

Large Aspen Tortrix

Yukon Forest Health —
Forest insect and disease

11



Yukon

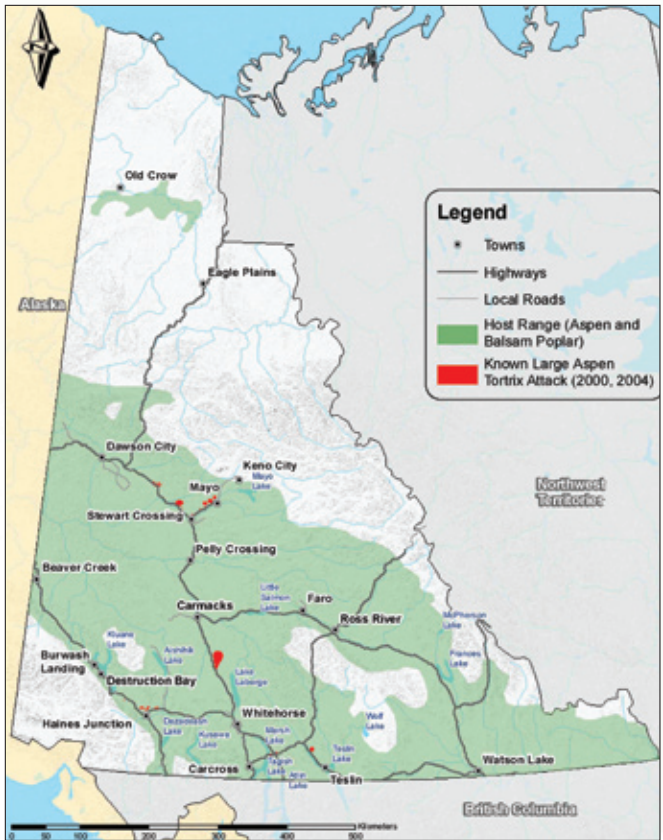
Energy, Mines and Resources
Forest Management Branch

Introduction

The large aspen tortrix (*Choristoneura conflictana*) is a native defoliator of trembling aspen (*Populus tremuloides*) throughout aspen's range in Yukon. Populations periodically reach outbreak levels that persist for up to two years. Outbreak damage results in severe defoliation, branch dieback and gnarly, stunted tree form. Successive years of outbreak can result in extensive tree mortality. Natural factors such as harsh weather, predation or depletion of available food sources usually keep populations in check.

Severe large aspen tortrix infestations were first recorded around Teslin Lake in the early 1980s and these outbreaks caused extensive tree mortality. Severe defoliation of trembling aspen was recorded near Braeburn in 1998 and around Haines Junction in 2000 but the populations collapsed in 2001. Since then, large aspen tortrix populations have been in decline, coinciding with the rise in aspen serpentine leafminer (*Phyllocnistis populiella*) populations. This suggests that the effects of interspecific competition and/or climate change are less advantageous to the tortrix. In Alaska, the ten-year tortrix cycle ceased in the early 1980s, coinciding with when mean annual temperatures began to increase.

Host Range for Large Aspen Tortrix



(Source data: Yukon Government Forest Inventory Data [2008] and U.S. Geological Survey [1999] Digital representation of "Atlas of United States Trees" by Elbert L. Little, Jr. (<http://esp.cr.usgs.gov/data/little/>)
Disclaimer: The data set for historic incidence is likely incomplete and only extends from 1994–2008. Endemic or outbreak populations may have occurred or may currently exist in non-mapped locations within the host range.

**Forest Health Program
Forest Management Branch
Energy, Mines and Resources
Government of Yukon
P.O. Box 2703 (K-918)
Whitehorse, YT Y1A 2C6**

867-456-3999

Toll free in Yukon: 1-800-661-0408, ext. 3999

www.forestry.emr.gov.yk.ca

Life Cycle

STAGE	Winter			Spring			Summer			Fall			W
	J	F	M	A	M	J	J	A	S	O	N	D	
Egg													
Larva	Overwinter												
Pupa													
Adult							Flight						

In Yukon, the large aspen tortrix completes its life cycle in one year. Adult moths emerge from late June to July. The eggs are laid in groups on the upper side of the leaf and hatch after approximately ten days. First instar larvae feed heavily on leaves, often resulting in the skeletonization of the upper surface. In late August, larvae move to protected areas of the tree (e.g., bark crevices, dead bark, or mossy stems and branches) and construct spun shelters in which they overwinter as 2nd instar larvae.

The following spring, larvae emerge and commence feeding on buds and new leaves. The 3rd instar larvae continue feeding heavily on new foliage and buds before rolling a leaf into a shelter (**photo 1**). It is at this stage that most of the damage occurs. The larvae pass through the remaining three instars within the leaf roll and, after consuming much of their shelter, pupate in mid-June. Adult moths emerge one to two weeks after pupation.

Definitions:

Instar: the stages in the growth of a larva before it pupates.

Host Species Attacked and Damage

Tree species attacked in Yukon: All age classes of trembling aspen are susceptible. During periods of outbreak this species may also feed on other broad-leaved trees such as balsam poplar (*Populus balsamifera*).

When larvae first begin feeding on a tree, the damage is generally limited to skeletonised leaves. Damage tends to be more pronounced in the second year of an infestation when the post-second instar larvae feed on emerging buds, new leaves and finally within rolled leaves. At this stage the leaves of the trees are often clumped and the crowns appear ragged (**photo 2**). Heavily defoliated trees normally flush a new set of leaves in late June or early July following the cessation of larval feeding, but the new leaves are small in comparison to the original set of leaves. Heavy and repeated defoliation leads to branch dieback, stunted growth and, occasionally, tree death. Mortality is more commonly seen in understory trees or otherwise suppressed trees. Outbreaks can occur over large areas (**photo 7**).

Key features for identification:

- Oval shaped eggs are green and from 0.7-1.0 mm diameter and are laid in clusters on the upper leaf surface (**photo 3**).
- Larvae (15-21 mm long) are grey-green to almost black and have dark head capsules. They can be recognized by the four distinctive black spots on each body segment (**photo 4**).
- Pupae are green then turn brown-black. Pupal shells can often be seen at the edges of rolled leaves following adult emergence (**photo 5**).
- The moth is gray with brownish markings on the forewings. The adult wingspan is 25-35 mm (**photo 6**).
- Trees, especially those in the understory, can be draped with heavy webbing during severe outbreaks.

Photo number:

1. **Rolled leaf.** Citation: Thérèse Arcand, Natural Resources Canada, Canadian Forest Service.
2. **Tree damage.** Citation: Thérèse Arcand, Natural Resources Canada, Canadian Forest Service.
3. **Egg mass.** Citation: Thérèse Arcand, Natural Resources Canada, Canadian Forest Service.
4. **Larva.** Citation: Thérèse Arcand, Natural Resources Canada, Canadian Forest Service.
5. **Pupa.** Citation: Thérèse Arcand, Natural Resources Canada, Canadian Forest Service.
6. **Adult moth.** Citation: Thérèse Arcand, Natural Resources Canada, Canadian Forest Service.
7. **Stand level damage.** Citation: USDA Forest Service, Rocky Mountain Region Archive, Bugwood.org







Similar damage

The large aspen tortrix is one of several defoliators of aspen in Yukon. Aspen defoliation can also be caused by the aspen serpentine leafminer (*Phyllocnistis populiella*). Damage caused by this insect is a distinctive translucent, snake-like mining pattern with a black line down the middle. The willow blotchminer (*Micrurapteryx salicifoliella*), aspen blotch miner (*Phyllonorycter populiella*) and Bruce spanworm (*Operophtora bruceata*) can cause damage similar to that caused by the tortrix. If pupal casings are seen at the edges of rolled leaves, small egg masses are present on the foliage, hibernation shelters are found on stems and branches, and heavy larval webbing occurs in the understory, then the damage is likely caused by the tortrix.

Risk Assessment

The following sections summarize the likelihood of occurrence and magnitude of impact of an outbreak at the stand level. These sections are a coarse guide for estimating the risk of an outbreak when populations are at endemic levels.

Likelihood of Occurrence

Defoliator outbreaks tend to be cyclical and, beyond the presence of the host species, are not necessarily linked to specific environmental, climatic or stand conditions that enable an approximation of the likelihood of occurrence. However, physiological stress in host trees influences susceptibility and defoliator populations can be negatively or positively impacted by environmental, climatic or stand conditions. For example, late spring frosts may kill large numbers of larvae and their food source, and high winds and rainfall can delay or prevent egg laying.

Notes:

1. In this context, traditional use values considered are hunting, trapping and understory shrub/plant use. Given that large aspen tortrix outbreaks rarely cause mortality, no impact is anticipated.
2. Visual quality is negatively impacted for a brief period during the current year's attack but aspen can refoliate within several weeks (if leaves are fully consumed), so visual impact is likely to be fleeting unless mortality occurs.
3. There is no commercial harvesting of aspen in Yukon and timber productivity is not considered applicable.
4. Given that aspen can refoliate within several weeks if leaves are fully consumed, and that mortality is rare, no impact on wildfire hazard is anticipated.
5. Given that large aspen tortrix outbreaks rarely cause mortality, no impact is anticipated.
6. Given that large aspen tortrix outbreaks rarely cause mortality, no impact is anticipated.

Implications of Climate Change

General Circulation Model (GCM) results in the 2007 Intergovernmental Panel on Climate Change (IPCC) report indicate that warming in northern Canada is likely to be greatest in winter (up to 10°C) and warmer by 3–5°C in summer. Mean annual precipitation is also predicted to increase (particularly in fall and winter). More rainfall is expected on windward slopes of the mountains in the west, therefore the rain shadow effect of the St. Elias Mountains may mean that southern Yukon will not experience increased rainfall. Higher temperatures will increase levels of evaporation and transpiration, and ultimately lower soil moisture levels. Therefore, even if summer rainfall is maintained at current average levels, higher temperatures would result in limited soil water availability and cause moisture stress in trees. Temperature and precipitation are likely to be the dominant drivers of change in insect populations, pathogen abundance and tree responses as it influences insect/pathogen development, dispersal, survival, distribution and abundance. Defoliator species may benefit from warmer temperatures because of:

- higher rates of overwinter survival
- fewer late spring frost events
- longer summer season for growth and reproduction

Alternatively, if the timing of critical stages in the host (e.g., spring budburst) changes so that it is no longer in sync with key life stages of the defoliator (e.g., spring larval emergence), the defoliator population may be negatively impacted. Elevated carbon dioxide levels would likely reduce the nitrogen content in host needles/leaves, which may have either a positive or negative impact on defoliators depending on their nutritional requirements. Current climatic conditions seem to favour proliferation of the aspen serpentine leafminer to the detriment of the tortrix.

Management Options

Monitoring

Large aspen tortrix activity can be viewed from both aerial and ground surveys. The best time of year for monitoring is late June following the cessation of larval feeding but before the flush of new leaves. For efficiency, ground-based and aerial monitoring should be focused in aspen leading stands. For aerial survey standards, refer to 'BC Aerial Survey Standards' (MoF, 2000). For strategic planning information, refer to the Forest Management Branch risk-based monitoring strategy (Ott, 2009).

Direct Control

Direct control is generally not recommended as there are many natural control agents for large aspen tortrix and infestations tend to collapse within several years. In high-use areas such as campgrounds or high value trees, direct control methods have been used successfully, including Bt (*Bacillus thuringiensis*) insecticide spray or placing a sticky strip around the trunk (about one metre above the ground) to intercept the larvae as they make their way toward the buds in May or toward their overwintering sites in August.

References

Cerezke, H. F. 1992. *Large aspen tortrix*. Nat. Resour. Can., CFS. For. Leaf. 21: http://nofc.cfs.nrcan.gc.ca/bookstore_pdfs/11657.pdf

B.C. Ministry of Forests. 2000. *Forest health aerial overview survey standards for British Columbia*. B.C. Forest Service. 46 pp.

Garbutt, R. 1998–2001. *Yukon Forest Health Reports*. Unpublished reports prepared for the Department of Indian Affairs and Northern Development.

Garbutt, R. 2002–2009. *Yukon Forest Health Reports*. www.emr.gov.yk.ca/forestry/foresthealth.html

Holsten, E.; Hennon, P.; Trummer, L. and Schultz, M. 2001. *Insects and Diseases of Alaskan Forests (eBook)*. USDA Forest Service, R10-TP-87. 207 pp: www.fs.fed.us/r10/spf/fhp/idbook/

Ostry, Michael E.; Wilson, Louis F.; McNabb, Harold S., Jr.; Moore, and Lincoln M. 1988. *A guide to insect, disease, and animal pests of poplars*. USDA Agric. Handb. 677: www.forestpests.org/poplar/

Ott, R.A. 2009. RAO Ecological Consulting Services. *Development of a Risk-Based Forest Health Monitoring Program for the Yukon*. 33 pp.

Snyder, C.; Schultz, M.E. and Lundquist, J. (Compilers). 2007. *Forest Health Conditions in Alaska*. USDA Forest Service, Alaska. Protection Report R10-PR18: www.fs.fed.us/r10/spf/fhp/cond_rept_links.htm

Werner, R. 2007. *Climate warming in Alaska: effects of climate change on forest insect populations*. Page 27 in *Climate change impacts on boreal forest disturbance regimes; Conference program & abstracts. Disturbance dynamics in boreal forests, VI International Conference, Fairbanks, Alaska, 30 May – 2 June.*





www.forestry.gov.yk.ca