August and find locations to overwinter in. They spin a silken cover and remain in this protected location until the following spring.

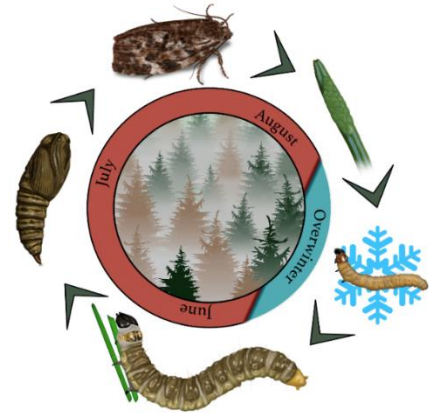


Figure 1. Spruce budworm lifecycle. Credit: Rob Johns, Canadian Forest Service.

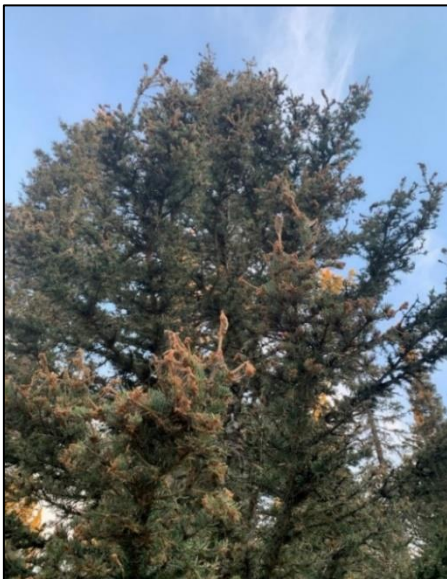


Figure 2. Larval feeding on the terminal branch shoots of this white spruce has created a reddish hue as partially eaten needles dry out and turn red.

## Symptoms and damage

Larvae are the damaging life stage and their feeding creates a number of symptoms. Larvae preferentially feed on new growth, which is located in tree crowns and at branch tips - these are the locations where defoliation is most noticeable (Fig. 2). If larvae are numerous, older needles may also be affected. Frass and webbing develops as larvae feed (Fig. 3) and large amounts of webbing can be present during severe defoliation. Tree crowns appear rusty brown when defoliation reaches its peak in late June due to the accumulation of partially chewed needles and buds. In the fall, affected trees take on a greyish appearance when the webbing and dead needles have dispersed by wind.

Spruce budworm do not kill trees in a single year - white spruce are resilient to defoliation. Over-mature spruce and spruce-fir stands are the most susceptible to defoliation by this insect because they can support large numbers of SBW when populations periodically increase in size. However, tree growth is reduced if severe defoliation extends into a second summer. By the fourth consecutive summer of severe defoliation, young trees may begin to die. Larger, mature trees may begin to die after five consecutive years of severe defoliation.

## Management

In most instances, management of SBW is not necessary since populations are small and do not pose a risk to our forests. However, when populations erupt and increase to a point where forest values are at risk, management may be appropriate. The approach to management will depend on the intent - either population suppression or foliage protection on high value trees. The control method and timing used for each of these tactics is different. Population suppression involves large-scale, aerial biological spray operations that target mature larvae. Foliage protection is done at a smaller scale and targets younger larvae to prevent defoliation in a given year.

There are important considerations when choosing if or how to manage SBW - the benefit of management must outweigh the cost in terms of dollars and ecosystem impacts. Aerial spray operations are expensive, may harm non-target organisms, and must be precisely timed to maximize the effect. Managing SBW on high-value trees does not affect surrounding populations; therefore, it may need to be done repeatedly over years which increases the cost and harm to the ecosystem.

Insecticide use has ecological implications and should be used with caution. *Bacillus thuringiensis* is the most common insecticide used to control SBW. It is derived from natural bacteria but must be used conservatively because it kills all moths and butterflies that feed at the same time as SBW. Alternatively, broad-spectrum insecticides can be used but are even more harmful since they are not species-specific and kill every insect that encounters the chemical and may impact other forest animals. Runoff into waterways is also a large concern with broad-spectrum insecticides. If feasible the best option for homeowners to protect high-value trees is to spray infested trees with water to knock larvae off. Though this method may need to be repeated, it will do the least harm.



Figure 3. Spruce budworm larva feeding on white spruce needles. Webbing and frass develops as they feed.

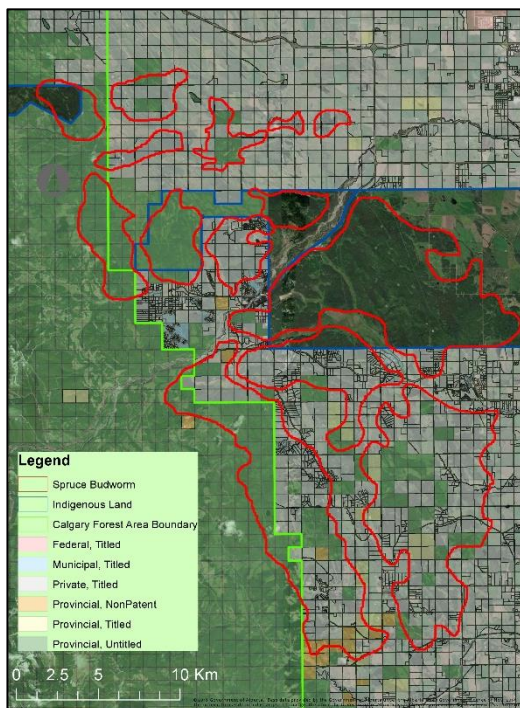


Figure 4. Extent of spruce budworm infestation mapped in July 2021 southwest of Calgary.

## Current status

Much of the time SBW populations are small and unnoticeable - populations are held in check by diseases, birds, insect predators and weather events (e.g. late spring frosts, cool wet summers). Nevertheless SBW can undergo periodic increases in population size. These increases are temporary and occur at various spatial scales, from local to landscape. Outbreaks in Alberta have been restricted to northern forests where the last outbreak started in 2008 and collapsed in 2011 after a late spring frost.

Alberta Agriculture and Forestry (AF) conducts aerial surveys annually to map forest damage on crown land within provincial forest areas. AF will expand the survey in 2021 to cover portions of municipal land adjacent to the forest area in southern Alberta (Fig. 4). SBW populations have been growing within small regions of southern Alberta for the past several years. Since 2018, the infestation has been light-moderate in areas adjacent to the forest area but in 2021, populations around Bragg Creek increased to moderate-severe (Fig. 4). Isolated populations have also been noted in the Sundre region - the extent of defoliation will be assessed in late July. Minimal defoliation has been observed within the Calgary and Rocky Mountain House Forest Areas.

AF recognizes that periodic insect outbreaks are natural events that are critical to maintaining forest health. Although the damage is alarming, it will not cause immediate tree mortality. AF will continue to monitor the situation and provide affected municipalities with guidance on an integrated management approach for SBW.