Forest Health NEWS

Government of
Northwest Territories

2019

Wet and cool summer hampered pests but boosted other physical disturbances

Yellow-stressed trees due to high water tables were a very common sight in the NWT in summer 2019.

Forest health monitoring in the Northwest Territories (NWT) is conducted on an annual basis. Typically, over 20 million hectares (25 per cent) of forested land are surveyed each year, primarily in areas occupied by mature spruce forests. These areas have been traditionally affected by the most serious insect pest in the NWT – spruce budworm (*Choristoneura fumiferana*). In recent years, aspen forests in the Dehcho and South Slave Regions have also been the subject of more detailed monitoring due to signs of a widespread decline. During forest health surveys, abiotic disturbances such as flooding, land sliding and slumping, drought, blowdown and species decline is also mapped. Tracking annual variations in natural disturbances allows for a better understanding of the effect of a changing climate on NWT forests.

The 2019 growing season was unusually wet and cool. Unseasonably warm weather in March and April triggered the early development of many insect pest species, but a cold snap in early May was likely the cause of a noticeable decline in pest and disease disturbances. All main insect and disease agents except for the aspen serpentine leafminer (*Phyllocnistis populiella*) declined significantly compared to 2018 levels. It is worth noting that all insect and disease agents observed were native to the NWT. As such they generally cause the trees health to decline and only rarely cause mortality.

The decline in observed damage was not consistent in all regions. Spruce budworm defoliation was low in the Dehcho and South Slave Regions but high in the Sahtú and along the Arctic Red River in the Beaufort Delta. It is suspected that the northern populations of this pest are less affected by rapid changes in weather patterns due to their cold climate adaptation. Some pests, like aspen serpentine leafminer, did not seem to be affected at all by the unusual temperatures, with a record breaking defoliation area noted in 2019.

NWT FOREST HEALTH IN NUMBERS

80 million hectares of forest in the NWT

20 million hectares are surveyed on an annual basis

1.15% of forested area affected by forest health issues

76% of forest health issues occurred in the Dehcho Region

MAJOR PEST POPULATION TRENDS*

SPRUCE BUDWORM	ASPEN SERPENTINE LEAFMINER	WILLOW BLOTCH LEAFMINER	TENT CATERPILLARS
48% decrease	76% increase	82% decrease	99% decrease

*Compared to 2018 population levels

Wet summers generally favour the development of fungal diseases. In 2019, increased activity of willow rusts was noted; however, cool summer temperatures hampered the activity of other common rusts, most notably the spruce needle rust which was abundant in the equally wet summer of 2018.

Wet conditions also seemed to induce more abiotic disturbances on the landscape. Abiotic disturbances like flooding, drought and blowdown are caused by environmental factors such as warming temperatures or climate anomalies and inclement weather events. Some permafrost thaw related damages such as slumping or the loss of root stability also often lead to what's called 'drunken forest'. Abiotic disturbances have received significant attention over the last five years and are becoming increasingly prevalent on the landscape across the NWT.

The most important abiotic disturbance noted in 2019 was tree stress and mortality caused by high water table issues and flooding. Large areas of yellow stress (yellowing of needles in conifers) were observed in all regions but especially evident in the Sahtú and Beaufort Delta regions. Excessive rain saturating the soil column is suspected to be the main cause of this stress. Heavy rains were also the main cause of extensive flooding along the Slave River in the South Slave Region, increased slumping activity along the Mackenzie River between Tulita and Fort Good Hope, as well as along the Arctic Red, Hume, and Carcajou Rivers.

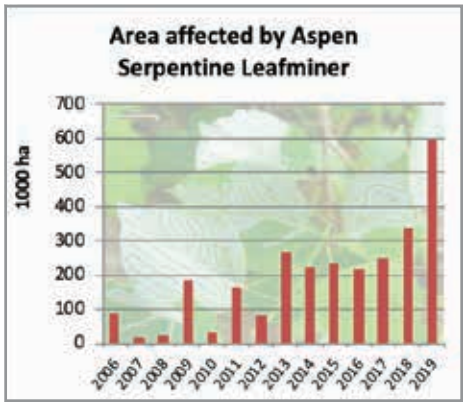
Signature northern pest – Aspen Serpentine Leafminer

Aspen serpentine leafminer larva mines the leaf of trembling aspen leaving a characteristic snake-like trail. Source: inaturalist.ca ©k8thegr8.

The damage caused by this pest is easily recognizable. When seen from the air, affected trees look like they are covered with ash with leaves having a silvery hue instead of their usual rich green. Closer examination shows whitish, snake-like trails on the leaves. This is the work of the aspen serpentine leafminer (*Phyllocnistis populiella*) larvae which feed on the delicate epidermis tissue leaving the outer structural layers of a leaf untouched. This kind of feeding manner is called mining. The tiny (1 mm in length) larvae feed individually on one or both sides of the leaf mid-rib and the mining path contains a conspicuous black line of frass (a mixture of fecal matter and chewed plant debris).

During periods of severe outbreaks, up to 75 per cent of the photosynthetic area of the affected tree can be impacted. This results in an overall decrease in productivity but rarely causes tree mortality. During successive years of defoliation top-kill and branch die-back may occur. Though tree mortality seldom occurs as a result of leafminer activity alone, it can occur when the activity of the leafminer follows a severe outbreak of other defoliators such as large aspen tortrix or forest tent caterpillar. In addition, severe drought events or other local stresses such as flooding or high water table can exacerbate the impact of aspen leafminer.

So how can the aspen serpentine leafminer impact an entire stand of trees? Trembling aspen (*Populus tremuloides*), the most common leafminer host tree, often regenerates by suckering, meaning that the cluster of neighboring trees grows from one big root mass. Roots provide water and nutrients to the leaves. On the other hand, leaves photosynthesize sunlight and send this energy to feed the roots. If the leafminers affect the leaves' ability to photosynthesize, the root mass will suffer and in turn will have less ability to support the trees. Although these large root systems have tremendous reserves, they cannot keep providing nutrients without sufficient energetic input from above. The entire cluster of trees will be affected.



Aspen serpentine leafminer (ASL) is one of the most prevalent pests in the NWT. The extent of defoliation practically matches the current aspen range in the territory, making it one of the most "successful" pests in the North. The area affected by ASL has been consistently growing over the last few years reaching almost 600,000 hectares in 2019. There is little information available on the typical duration of leafminer outbreaks but the NWT outbreak seems prolonged since it has been occurring for approximately 20 years. Given the current spread of this pest, it is safe to assume most aspen stands in the NWT suffer some level of damage on an annual basis.

Defoliator outbreaks tend to be cyclical and are not necessarily linked to specific environmental, climatic, or stand conditions. However, physiological stress in host trees can influence susceptibility. For example, late spring frosts can kill a large numbers of larvae and their food source while warm and dry weather helps improve insect population survival. Interestingly, despite 2019 being a wet and cool year with some cold snaps in late April/early May, aspen serpentine leafminer populations were the highest on record in the NWT. The consistently increasing populations of this pest could be a sign of its ease to adapt to a changing climate in the North. Being one of the few broadleaf tree species present in the NWT, aspen plays a significant ecological role and is an important northern landscape component. The long-term ramifications of prolonged ASL outbreaks in NWT forests remain uncertain; therefore, consistent monitoring is required to track changes in aspen condition on an annual basis.

Silver-hued leafminer defoliation on aspen contrasts with rich green birch stands in the northern Dehcho.

PICASSO OF THE WOODS

Serpentine Leaf Miner
Artist on a tree
Your path you trace on aspen leaves
Most exquisitely
How is it you're called a "pest"
With work that is so fine
Decorating every leaf
With a lovely, squiggly line
Even if you cause some harm
You don't go on killing sprees
In that regard you pale compared
To other insects or disease
So Phyllocnistis populiella
Your craft's a guilty pleasure
The artistry is there to see
And the damage hard to measure

By Tom Hutchison,
Alberta Agriculture and Forestry

Interesting observations

The first case of Armillaria Root Disease found in the NWT's South Slave Region.

- First record of Armillaria Root Disease (*Armillaria ostoyae*) was noted on a young pine in the South Slave Region. Armillaria Root Disease is caused by the pathogenic fungus attacking roots and lower stems areas of several common tree species, both conifer and broadleaf. Armillaria is a fungus present in soil that becomes active when unfavourable growing conditions exist for the tree. These can include drought, soil compaction, nutrients deficiencies, or insect defoliations. The disease causes sapwood decay leading to tree mortality.

- Western Balsam Bark Beetle (*Dryocoetes confusus*) is the most serious pest of subalpine fir. Scattered mortality caused by this pest has been observed in the southern ranges of the Mackenzie Mountains in the Dehcho since 2010. The greatest concentration of damage is visible on the southern slopes of Mount Cody near Fort Liard. In 2019, there were 937 ha affected in total. Western balsam bark beetle has been in an outbreak phase throughout the range of subalpine fir in British Columbia and Alberta for over a decade now.

Scattered fir mortality caused by western balsam bark beetle on the southern slopes of Mt. Cody, Dehcho.

Investigations of the Mackenzie Delta spruce mortality

The Mackenzie Delta is Canada's largest delta. It is an intricate network of stream channels, small ponds, and alluvial uplands covered with white spruce forests. Dense and relatively vigorous stands at the south end of this unique ecosystem gradually become open and stunted towards the north, finally giving way to treeless dwarf birch shrublands near the Beaufort Sea. In the southern parts of the Delta, tall closed spruce stands have dense green alder and willow understories with prevalent herb and a feather moss ground layer growing on fine textured soils underlain by permafrost that extends below the rooting zone. On higher terraces and further north, permafrost is closer to the surface. Spruce stands become open and stunted, and dwarf birch, low growing alder and cloudberry become the main understory species.

Over the last few years, an increasing occurrence of spruce mortality has been noted in some stands that grow in the transition zone between dense, richer sites with deeper permafrost to the more open areas with shallow permafrost. Aerial and ground investigations revealed areas of decline and dieback that seem to radiate out from the centre of the islands. In some cases, there is a distinct line marking a vegetation change between the healthy and unhealthy areas. The observed damage is suspected to be high water table related, possibly due to fluctuating thawing permafrost and high water tables in the Delta channels. Many areas have trees falling over into the water. This seems to be also caused by high water tables in the channels, assisting in melting icebound root systems on the shorelines.

Roger Brett (CFS) and and Hayley Smith (ENR summer student) collect tree core sample from one of the affected trees in the Mackenzie Delta.

Spruce mortality observed in the Mackenzie Delta south of Aklavik. Mortality appears to be radiating out from the centre of upland areas towards the channel shores.

On July 19, 2019, ground investigations were carried out in one of the affected locations. The Beaufort Delta ENR office organized access for a team consisting of Hayley Smith (summer student, ENR Beaufort Delta), Roger Brett (Canadian Forest Service, CFS), and Jakub Olesinski (ENR Forest Management) to reach the site southwest of Aklavik. Observed tree symptoms included dead tree tops and branches, as well as foliage discoloration. Confirming aerial observations, mortality and evidence of ground water (frozen at the time) was higher closer to the centre of lowland areas.

A few sample tree cores were collected at the site. They will be analyzed by the Canadian Forest Service to provide additional information on tree ages and potential changes of growth patterns in recent years. The Mackenzie Delta will be monitored on an annual basis to track the status of affected areas and to discover any potential new areas with similar symptoms.

For more information on the forest health program in the NWT, please contact: Jakub Olesinski, Forest Ecologist • Forest Management Division – Environment and Natural Resources
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