Government of Northwest Territories Gouvernement des Territoires du Nord-Ouest

2018
Northwest Territories Forest Health Report

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1. Forest Health Program in the Northwest Territories

Background

The Forest Management Division (FMD) of the Department of Environment and Natural Resources (ENR) is responsible for monitoring forest health conditions across the NWT to ensure the forest has the capacity for renewal after a wide range of disturbances, and is able to retain its ecological resiliency while meeting the current and future needs of NWT residents. The focus of the forest health program has been on monitoring insect and disease impacts in the NWT forests. However, since 2015, FMD has also been recording abiotic disturbances to address the uncertainty of forest ecosystem response to a changing climate. Examples of abiotic disturbances recorded during monitoring surveys include: drought symptoms (reddening of foliage, sun scalding scars, stunted and gnarled foliage), flooding, wind and snow damage, land slumps and permafrost related disturbance (i.e. “drunken forest” phenomenon). General decline of some tree species is also tracked. In cases where a biotic agent cannot be identified, it is considered to be of abiotic origin.

Since 2009, annual forest health surveys have been conducted by FMD staff, assisted by the Canadian Forest Service (CFS). In 2018, the aerial surveys were conducted by Jakub Olesinski (ENR) and Roger Brett (CFS). Brent Starling, a Forest Officer from ENR’s South Slave Region, also participated in surveys conducted in the South Slave.

Monitoring scope

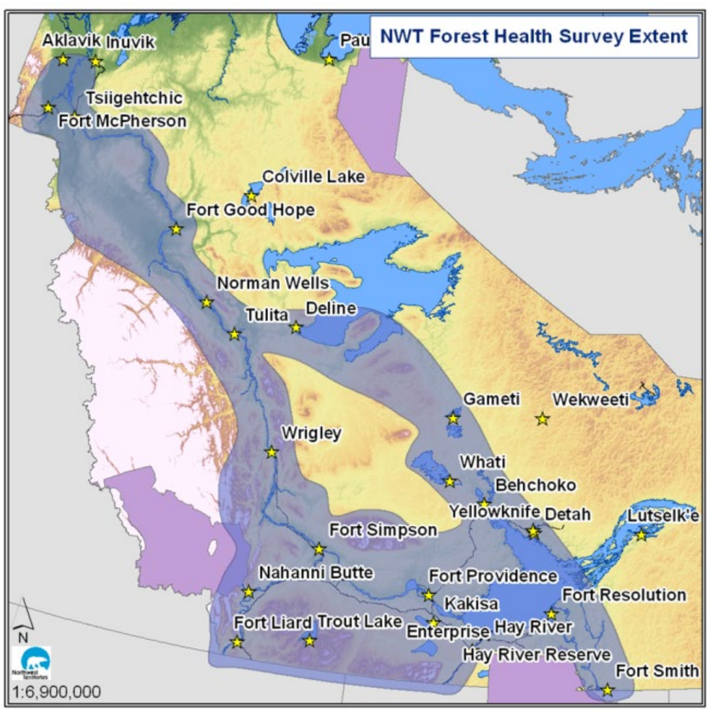

Figure 1: Forest Health monitoring extent in the NWT

Forested land in the NWT encompasses nearly 800,000 km^2 (larger than any European country except for Russia); therefore, it’s necessary to prioritize areas surveyed annually. Traditionally, areas occupied by mature spruce forests have been a priority because of their significance as the preferred host for the most serious insect pest in the NWT – the Spruce Budworm (*Choristoneura fumiferana*) (SBW). These areas extend along major rivers and waterways, including the Mackenzie, Liard and Slave Rivers and their main tributaries, as well as the foothills of the Mackenzie Mountains and slopes of the Cameron Hills, Marten Hills and Ebbutt Hills. Since 2015, monitoring has been extended to include the Mackenzie Delta. This decision was triggered by the discovery of the SBW outbreak in this sensitive region.

Methods

Aerial detection

Monitoring is mostly conducted through aerial detection mapping using fixed-wing aircraft. Helicopter is used when ground verification is required in areas with limited road or water access. Disturbed areas are digitally mapped using a tablet with ESRI Arc Pad 10 software. Insect and disease agents are usually identified on site. However, in some cases, samples are collected and taxonomic identifications are made at the CFS Northern Forestry Centre lab in Edmonton.

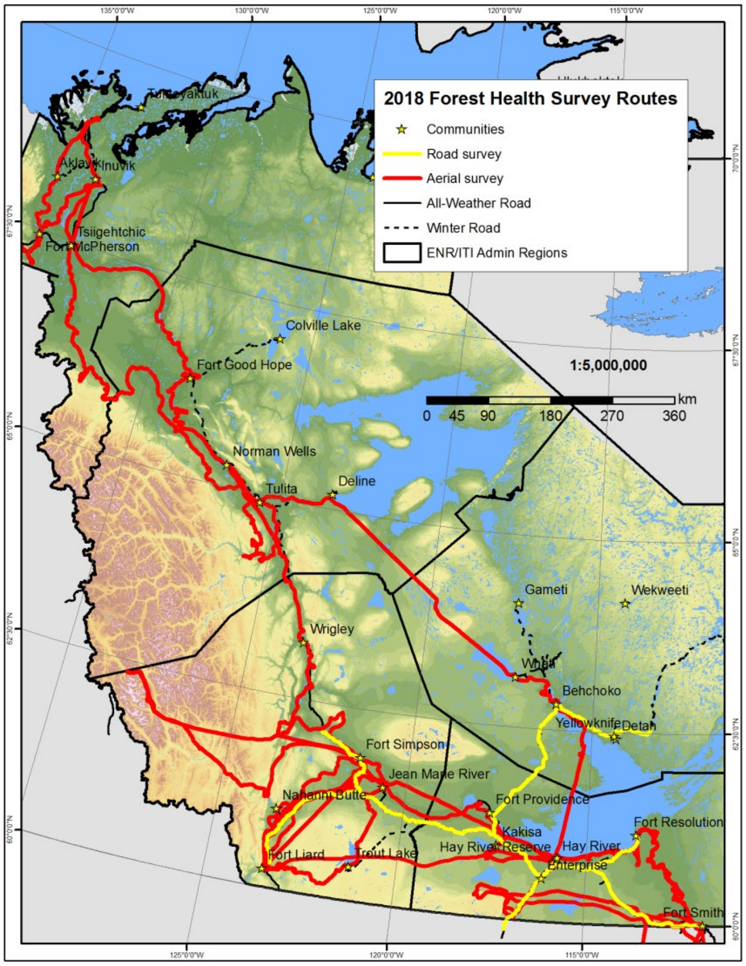

Figure 2: Forest health survey routes in 2018

Approximately 10,800 km of forest health survey routes were flown in 2018 (Fig. 2). In addition, approximately 2,000 km were flown in the Nahanni and Wood Buffalo National Parks.

Severity of defoliation and damage is also recorded during aerial surveys as an attribute associated with spatial data. Severity expresses the degree of foliage affected, or amount of mortality present in a stand, caused by the particular pest or damaging agent. In the case of defoliators or foliar damage, severity class is assessed visually as a percentage of current growth affected (Table 1), whereas with mortality agents such as bark beetles or abiotic factors, severity represents the percent of trees affected within a stand. Mortality can also result from moderate to severe defoliation reoccurring over several years, which is especially the case with spruce budworm. Other defoliators, like aspen serpentine leafminer or willow blotch leafminer, are rarely the sole cause of tree mortality despite the severe damage they cause each year. The ramifications of severity of defoliation are described below when discussing each particular pest agent.

Table 1: Defoliation severity classes and mortality severity classes used by FMD

Defoliation severity class	% of current growth defoliated (conifer)	% of current growth defoliated (broadleaf)
Light (L)	<30	<30
Moderate (M)	30-50	30-70
Severe (S)	>50	>70
Mortality severity class	**% of trees affected within a stand**	
Light (L)	<=10	
Moderate (M)	30-50	
Severe (S)	>50	

Ground surveys

Ground surveys along the major NWT highways are conducted annually. These surveys play an important role as they are often the only opportunity to confirm suspected pest agents on the ground. Ground surveys also provide opportunities for collecting samples and discovering new and emerging factors affecting forest health, often not discernable from the air.

In 2018, ground surveys were conducted by Roger Brett (CFS) in the following areas along accessible highways:

- NWT border to Hay River
- Hay River to Fort Smith
- Fort Providence to Yellowknife
- Along the Ingraham Trail
- Fort Simpson to Blackstone (Liard Highway)
- Fort Simpson to Camsell Bend
- Fort Simpson to Fort Providence
- Fort Providence to Enterprise

Pheromone trapping

Pheromone trapping is currently used to help detect presence/absence of the mountain pine beetle using dispersal baiting. Six baiting locations were established in the southern NWT. Three locations were established along the Highway 1 corridor (Alberta border to Enterprise), and three locations were established between Enterprise and Jean Marie River (Fig. 3).

In addition, the spruce budworm pheromone trapping program was reactivated in the Inuvik Region in 2017. FMD collaborated with CFS and the regional forestry staff to deploy traps in historical trapping locations along the Arctic Red River, Peel River and the upper Delta. Four sites were established with three traps per site (Fig 3).

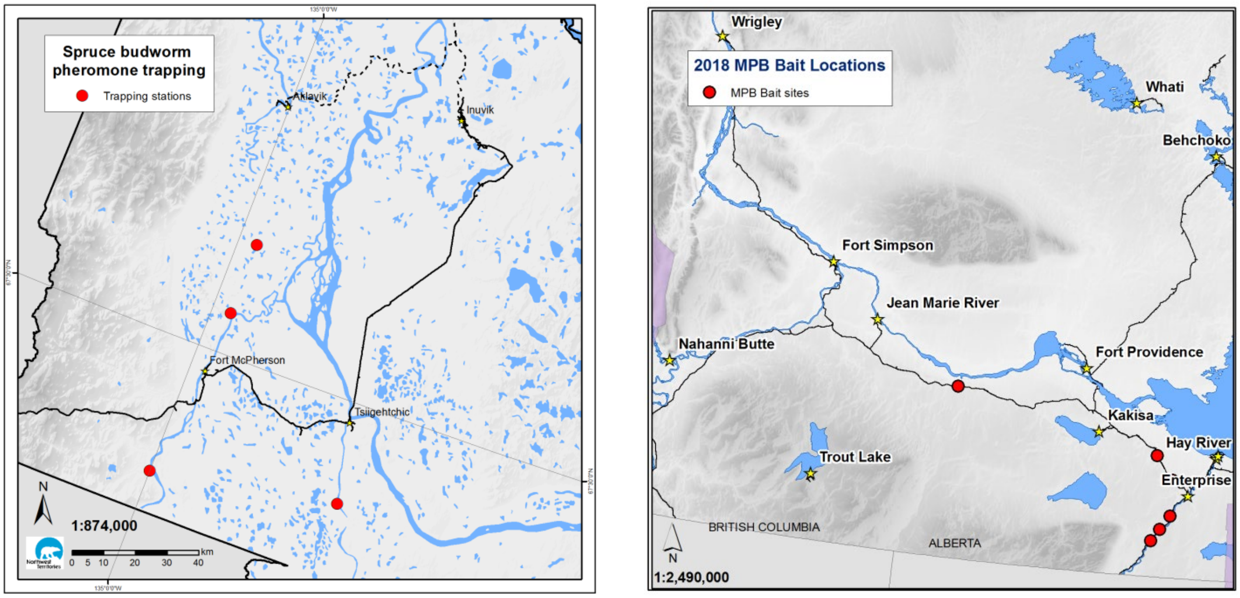

Figure 3: Pheromone trapping locations for spruce budworm in the Inuvik Region (left) and baiting locations for mountain pine beetle in the Dehcho Region (right)

Public reports

Public sightings and regional reports are an important addition to the existing body of knowledge. Renewable Resource Officers, Forest Officers and the public are encouraged to report any forest health issues that draw their attention. Each year, FMD receives inquiries with photos of various insect and disease disturbances from communities across the NWT. Public reports are important because they not only help corroborate aerial survey observations, but often help direct ground surveys.

In 2018, public reports included:

- Northern tent caterpillar (*Malacosoma californicum*) infestation in Yellowknife
- Rusty Tussock Moth (*Orgyia antiqua*) infestation in the Inuvik area
- Spruce needle rust (*Chrysomyxa ledicola*) in the Inuvik Region

Survey schedule

Aerial surveys are flown in the second half of July when the spruce budworm defoliation is most evident. Any other disturbances visible from the air are also recorded during this main pan-territorial survey. Additional surveys targeting specific pests are flown as required.

Dates of the 2018 surveys:

- June 14-21 – aspen defoliation and decline aerial survey, targeting forest tent caterpillar (*Malacosoma disstria*) in the South Slave and aspen decline in the Liard Plains
- July 13-14 – ground survey: Fort Smith – Fort Resolution – Hay River – Fort Simpson
- July 16-23 – main aerial survey coinciding with peak SBW defoliation (territorial)
- July 24-29 – ground survey (North Slave, South Slave)

2. Climate and wildfire conditions (source: 2018 Fire Weather Report)

Climate

- Very dry conditions across much of the NWT in March-April with many locations receiving below normal precipitation
- Cool conditions for most of April leading to a delayed snow melt in many areas
- Significant fluctuations of cool and very hot temperatures in May (15 maximum temperature records set at 10 different locations)
- Heavy precipitation across the southern NWT in June
- Variable conditions across the territory in July (Hay River and Fort Liard received only 30% of normal precipitation while Yellowknife continued to be unusually wet with over 210% of normal precipitation)
- Cool and damp conditions in the north, while warm and windy conditions dominated in the south for most of August

Total and Percent of Normal Precipitation: Summer 2018		May	June	July	August	Total Summer Rainfall	% of Normal Summer 2018
Fort Smith A	[redacted]	30.5	84.8	46.8	5.0	167.1	90
	[redacted]	27.8	48.8	54.5	54.5	185.6	
Hay River A	[redacted]	20.4	98.0	14.2	9.6	142.2	91
	[redacted]	23.3	31.9	43.0	58.7	156.9	
Fort Chipewyan RCS	[redacted]	19.6	59.7	33.4	13.0	125.7	66
	[redacted]	27.2	44.4	67.4	50.2	189.2	
Yellowknife A	[redacted]	11.4	114.1	86.2	38.7	250.4	197
	[redacted]	18.4	28.9	40.8	39.3	127.4	
Fort Simpson A	[redacted]	20.4	87.8	37.2	30.4	175.8	87
	[redacted]	29.4	51.3	61.1	61.4	203.2	
Liard M124	[redacted]	14.5	137.2	27.4	20.6	199.7	83
	[redacted]	41.4	59.5	83.4	55.3	239.6	
Norman Wells A	[redacted]	14.0	56.0	36.3	102.4	208.7	144
	[redacted]	19.0	42.7	41.8	41.8	145.3	
Inuvik Climate	[redacted]	33.8	3.5	57.9	60.0	155.2	142
	[redacted]	17.3	17.3	35.0	39.4	109.0	

Figure 4: Total and percent of normal precipitation (in millimeters) in May - August recorded in NWT weather stations in 2018 (Source: 2018 NWT Fire Weather Report, True North Consulting Inc.)

Wildfire activity

- The 2018 fire season was one of the slowest on record (5th slowest on record).
- Only 57 ignitions for a total of 13,222 ha burned across the NWT.
- Fire season data since 2000 indicates fire season severity in the NWT has become increasingly variable (Fig. 5).

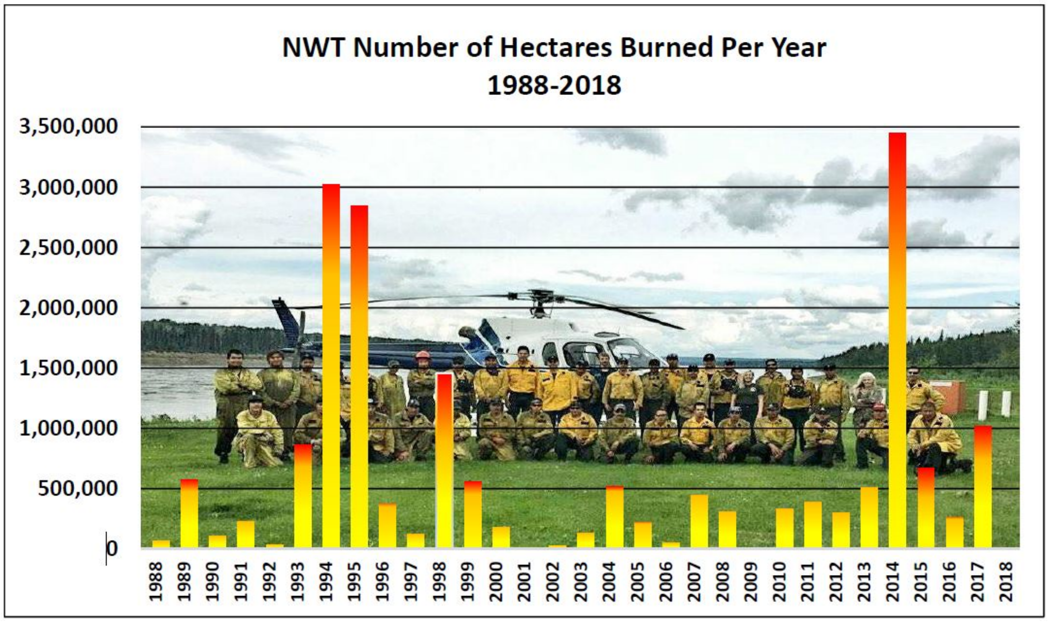

Figure 5: Total area burned over the last 30 years in NWT (Source: 2018 Fire Weather Report – True North Consulting Inc.)

- Fire activity (number of ignitions and total area burned) were significantly lower than 5-25 year averages in 2018.

3. Overview of forest health conditions

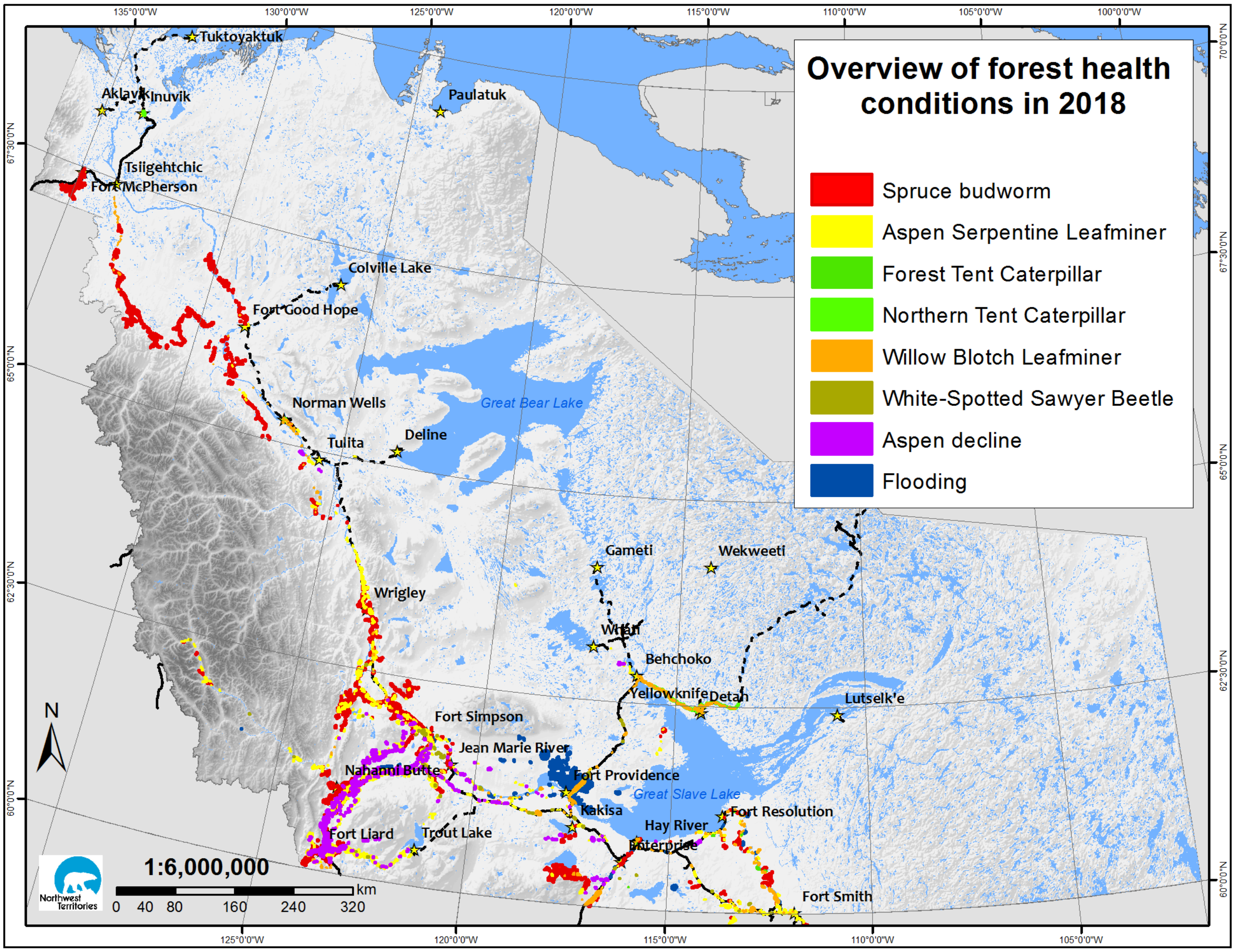

Figure 6: Overview of NWT forest health conditions in 2018

Out of the NWT's 80 million hectares of forest, over 875,000 ha were affected by insect and disease agents in 2018, marking a 52% increase compared to 2017. Most pests observed in 2016 continued to affect the NWT forests by expanding the infested areas, with the exception of the Forest Tent Caterpillar (FTC) outbreak, which collapsed in 2018 with only 3,141 ha affected. There was a significant expansion of the SBW outbreak, which doubled in size mostly in the Dehcho and Sahtu regions (417,700 ha affected; a 66% increase compared to 2017). Outbreaks of other deciduous defoliators continued to expand throughout the NWT, with notable increases of leafminers. The Willow Blotch Leafminer (WBL) expanded by 200%, while the Aspen Serpentine Leafminer (ASL) outbreak expanded by 35%.

Abiotic disturbances were also recorded during surveys and accounted for over 114,700 ha – most of which was attributed to aspen decline mapped extensively in the Dehcho Region (Liard Plain MB Ecoregion).

Table 2: Summary of areas affected by the insect and disease agents across administrative regions of the NWT based on the area surveyed. Since 2015, abiotic disturbance has also been recorded during annual forest health surveys.

Area affected (ha)	**Dehcho**	**Inuvik**	**North Slave**	**Sahtu**	**South Slave**	**Grand Total**
Biotic disturbances	**549,992**	**53,117**	**40,712**	**70,576**	**161,364**	**875,761**
Aspen serpentine leafminer	288,765		1304	6499	39,419	**335,987**
Scarab Leaf Beetle					1397	**1397**
Eastern Larch Beetle	644		409		699	**1752**
Forest tent caterpillar					3141	**3141**
Gray willow leaf beetle	1758					**1758**
Northern tent caterpillar		1206	10,037	206		**11,449**
Spruce budworm	245,765	47,998	1304	59,649	63,143	**340,985**
Willow blotch leafminer	8202	2544	27,127	4222	52,535	**94,630**
Rusty Tussock Moth		1330				**1330**
Birch leafminer			237			**237**
Western Balsam Bark Beetle	923					**923**
Yellow-headed Spruce Sawfly			8		204	**212**
White-spotted sawyer beetle	3935		286		826	**5047**
Spruce Needle Rust		39				**39**
Abiotic disturbances	**95,185**		**1671**	**1176**	**16,709**	**114,741**
Flooding	2648			78.3	10,253	**12,979**
Drought					5	**5**
Red belt	1077					**1077**
Slumping	500			176		**676**
Aspen decline	90,475		1224	922	6403	**99,024**
Blowdown	485		447		48	**980**
Grand Total	**645,177**	**53,117**	**42,383**	**71,752**	**178,073**	**990,502**

4. Insect pest activity

Spruce budworm (*Choristoneura fumiferana*) – SBW

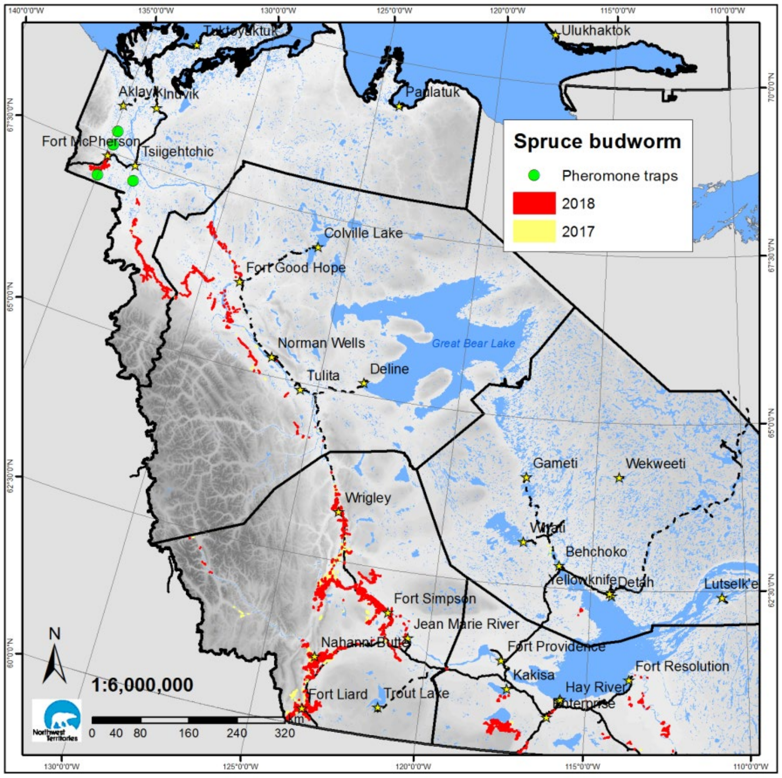

Figure 7: Overview of spruce budworm activity in the NWT in 2018

The general dynamics for SBW over the last couple of years has been a build-up phase, especially evident in the Dehcho Region. As expected, there was a substantial expansion of this pest in the Liard Valley and, to a lesser extent, in the Sahtu, Inuvik and South Slave regions.

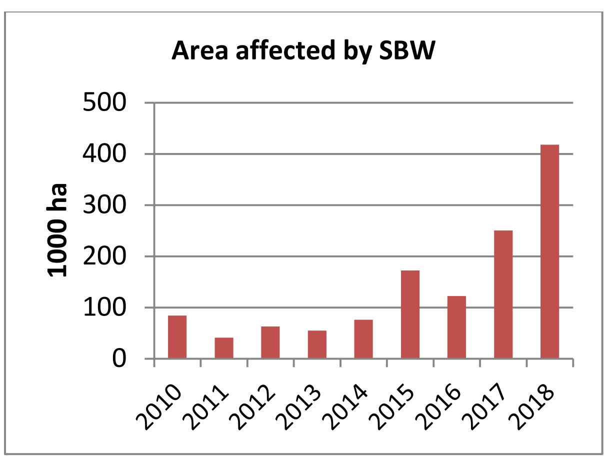

Figure 8: Area affected by spruce budworm defoliation

Inuvik Region

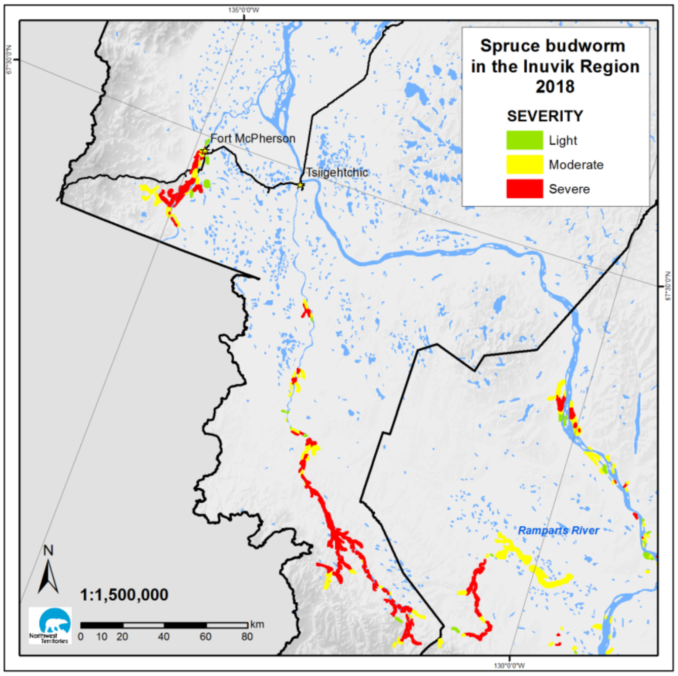

Figure 9: Spruce budworm defoliation observed in the Inuvik Region in 2018

A total of 47,998 ha of SBW defoliation was recorded in the Inuvik Region – an increase of over 20,000 ha compared to 2017. Most of the new defoliation occurred along the Peel River in the Fort McPherson area. Increased defoliation was also observed in the Arctic Red River valley.

A pheromone trapping program was reactivated in the Inuvik Region in 2017 and was continued in 2018. Trap count results from the Peel River confirm substantial populations, with counts as high as 2,026, which accounted for moderate to severe defoliation in the area. The Arctic Red River traps also showed significant populations, with counts as high as 2,434. Defoliation in this area could not be assessed because the low cloud ceiling prevented proper aerial assessment of this section of the river. The Husky and Peel Channel traps both had counts indicative of endemic populations (Table 2).

COORDINATES	SITE	TREE	COUNT
67.213232 N	1 Arctic Red	1	1224
133.630127 W	2 Arctic Red	2	639
	3 Arctic Red	3	2434
67.115448 N	2 Peel River	1	25 (damaged)
134.999134 W	3 Peel River	2	1289
	4 Peel River	3	2026
67.616253 N	3 Husky	1	9
134.856515 W	4 Husky	2	9
	5 Husky	3	8
67.823584 N	4 Peel Channel	1	6
134.856215 W	5 Peel Channel	2	2
	6 Peel Channel	3	5

Table 3: 2018 SBW Pheromone trapping results from the Inuvik Region.

Sahtu Region

The total area of SBW defoliation recorded in the Sahtu in 2017 was 59,650 ha— an increase of over 22,900 ha compared to 2017. This notable increase occurred mostly along the Mackenzie River between the confluences of the Mountain and Carcajou Rivers, and north of Fort Good Hope to the region's border.

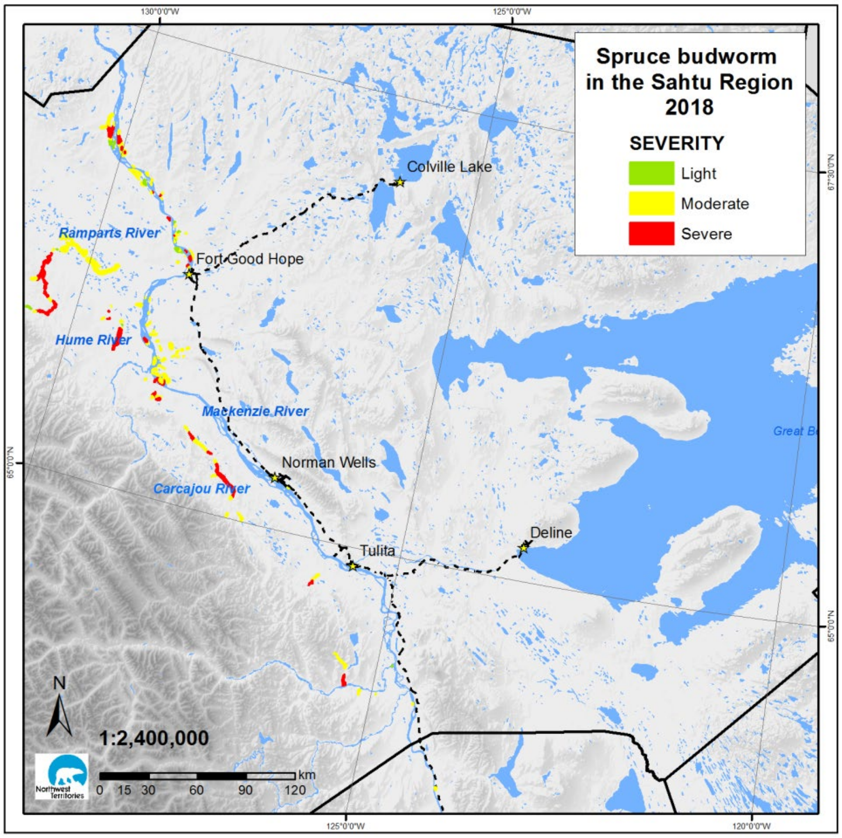

Figure 10: The extent of 2017 spruce budworm defoliation in the Sahtu Region

Dehcho Region

The SBW population build-up in the southern Dehcho was very noticeable in 2016, with trace defoliation observed in many locations along the Liard Highway. In 2017, SBW populations in the Dehcho increased significantly and in 2018 they continued to expand. Increases were recorded in the Fort Liard area along the Liard and Muskeg Rivers, in the Fort Simpson area along the Mackenzie northward to Wrigley, and along the Ebbutt Hills (Fig. 12). The total area affected in the Dehcho Region was 245,765 ha of mostly moderate defoliation.

Figure 11: Moderate SBW defoliation observed in the Fort Liard and Muskeg River area

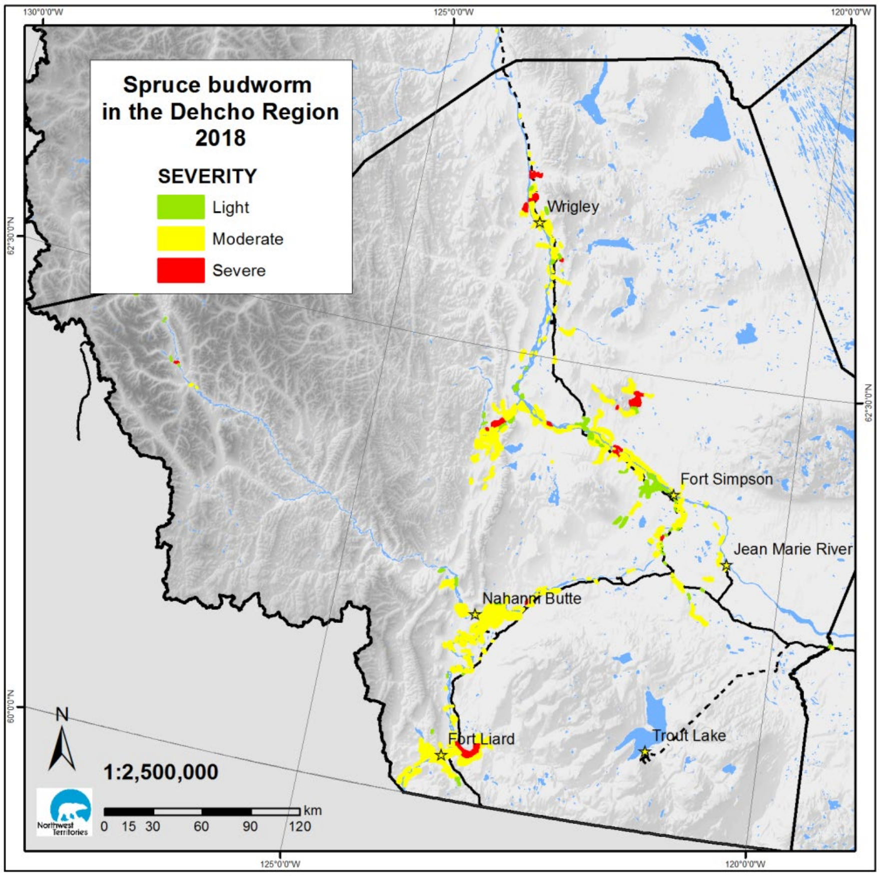

Figure 12: Spruce budworm defoliation observed in the Dehcho Region in 2018

North and South Slave Regions

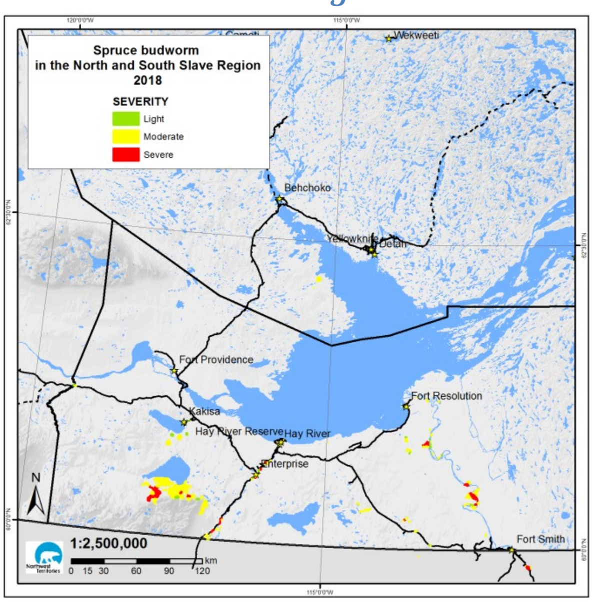

Figure 13: SBW defoliation observed in the North and South Slave Regions in 2018

A new patch of SBW defoliation was found in the North Slave Region along the western shore of the Great Slave Lake east of Dessert Lake. Total defoliation observed in the North Slave Region was 1,304 ha.

In the South Slave, SBW expansion areas included the Little Buffalo and Slave Rivers north of Fort Smith, along the Hay River, and along the northern slopes of the Cameron Hills.

Aspen defoliators

Forest tent caterpillar (Malacosoma disstria) - FTC

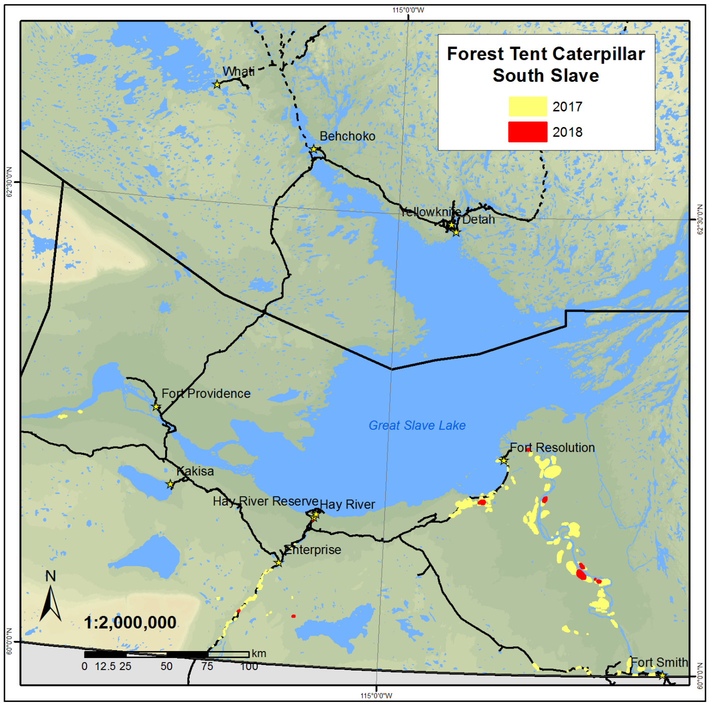

Figure 14: Forest Tent Caterpillar defoliation observed in 2017-2018 in the South Slave Region

Forest tent caterpillar (FTC) is the most serious aspen defoliator in the NWT. The only previously recorded outbreak occurred in the mid-1990s in the Dehcho. The outbreak currently observed in the South Slave started in 2015 with over 100,000 ha defoliated. A substantial expansion was observed along the Slave River and in the Fort Smith area in 2016 (24% increase compared to the previous year). FTC defoliation declined by 58% in 2017, with a total affected area of 56,677 ha, and it further declined in 2018 with total area of only 3,141 ha affected. All FTC damage was recorded in the South Slave Region, primarily along the Slave River north of Fort Smith, and along the Hay River south of Enterprise. The decline is consistent with the typical duration of FTC outbreaks, which is roughly 3 years in a stand and up to 6 years at the landscape level.

Aspen serpentine leafminer (*Phyllocnistis populiella*) – ASL

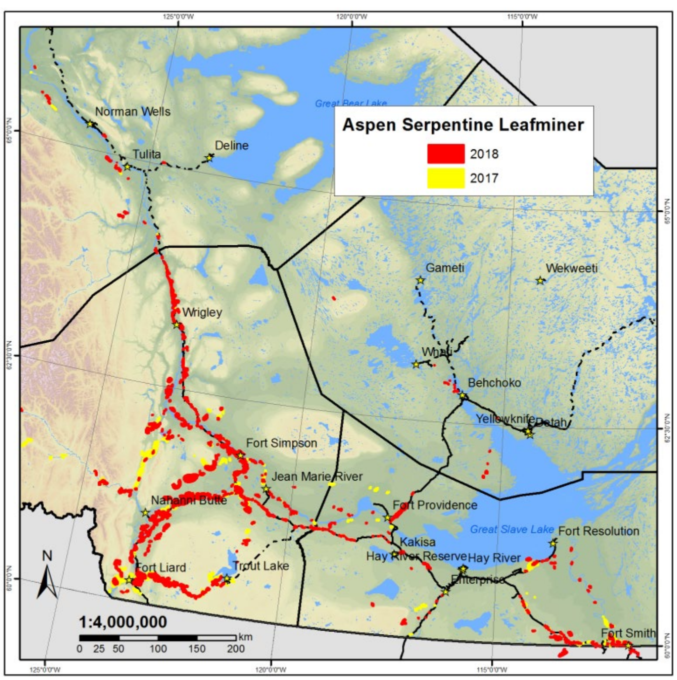

Figure 15: Aspen Serpentine Leafminer defoliation observed in 2017-2018

Aspen serpentine leafminer (ASL) continues to be one of the most prevalent insect pests in the NWT. The extent of ASL matches the current aspen range in the NWT, making it one of the most "successful" pests in the North. Approximately 336,000 ha of aspen serpentine leafminer damage was recorded in 2018, which accounts for a 35% increase compared to 2017. There is currently little information available on duration of ASL outbreaks; however, the NWT outbreak seems prolonged, as it has been occurring for approximately 20 years. Normally this pest is considered secondary, causing very minor growth loss and no lasting long-term health effects; however, given the duration and severity of the outbreak, it is likely having a more significant effect on forest health. Given its current spread, it is safe to assume most aspen stands in the NWT suffer some level of damage on an annual basis. ASL is also being assisted by several other secondary pests contributing to the overall damage inflicted on aspen. They included but were not limited to: scarab beetles, American leaf beetle, aspen blotch leafminer and gall mites.

Willow defoliators

Willow blotch leafminer (Micrurapteryx salicifoliella) - WBL

Willow blotch leafminer (WBL) is another prevalent pest that continues to damage willow foliage throughout the NWT. The total affected area mapped in 2018 was 94,630 ha – three times as much as in 2017. However, due to the widespread extent of defoliation and only a fraction of willow range surveyed, the full affected area is likely being underestimated on an annual basis. In 2018, WBL damage was especially heavy in the South and North Slave. Severe damage was observed north along the Arctic Red River to just south of Tsiigehtchic. It is interesting to note that willows in the Mackenzie Delta were not affected.

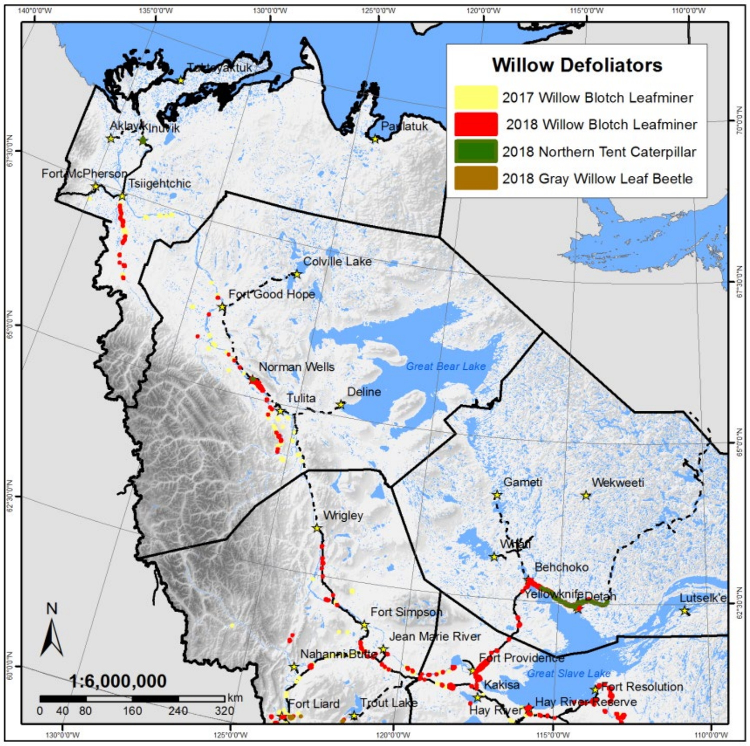

Figure 16: Willow defoliator damage observed in 2018

Gray willow leaf beetle (Tricholochmaea decora) - GWLB

A new outbreak of this secondary pest was first observed in 2015 near Fort Liard and on the northern slopes of the Cameron Hills. GWLB is native to the NWT; however, it has never been recorded at outbreak levels before. In 2016, the infestation continued and the total affected area decreased by 50% compared to 2015. In 2017, approximately 8,267 ha of GWLB defoliation were mapped in the Trout Lake, Fort Liard and Nahanni Butte areas. A substantial decrease was observed in 2018 with only 1,758 ha along the Muskeg River mapped in the Dehcho.

Northern tent caterpillar (Malacosoma californicum) – NTC

A northern tent caterpillar (NTC) outbreak has been occurring since 2015. NTC was active in the Yellowknife area, attacking mostly willow and small shrubs. In 2017, the NTC outbreak expanded and was recorded in other areas in the NWT, including the Cameron Hills and along the Mackenzie River in the vicinity of Tulita and Norman Wells. The total area recorded in 2017 was 8,609 ha. In 2018, expansion was noted particularly in the North Slave between Behchoko and Yellowknife, and along the Ingraham Trail. The total area affected throughout the NWT was 11,449 ha. The majority of observed damage was mapped during ground surveys along highways; however, it can be expected that nearby areas with willow were also affected. NTC was also observed in Norman Wells, Inuvik and, reportedly, in Fort McPherson (unconfirmed).

Rusty tussock moth (Orgyia antiqua) – RTM

Rusty tussock moth (RTM) is common and native to NWT but has not been observed at outbreak levels before. In 2018, two patches were mapped in the Inuvik area at a total of 1,330 ha. Since the outbreak occurred in the vicinity of the airport, it is possible the insect was introduced to Inuvik by plane. Alternatively, native populations could have taken advantage of a warming climate, leading to the outbreak occurrence.

Figure 17: Rusty tussock moth as observed near Inuvik airport in 2018

Secondary pests of notable occurrence

Over the last two years, increased activity of several secondary pests has been noted:

- **White-spotted sawyer beetle (*Monochamus scutellatus*) (WSSB) complex** – previously described in the 2015 Forest Health Report, water-stressed mature pine stands near Checkpoint (Dehcho) were attacked by a complex of insects with WSSB being the main pest. Another spruce leading stand near Jean Marie River was suspected to be affected by the WSSB complex as well. The affected area expanded from 767 ha in 2015 to over 2,000 ha in 2016. In 2017, the area affected was 695 ha in the Dehcho. In 2018, WSSB activity was more prevalent in several areas along the highway to Fort Simpson, especially in the Kakisa area. Other new pockets were observed north of Fort Providence. The total affected area mapped in 2018 was 5,047 ha.
- **Eastern larch beetle (*Dendroctonus simplex*) ELB** – ELB is native in the NWT, though no previous outbreaks were ever recorded. However, tamarack mortality likely caused by this insect was observed in northeastern British Columbia during the mountain pine beetle aerial survey in 2015. Twenty-three hectares of tamarack mortality were mapped the following year along the Liard Highway. In 2017 and 2018, ELB was found at several locations along Highways 1 and 3 with pockets of tree mortality (3 -13 trees per pocket), and current healthy broods were present. ELB damage is difficult to capture from aerial surveys due to sporadic distribution of tamarack. The total area affected was 1,752 ha, with

approximately 700 ha mapped in the South Slave, 650 ha mapped in the Dehcho, and 409 ha mapped in the North Slave.

- **Amber-marked birch leafminer (*Profenusa thomsonii*) BLM** – drought conditions likely contributed to increased population levels of this invasive alien species in 2015-16. BLM was still at trace levels throughout the Yellowknife/Ingraham Trail area, with 237 ha mapped in 2018.
- **Birch leaf roller (*Epinotia solandriana*) –** trace activity found at the Blackstone River and along the Ingraham Trail.
- **Western Balsam Bark Beetle (*Dryocoetes confusus*)** is the most destructive insect of subalpine fir in British Columbia. Scattered mortality caused by this pest was noted in the southern ranges of the Mackenzie Mountains in the Dehcho. The total area recorded in 2017 was 106 ha and it expanded to 923 ha in 2018.
- **Spruce gall adelgid (*Adelges* cooleyi)** was noted in several areas including near Hay River, Fort Smith/Little Buffalo, Angus Tower and the Ingraham Trail.
- **Scarab leaf beetles (*Dichelonyx spp.*)** – observed causing light to moderate damage on aspen, rose, Saskatoon, willow and buffalo berry along the highway to Fort Resolution. Often seen in clusters on single branches (Fig. 18).
- **American leaf beetle (*Chrysomela crotchi*) and the Cottonwood leaf beetle (*C. scripta)*** – both found causing trace defoliation to aspen at several locations along the highway south of Hay River. Very abundant in 2018.
- **Lacebug (*Corytucha spp.*) –** scattered severe damage was observed in the Little Buffalo River area along the highway.
- **Yellow-headed spruce sawfly (*Pikonema alaskensis*)** – higher than usual damage noted along the Ingraham Trail and in the Fort Smith/Wood Buffalo National Park area.

Figure 18: Scarab leaf beetle as observed in Fort Resolution (left) and the American leaf beetle (right) as observed south of Hay River

Mountain pine beetle (*Dendroctonus ponderosae*) update

Mountain pine beetle (MPB), the most damaging insect pest of pine trees in North America, has been monitored in the NWT since 2009. In 2012, the beetle was found in one pine stand just north of the NWT-Alberta border. The affected trees were cut and burned the following spring, and wildfire occurred in this area later in the season, destroying the stand completely. Since then, there has been no recorded presence of MPB in the NWT.

During the 2017 survey, a pine stand with suspected MPB activity was found approximately 40 km southeast of Trout Lake. The site was ground checked on February 27, 2018 and no MPB was found within the stand. Trees in the stand were affected by several factors including:

- Western Gall Rust – pine stems were infected at an earlier stage, causing cankers as the trees matured and grew around the stem galls. Almost every green, weakened or dead pine checked in the stand had at least one stem canker, and some had more. Several older broken stems from wind events were also present in the stand, with the breaks likely occurring at old stem gall locations. No active galls were noted in the crowns, meaning the infection possibly died out years ago.
- *Ips pini* and *Monochamus scutellatus* were also present in affected trees. Being secondary agents, they were likely taking advantage of the weakened trees, potentially finishing them off if the cankers had not.
- Drought – there have been several drought years in the Dehcho over the last decade, which likely contributed to weakening the trees and predisposing them to secondary agents. Further evidence of drought weakening was the number of spruce in the stand experiencing the same *Ips* and *Monochamus* attacks.

The MPB pheromone baiting program was also continued in the southern NWT. Three baiting locations were established along Highway 1 between the NT-AB border and Enterprise, and two between Kakisa and Jean Marie River. Dispersal baiting procedures were used as described in the MPB Monitoring Plan for NWT Pine Forests (2015-2020). No evidence of MPB was recorded in any baiting location. The pheromone program will continue in 2019.

5. Disease agents

Improved moisture and humidity conditions across the NWT in 2017-18 following the relatively dry 2014-15 seasons may have caused an increased activity of various pathogens.

Spruce needle rust (Chrysomyxa ledicola) was observed in the Inuvik Region in the vicinity of Fort McPherson and along the highway to Fort Smith. In late July/early August, Gwich'in Renewable Resources Board (GRRB) staff received reports from Fort McPherson and Tsiigehtchic residents of an orange/brown goo floating on the surface of the Peel and Arctic Red Rivers, as well as on local lakes. Samples of water with the floating substance were collected, photographed under the microscope and sent for chemical analysis. Lab results indicated high aluminum and iron content and it was suggested that iron bacteria may have developed, causing the orange goo. However, further analysis by Dr. Tod Ramsfield of CFS confirmed the orange goo to be aeciospores of *Chrysomyxa ledicola* – Large-spored labrador tea spruce rust, or spruce needle rust. A similar situation was observed in Alaska in 2012 when large quantities of spruce needle rust spores were noted floating on rivers and lakes. High levels of aluminum and iron in water samples may have resulted from runoff materials from many retrogressive thaw slumps occuring along and in tributaries to the Peel River.

Spruce needle rust rarely kills trees. The damage is rather cosmetic, with diseased trees appearing discolored. Only the current-year needles are affected and, generally, this disease is not a threat to spruce stands. Infection levels by spruce needle rust can be very high, especially on trees that grow close to boggy areas with infected

Labrador tea. It is possible that spruce growth may be impaired by the fungus, but this has not been adequately researched.

Figure 19: Orange goo floating on the surface of the Peel River as observed in late July (left) was identified as aeciospores of spruce needle rust, photographed under the microscope (right). Photos courtesy of Sarah Lord (GRRB)

Other disease agents

- Commandra blister rust (*Cronartium comandrae*) – disease of hard pines, including jack pine, caused by a fungus growing in the inner bark. The rust attacks pine of all sizes and ages, causing stem cankers and leading to mortality of seedlings and branch mortality in older trees. It was observed along the Yellowknife Highway and Ingraham Trail affecting mature trees in the form of branch flagging (a condition when branches scattered throughout the tree's crown turn brown).
- Yellow witches broom or spruce broom rust (*Chrysomyxa arctosphyli*) – another fungal disease that may be associated with increased humidity following drought. It was observed in spruce stands along the Mackenzie River in areas affected by suspected spruce needle rust.
- Western gall rust (*Endocronartium harknessii*) – increased branch mortality on mature trees was observed in the Fort Simpson and Checkpoint area in 2015. The mortality was likely triggered by drought. Further expansion was noted in 2017.
- Sweet fern blister rust (*Cronartium comptoniae*) – found on single pine trees around Yellowknife.
- Fir-Willow rust (*Melampsora abietis-capraearum*) – common throughout the NWT.
- Marssonina leaf spot (*Marssonina populi*) – found in aspen across the South Slave region.
- *Puccinia caricis-sheperdiae* (rust) – abundant on buffalo berry plants throughout the NWT.
- Willow witches broom – caused by bacteria called Aster Yellows Group (*Candidatus phytoplasma*).

6. Abiotic disturbances

In the wake of climate change, monitoring for climate-related disturbances has become equally important as monitoring for pests and disease. Direct impacts of climate on forest condition may be subtle and require long-term consistent monitoring over large areas. There is currently little baseline information on abiotic disturbances in the NWT, yet understanding the natural range of variation in the northern boreal forest is essential for inferring climate change impacts. To address this issue, FMD has started recording abiotic disturbances during annual aerial surveys. Information gathered each year will be evaluated for any changes in the extent, frequency or patterns to determine natural regimes and distinguish new trends.

Flooding and high water table issues

Flooding is an example of water stress which can result in stand mortality. In the North, flooding can be associated with thawing permafrost, a phenomenon that can be triggered by increased fire activity, localized disturbance or climate warming. In areas where timber harvest is occurring, flooding may be caused by an erroneous silvicultural prescription applied to a flood prone area. Lastly, local flooding can be a result of increased beaver activity. While identifying the anthropogenic causes is relatively easy, diagnosing the natural or climate-related causes is much more challenging because it requires long-term monitoring and a good understanding of the fire regime.

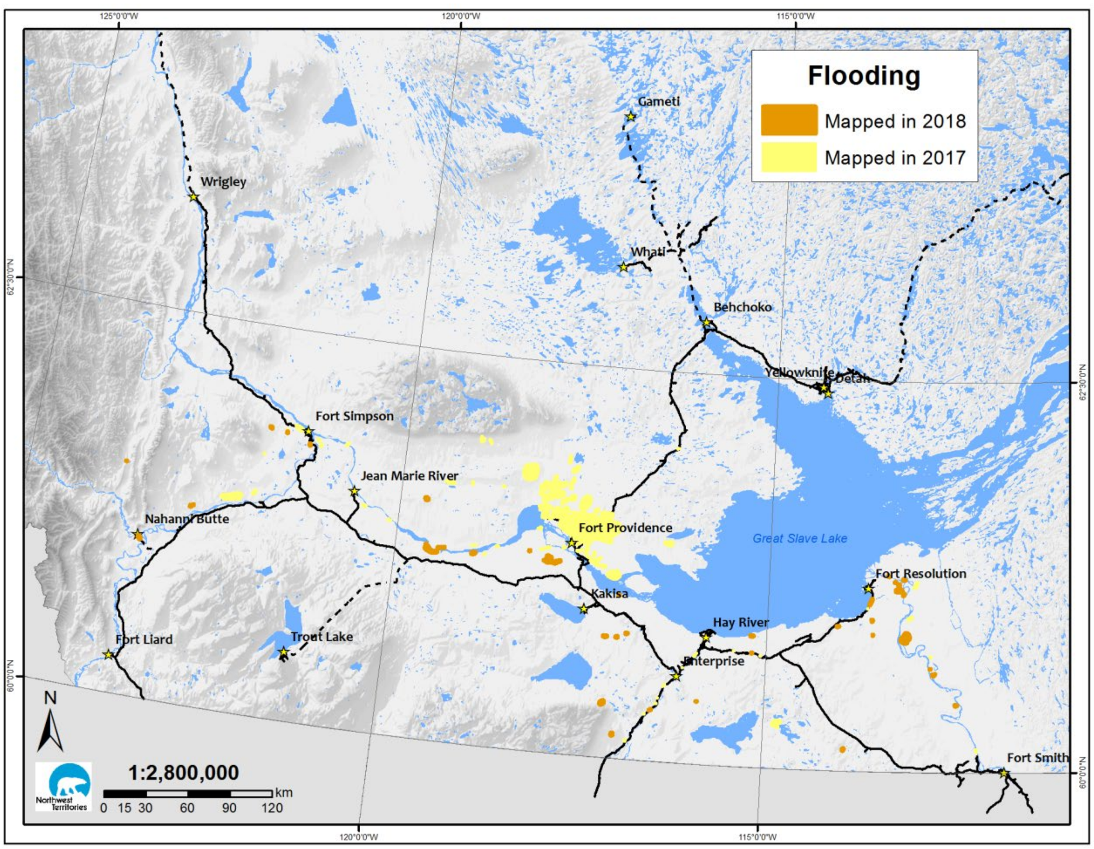

Figure 20: Flooding mortality mapped in 2017-18

High water tables appear to cause forest health issues in productive stands, especially in aspen but also willow and spruce. Several areas along the Slave, Hay (South Slave) and Mackenzie Rivers (Dehcho) were mapped in 2018. The total area mapped in 2018 was 12,979 ha. FMD is planning a remote sensing research project with the Canadian Forest Service that will focus on attempting to quantify these changes.

Aspen decline

Aspen decline has been occurring throughout the range of aspen in the NWT but appears more severe in the west (Dehcho) than the east (South Slave). Most of the damage is linked to droughts and prolonged defoliator events such as the ASL; however, some of the decline is also suspected to result from high water table issues. Drought-driven decline appears to affect upland areas while high water table issues affect lowland areas. Although much of the decline is occurring in mature and over-mature aspen forests, dieback can be also seen in younger aspen throughout the Dehcho and parts of the South Slave.

On June 16-17, 2018, dedicated aspen decline surveys were conducted in the Liard Plains. Decline was also mapped during the main pan-territorial survey in July. A total of 99,024 ha were mapped. Since surveys were not completed they will be continued in 2019.

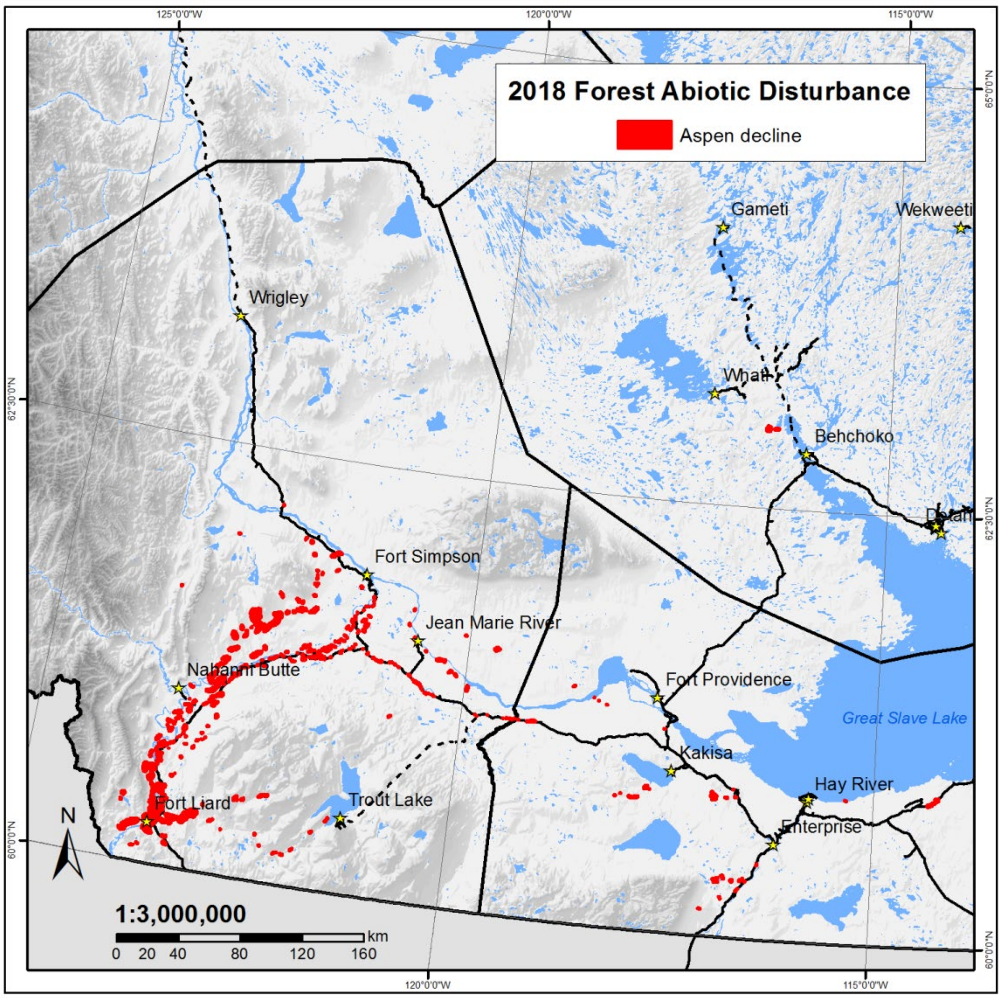

Figure 21: Aspen decline mapped in 2018

Observations of decline in the Liard Plains area correspond with mortality rates measured at the Poplar River CIPHA (Climate Impacts on Productivity and Health of Aspen) site, which is the only NWT component of a long-term aspen monitoring project led by the Canadian Forest Service (Fig. 22).

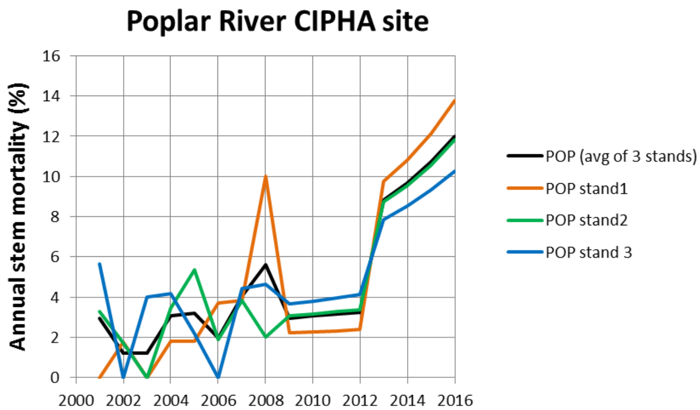

Figure 22: Mortality rates measured at the Poplar River CIPHA site in the NWT over the last 15 years

Mackenzie Delta spruce mortality

Increasing occurrence of spruce mortality has been noted over the last few years in the Mackenzie Delta. High water table is suspected to be a direct cause of this mortality; however, the underlying cause is not clear. It is likely a result of the changing permafrost regime in this area due to warming conditions. If this trend continues, it could have serious implications for carbon cycling in this climate-sensitive ecosystem. FMD will be investigating these apparent trends in 2019 using ground site visits.

 

Figure 23: Examples of spruce mortality observed in the Mackenzie Delta. High water table resulting from thawing permafrost could be a possible cause of this phenomenon.

Blowdown

Several blowdown events were noted in 2018 – more than have been observed over previous years. The most significant damage was seen along the Muskeg and Slave Rivers (Fig. 24), and around Behchoko.

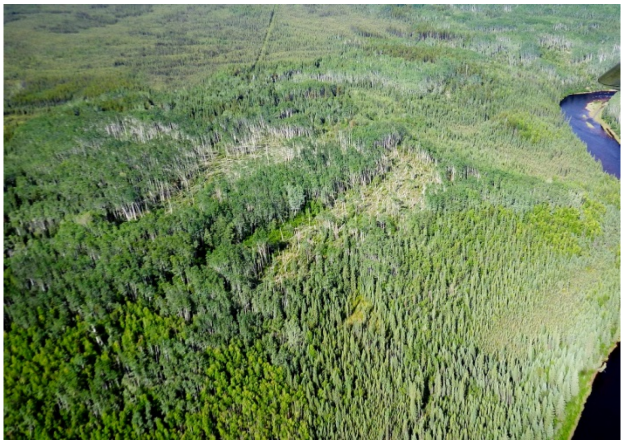 

Figure 24: Blowdown events observed along the Muskeg (left) and the Slave River (right)