Government of
Northwest Territories

Forest Health 2021

Every year, we check in to see how the NWT's forests are doing.
Here's a rundown of the numbers, trends, and highlights from 2021.

By the numbers: NWT forest health

- 80 million hectares (ha) of forested land in NWT
- 14 million ha surveyed
- 17% of surveyed area affected by forest health issues
- 95% of forest health issues occurred in the Dehcho and South Slave Regions

Pest and disease disturbance trends (compared to 2019)

- Spruce budworm – 80% increase
- Aspen defoliators – 45% increase
- Willow defoliators – 12% decrease
- Fungal diseases – 90% increase

Things to watch

Spruce budworm outbreak in the southern NWT

Eastern spruce budworm (*Choristoneura fumiferana*) is a native forest insect pest in the NWT and an important part of a boreal forest life cycle. Typically, populations of this insect are at endemic (low) levels and are rarely noticed. However, population numbers can sometimes build up and erupt into outbreaks that can result in the loss of leaves or needles over a large area of forest.

Affected trees can die if that a large loss of leaves and needles occurs over 5-7 consecutive years.

That sounds bad, but it's not *all* bad. Disturbances like this help the forest to renew itself by releasing nutrients stored within dead trees. Infestations also eliminate sick and aging trees, reducing competition among trees and helping that ecosystem support new life.

Figure 1. Spruce budworm pupa observed on larch, a tree species normally not affected by this pest.

Climate change and spruce budworm populations

Forest insect populations are influenced by environmental conditions (such as winter temperature, growing season temperature and precipitation), and climate change is expected to alter natural cycles.
Spruce budworm outbreaks usually happen every

30-40 years and can last up to 10 years. Warming weather trends accompanied by altered precipitation patterns may cause outbreaks to occur more frequently or last longer. In the NWT, there were two major outbreaks since records have been kept. Approximately 1.4 million ha of forests lost needles in 1959, and almost 2.7 million ha in 2002.

The current outbreak is happening in about half as much time as we expected it would have – about 20 years since the last outbreak, rather than 40. This change to the cycle may or may not be significant. We will continue to monitor to improve our understanding.

How did it start?

The first signs of the most recent outbreak in the NWT started in 2020 with over 107,000 ha of white spruce dominated forest being defoliated in the two southern regions: South Slave and Dehcho. In 2021, the area affected increased almost ten times, with a total defoliation of 1.09 million ha.

How did it start?

Most of the mapped damage was severe or moderate, meaning that over 50% of the needles produced in the spring were consumed by the spruce budworm larvae. High abundance and activity of the pest was noticeable around many South Slave communities (Hay River, Fort Resolution, Enterprise, Fort Smith), as well as several communities in the Dehcho (Fort Simpson, Fort Liard). People could easily see the reddening spruce tops along major highways in the southern NWT. This year's spruce budworm population levels were so high that the larvae were also found feeding on tamarack and black spruce, the species normally not affected by this pest.

What next?

It is expected that this outbreak will persist in the South Slave and Dehcho for a few years, and then recede back to a lower level. The GNWT will continue tracking the extent and severity of the current infestation on an annual basis but since it is a natural phenomenon, no control effort is considered at this point.

Events such as the current outbreak provide ENR with valuable data on the natural disturbance regime, and potential impacts of a changing climate.

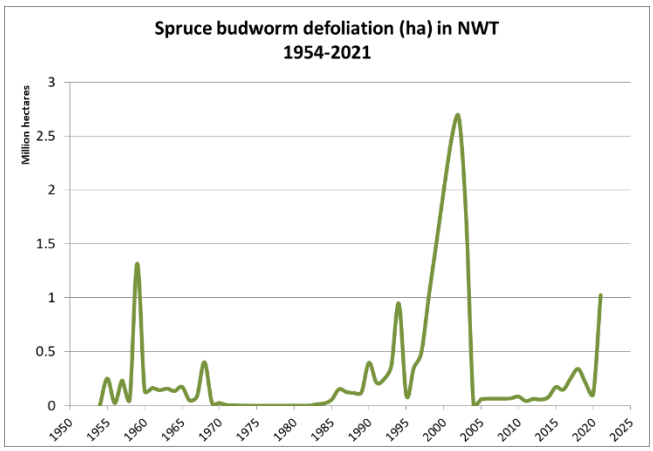

Figure 2. Long-term record of spruce budworm defoliation in the NWT. Typically, outbreaks of this pest occur at 30-40 year intervals. The current outbreak in the South Slave and Dehcho is occurring after 20 years since the last one.

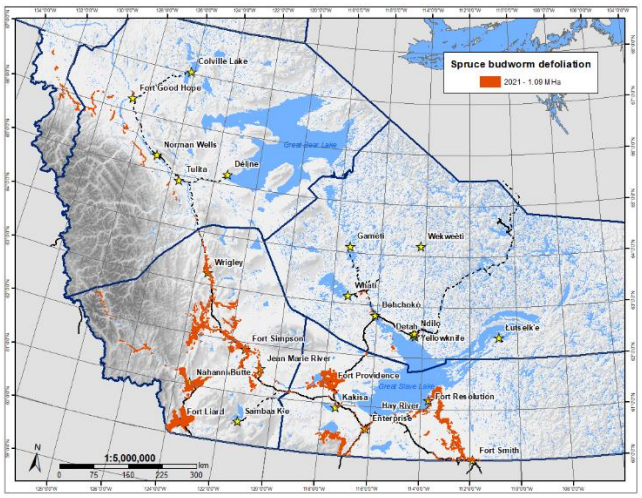

Figure 3. Extent of the spruce budworm defoliation observed in 2021.

Extreme winds flattened large area of forest in the southern Dehcho

When severe winds hit a forest, it can sometimes result in an event called a "blowdown".

A blownown is when severe winds are so strong that they uproot and knock over trees in a forest. One of the largest areas of blownown ever recorded

in the NWT (over 20,000 ha) occurred on June 29 west of Sambaa K'e. In the most severely impacted areas, forests mostly filled with Aspen trees were completely flattened with trees falling in all directions, often in a circular pattern.

In other areas, trees were left standing with leaves and needs stripped and broken branches. There were also signs of hail happening alongside the high winds.

The swath of damage extended for approx. 70 km west of the southern tip of Trout Lake towards the southeast. In the widest point, the swath was approx. 9 km wide.

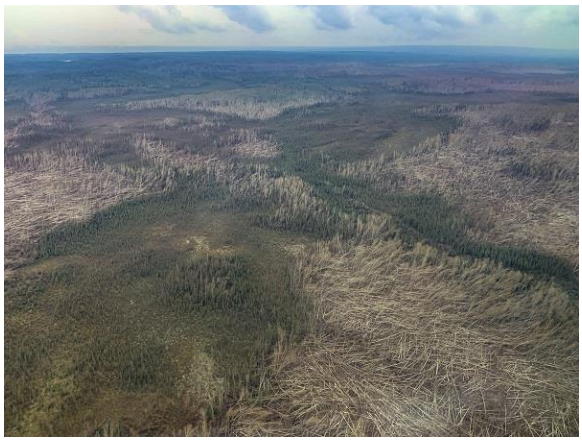

Figure 4. Aspen trees damaged in the extreme wind event west of Samba K'e.

The extreme winds, estimated by the Northern Tornadoes Project to have reached up to 190 km/h, were a direct result of the ongoing heat dome which affected western Canada in the last week of June 2021.
The Sambaa K'e event was classified as a series of overlapping downbursts.

A downburst is a strong, ground-level wind that originates from a point aloft, most often a thunderstorm (see Figure 5). The winds in such events usually blow in straight lines, in all directions from the point of contact at ground level. Generally, once the downburst core hits the ground, a series of ring vortices would fan out from the center causing winds to move from the impact point in a chaotic manner and sometimes creating a circular pattern in damage.

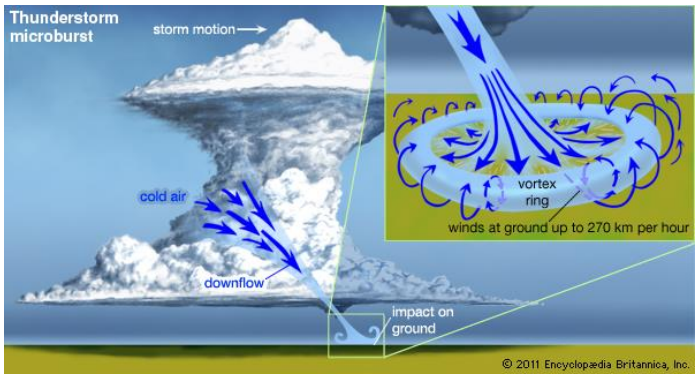

Figure 5. Diagram showing the mechanics of a microburst (downburst). According to the Northern Tornadoes Project, a series of overlapping downbursts caused the damage in the Dehcho.

It is worth noting that the vast majority of trees affected by this wind event were aspen trees. This species has been experiencing a general decline in that area caused by combined effects of:

1. Droughts (1995-96, 2014-15)
2. Long-term loss of leaves because of the Aspen Serpentine Leaf Miner – a type of moth which eats Aspen leaves.
3. Local changes in water tables
4. Mature and over-mature status of collections of Aspen trees

All of this is leading to weaker Aspen trees in the NWT, which are then more likely to be affected by major wind events like blowdowns.

New pest complex impacts aspen in the Dehcho

Larvae (caterpillars) of at least three moth species

were causing damage to leaves in aspen forests, mostly in the southern Dehcho region. The three species were feeding at the same time, but depending on the area, different primary agents were identified as: 1) aspen two-leaf tier (*Enargia spp. Poss decolor*), large aspen tortrix (*Choristoneura conflictanta*), and aspen leaf roller (likely *Pseudexentra oregonana*). The vast majority of affected area (99%, 190,000ha) was dominated by aspen two-leaf tier as the main primary agent with the other two as additional agents.

Defoliation caused by all three abovementioned pests occurred in stands already affected by aspen serpentine leafminer – another prevalent pest of aspen. In many cases, there was evidence of activity of four different agents feeding on the same tree. Similar outbreaks of the same pest complex were also reporter in northern Alberta.

Figure 6. Aspen two-leaf tier builds cases from two leaves bound together (left). Pupa (developmental stage) of large aspen tortrix as observed in this aspen defoliation complex. Both agents are accompanied by aspen serpentine leafminer (maze-like pattern on leaves).

Young two-leaf tier larvae feed inside rolled leaves. As they mature, they begin feeding on the edges and outer surfaces of the leaves, and mature larvae construct their shelter by tying the flat surfaces of two leaves together. A serious infestation may result in the complete defoliation of the host tree; however, severe damage is rarely caused because outbreaks are usually short-lived.

Large aspen tortrix larvae mine into the buds and can destroy bud and leaf tissue. As they mature, they feed within rolled leaves or within two or more leaves pulled together and secured with silken webbing which serve as a shelter for pupation. The empty pupal cases are often found protruding from the rolled leaves or leaf clusters, as seen in the photo above.
Pests which cause damage or loss of leaves are called defoliators. Defoliators rarely cause trees to die, but they can significantly decrease a tree's ability to produce sugars through the process of photosynthesis.

Aspen trees usually react to defoliation by producing second flush of buds but resulting leaves are often too small to compensate for the loss of the first flush of leaves. If defoliation occurs each year for many years, trees become weakened and vulnerable to other pests and environmental factors such as drought.

Another wet growing season in the South Slave

Southern parts of the territory, especially the South Slave region experienced the fourth consecutive wet spring and summer with excessive rain leading to local flooding along the shores of Great Slave Lake and countless smaller lakes and rivers.

The weather station at the Hay River airport recorded 180% of normal summer rain. Slightly more than average rainfall was also recorded in Fort Simpson (105%).

With the exception of wildfire, flooding and tree mortality caused by high water tables have been the most important source of environmental

disturbance in the NWT forests in the last five years. While some tree species such as black spruce, bog birch, or tamarack can tolerate high soil moisture content and are often found growing in treed wetlands (e.g. muskegs), most trees prefer well drained soils and will not tolerate prolonged periods of roots drowning beneath the water table.

During aerial surveys, it is common to see the sunlight reflecting through the canopy of the forest – clear evidence of standing water on the forest floor. Many lowland areas have been flooded recently causing trees to die in the upland areas -- dead grey trees can be seen in the forks of the overflowing stream.

Interesting finds

Thaxter's pinion (Lithophane thaxteri) – the larva of this species feed on various tree hosts but they can also be carnivorous, feeding on other insects such as sawflies. Observed on larch near Enterprise.

Pitch nodule maker (Petrova albicapitana) –larvae of this moth species tunnel through the twigs of young pines causing the pitch to flow freely. They use the pitch to build the protective structures (nodules) over their tunnels where they feed.