2023 NORTHWEST TERRITORIES FOREST HEALTH REPORT

RAPPORT de 2023 SUR LA SANTÉ DES FORÊTS AUX TERRITOIRES DU NORD-OUEST

Mandate commitment of the 20th Legislative Assembly

Engagement du mandat de la 20e Assemblée législative

Government of Northwest Territories
Gouvernement des Territoires du Nord-Ouest

K'áhshó got'ı̨ne xədə k'é hederı ɂedı̨htl'é yerınıwę nı dé dúle.
Dene Kədə́

ʔerıhtł'ís Dëne Sųłıné yatı t'a huts'elkër xa beyáyatı theɂą ɂat'e, nuwe ts'ën yółtı.
Dëne Sųłıné

Edı gondı dehgáh got'ı̨e zhatıé k'ę́ę́ edatł'éh enahddhę nıde naxets'é edahłí.
Dene Zhatıé

Jii gwandak izhii ginjìk vat'atr'ijąhch'uu zhit yinohthan jì', diits'àt ginohkhìi.
Dinjii Zhu' Ginjik

Uvanittuaq ilitchurisukupku Inuvialuktun, ququaqluta.
Inuvialuktun

ᑖᒃᑯᐊ ᑎᑎᕐᑲᐃᑦ ᐱᔪᒪᒍᕕᒋᑦ ᐃᓄᒃᑎᑐᓕᕐᒃᓯᒪᓗᑎᒃ, ᐅᕙᑦᑎᓐᓄᑦ ᐅᖄᓚᔪᓐᓇᖅᑐᑎᑦ.
Inuktitut

Hapkua titiqqat pijumagupkit Inuinnaqtun, uvaptinnut hivajarlutit.
Inuinnaqtun

kīspin ki nitawihtīn ē nīhīyawihk ōma ācimōwin, tipwāsinān.
nēhiyawēwin

Tłı̨chǫ yatı k'ę̀ę̀. Dı wegodı newǫ dè, gots'o gonede.
Tłı̨chǫ

Indigenous Languages
request_Indigenous_languages@gov.nt.ca

Contents

Background – Forest Health Program in the Northwest Territories

The forest health monitoring program in the Northwest Territories is carried out by the Government of the Northwest Territories' (GNWT) Department of Environment and Climate Change (ECC). Historically, the program has focused on insect and disease damage. Since 2015, it has expanded to address the uncertainty of forest ecosystem response to a changing climate, including abiotic and biotic disturbances. These are environmental effects such as drought, flooding, wind and snow damage, and permafrost-related issues such as slumping, multi-directional tree falling ("drunken forest"), and wildlife damage. Initially, forest health surveys were conducted by the Canadian Forest Service (CFS) from the 1950s until 1998 when, with continuous assistance from the CFS, the territorial government took over this function. Beginning in 2022, when CFS was no longer able to help, GNWT hired Roger Brett, a private consultant with SKOG Forest Health, a former CFS employee who has been working with GNWT for several years in this role.

The program's ongoing adaptation and collaboration ensures the continued monitoring and management of forest health in the face of evolving environmental challenges.

Contexte – Programme de santé des forêts aux Territoires du Nord-Ouest

Le Programme de santé des forêts aux Territoires du Nord-Ouest est dirigé par le ministère de l'Environnement et du Changement climatique (MECC) du gouvernement des Territoires du Nord-Ouest (GTNO). Par le passé, le but du programme était principalement d'étudier les dommages causés par les insectes et les maladies. Depuis 2015, la portée du programme a été élargie pour tenir compte de l'incertitude liée à la réaction des écosystèmes forestiers au changement climatique, y compris les perturbations abiotiques et biotiques. Ces effets environnementaux comprennent notamment les sécheresses, les inondations, les dégâts causés par le vent et la neige, ainsi que les problèmes liés au pergélisol tels que les affaissements, les chutes d'arbres multidirectionnelles (« forêts ivres ») et les dégâts causés par la faune. Les relevés sur la santé des forêts ont été menés par le Service canadien des forêts (SCF) des années 1950 jusqu'en 1998, date à laquelle le GTNO a repris cette fonction, bien que le SCF ait continué d'y contribuer. En 2022, lorsque le SCF n'a plus été en mesure d'apporter son aide, le GTNO a engagé Roger Brett, un consultant privé du cabinet SKOG Forest Health et un ancien employé du SCF qui travaille avec le GTNO depuis plusieurs années.

Les efforts d'adaptation et de collaboration dans le cadre de ce programme permettent de continuer à surveiller et à gérer la santé de nos forêts, dans un contexte où les défis environnementaux évoluent constamment.

Scope of Monitoring

Due to the immense size of the forested land in the NWT, which encompasses nearly 800,000 km^2 (80 million hectares (ha)), it is necessary to prioritize areas surveyed annually. Traditionally, areas occupied by mature spruce forests have been prioritized due to their importance as the preferred host for the most significant insect pest in the NWT – Spruce Budworm (Choristoneura fumiferana) (SBW). These areas extend along major rivers and waterways, including the Mackenzie, Liard, and Slave Rivers, as well as their main tributaries. Additionally, they encompass the foothills of the Mackenzie Mountains and the slopes of the Cameron Hills, Martin Hills, and Ebbutt Hills. The total area assessed by surveys varies slightly each year due to visibility. Under optimal flying conditions, approximately 12-14 million ha are assessed annually, which is about 15% of the total forest land area in the NWT.

Surveys include an Aspen Defoliation Ground Survey near Primary Highways in the South Slave and Dehcho Regions, a General Ground Survey accessed by roads in the South Slave, North Slave, and Dehcho Regions, and an Aerial Overview Survey throughout priority forested areas of the South Slave, Dehcho, Sahtu, Beaufort Delta, and North Slave Regions. Additionally, surveys are completed for Parks Canada Agency (PCA) Wood Buffalo National Park and Nahanni and Nááts'įhch'oh National Park Reserves under a new agreement established between the GNWT Environment and Climate Change (ECC) and Parks Canada.

Methods

Types and Criteria of Surveys

The timing of the aspen defoliation survey aims to catch late-instar larvae and pupae, or even adults, for easier identification of primary defoliating insects. This timing is often variable, changing substantially from year to year. General forest health ground surveys are non-systematic reconnaissance surveys that include on-the-ground investigations of observed issues and random spot-checks of trees and shrubs. Most damaging agents are identified in the field and later verified in the office, except in cases that are exceedingly difficult. The most challenging specimens are sent to a taxonomic specialist at the NRCan-CFS Northern Forestry Centre in Edmonton for identification support.

During aerial overview surveys, all forest health issues observed from the air are mapped digitally as polygons and assigned a damage severity rating (Table 1). The severity rating is based on either the percentage of affected foliage for defoliation and abiotic foliar damage or the stand's tree mortality percentage. Smaller areas consisting of a few trees are recorded as points. Aerial observations are calibrated, and areas with limited visibility or hazardous conditions, supported by observations from ground surveys. Aerial surveys are primarily conducted using aerial detection mapping, typically with small planes such as the

Cessna 206. A helicopter is used when ground verification is required in areas with limited road or water access.

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

Severity class	Mortality (% of trees killed)	Defoliation (% of current-year foliage affected)
Nil	0	0
Light (L)	<10	<30
Moderate (M)	10-30	30-70
Severe (S)	>30	>70

All forest health issues observed are digitally mapped using a tablet with ESRI Arc Pad 10 software in ESRI shapefile format, adhering to GNWT forest health data standards. The attributes include damaging agent, year, severity, area affected, region, and comments. Data recorded in the shapefile are classified as Nil, Light, Moderate, or Severe, depending on the type of forest health issue recorded. Georeferenced photos are presented as a catalogue of folders, with each containing a KML file of the georeferenced photos.

Pheromone Trapping

Pheromones are used to detect both mountain pine beetle and spruce budworm. Mountain pine beetle is detected using a dispersal baiting method. Five baiting locations were established in the southern NWT. Three locations were established along the Highway 1 corridor (Alberta border to Enterprise), and two locations were established between Enterprise and Jean Marie River (Fig. 1).

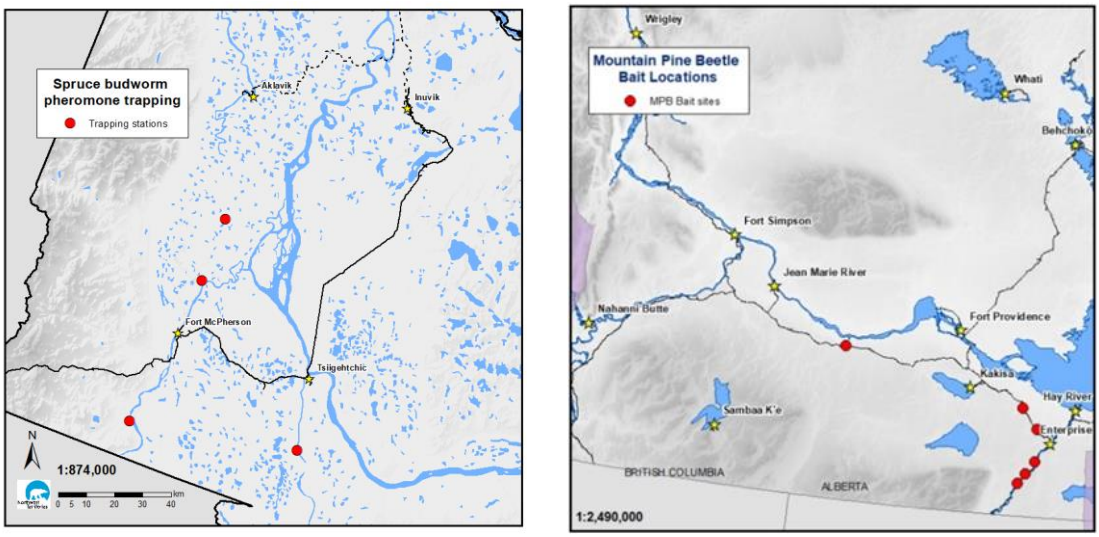

Figure 1. Pheromone trapping locations for spruce budworm in the Inuvik Region (left) and baiting locations for mountain pine beetle in the South Slave and Dehcho Regions (right). Some of the mountain pine beetle trapping sites were damaged during the 2023 wildfire season and will be re-established.

The spruce budworm pheromone trapping program was active across the territory from 1997 to 2012, and in the Beaufort Delta Region, it has been active again since 2017. Regional forestry staff deploy traps in historical trapping locations along the Arctic Red River, Peel River and the upper Delta. There are currently four active trapping locations, with three traps at each site. The Unitrap container-type traps are deployed from mid-June to mid-August (Fig. 2) using rotary-wing aircraft. Each trap contains a pheromone lure to attract male moths and an insecticide strip to kill trapped moths. When traps are collected in August, the SBW moths are separated from other insects that may have been caught and then counted. Moth count results are sent to the Forest Management Division to track whether populations are stable, increasing or decreasing.

Public Reports

Public sightings and regional reports are an important addition to the existing body of knowledge. Renewable Resource Officers, Forest Officers and the general public are encouraged to report any forest health issues that come to 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 corroborate aerial survey observations, but often help direct ground surveys.

2023 Survey Conditions and Coverage

Forest health aerial and ground surveys were conducted throughout the forested areas of the NWT, including the NWT portion of Wood Buffalo National Park and Nahanni National Park Reserve from June 15 to August 2, 2023 (Fig. 2). Surveys included an aspen defoliation ground survey (June 15 to 22), a general ground survey (July 8 to 20), and an aerial overview survey (July 21 to July 31). Wildfire smoke during the 2023 aerial and ground forest health surveys caused the worst visibility issues in the last 30 years (Fig. 3 and 4).

Given the 2023 visibility conditions, survey coverage was calculated by buffering each side of the roads by 300 m, instead of 1000 m as done in most years, and each side of the aerial survey routes by 3 km, instead 10 km. Survey routes remained the same as in previous years, except in some areas with the lowest visibility.

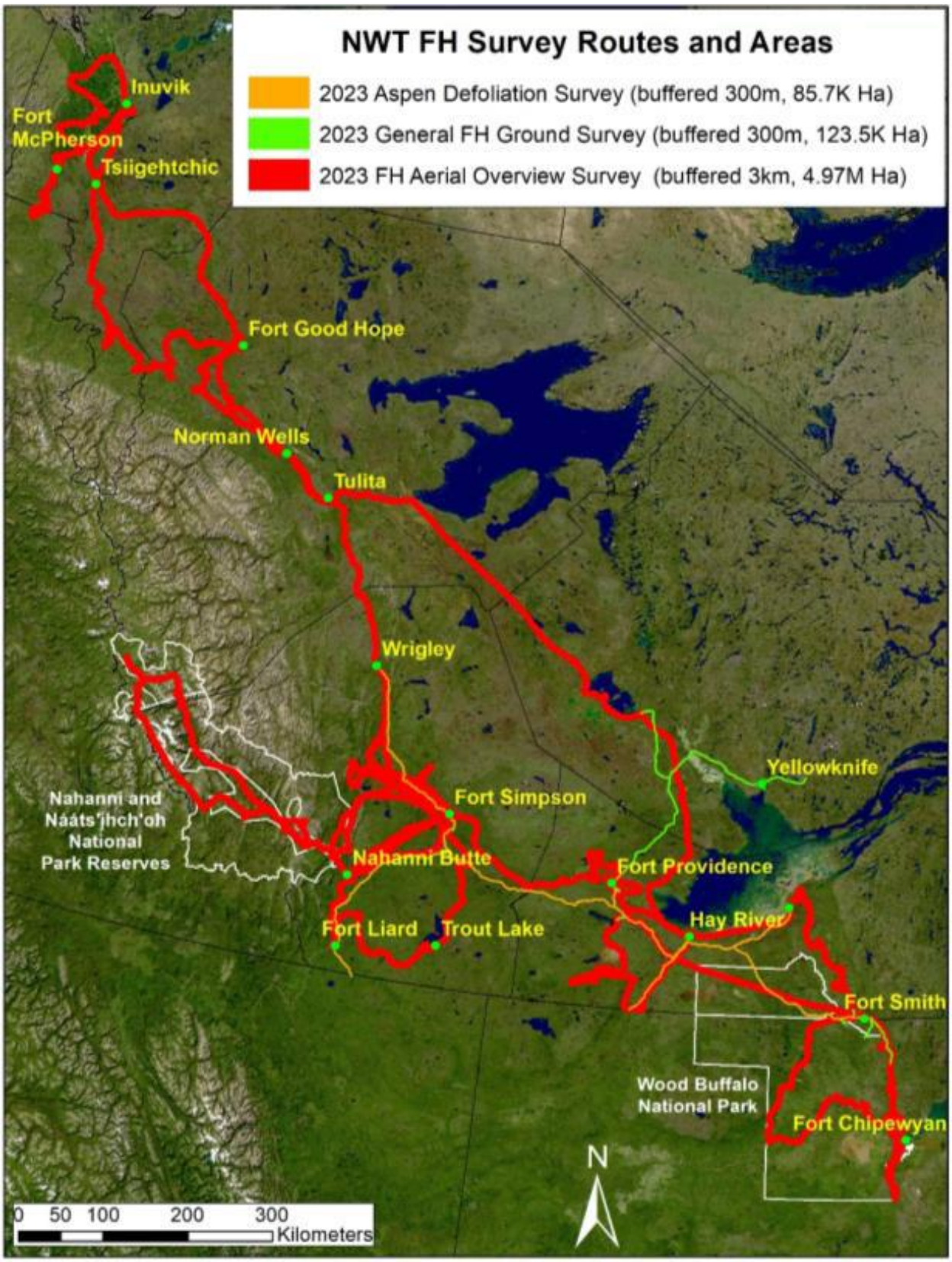

Figure 2. 2023 NWT Aerial and Ground Survey routes and coverage

Figure 3. Wildfire smoke along the Great Bear River

Figure 4. Norman Wells, zero visibility from heavy smoke

2023 NWT Forest Health Survey Results

Summary

Forest health surveys in 2023 were significantly impacted by visibility issues due to wildfire smoke. Although the flight paths remained largely consistent from 2022 to 2023, only one-third of the 2022 survey area was re-surveyed in 2023 (5.18 M ha, 5% of the NWT forested area) because of restricted aircraft visibility and the correspondingly narrower observation (buffering) zone each side of the route. Partly due to poor visibility, but also due to a general decline in aspen and spruce budworm defoliation, only 1.12M ha of disturbances were mapped in 2023 compared to 3.1M ha in 2022. This indicates that roughly 20% of the 2023 survey area was affected by forest disturbances. In total, 26 forest health issues were recorded (Table 2). Among them, drought was a major issue and may potentially persist in 2024. The primary insects, diseases, animals, and abiotic factors affecting 2023 forest health in the NWT are described in further detail below, representing the majority of what was captured in the spatial data. Other secondary observations, documented in the georeferenced photo catalogue, are also noted.

Table 2. 2023 Forest Health Conditions Summary (thousands ha)

Damaging Agent	Decho	Sahtu	South Slave	North Slave	Beaufort Delta	Nahanni	WBNP (NWT side)	Total
Eastern Spruce Budworm	272,4	16.8	225.1	3.4	7.9	5.2	4.3	535.1
Aspen Serpentine Leafminer	293.3	1.0	134.4	0.3		11.1	8.8	448.8
Drought	14.1	1.4	25.8	3.5	11.3	0.4	11.8	68.4
Wind	0.9	30.1						31.1
Willow Blotch Leafminer	4.7	1.6	16.9	1.4	0.2	0.1	1.4	26.3
Spruce Mortality		2.1	0.1		2.2			4.5
Aspen Decline	0.6		2.1	0.1				2.8
Flooding	0.5	0.1	1.3	0.1			0.1	2.0
Slumping	0.1	0.1	0.2		05	0.1		1.0
Western Gall Rust	0.1						0.6	0.7
Unknown Bark Beetle	0.6							0.6
Bead-Like Gall Aphid				0.2				0.2
Bison				0.1				0.1
Bear						0.1		0.1
Jackpine Tube Moth				0.03				0.03
Eastern Larch Beetle			0.02	0.01				0.03
Jack Pine Resin Midge			0.02					0.02
Yellow-Headed Spruce Sawfly			0.01	0.01				0.02
Poplar Twiggall Fly				0.02				0.02
Venturia Leaf Blight			0.01					
Commandra Blister Rust				0.01				
Porcupine	0.01							0.01
Orthotomicus Coelatus				0.004				
Pine Engraver Beetle							0.006	
Grand Total	587.3	53.2	406.0	9.2	22.2	16.9	26.9	1,121.8

Notes on Tree Mortality Associated with Disturbance Agents

Insect pests that feed on leaves and needles of trees on an annual basis are called defoliators. These infestations normally do not kill trees immediately. A significant loss of leaves or needles results in decreased growth, increased susceptibility to attack by other insects and pathogens, and eventually – mortality. In the case of spruce budworm, it takes 5-7 years of consecutive severe defoliation to kill a tree. Other defoliators, such as the aspen serpentine leafminer, usually inhibit tree growth and weaken a tree without killing it. Because defoliation can occur over several years in the same areas, the reported area for defoliators is unique for each year. Some pathogens can also cause defoliation (e.g. spruce needle rust); therefore, areas affected by these agents are also unique for each year.

Common defoliators in the NWT: Spruce Budworm, Aspen Serpentine Leafminer, Forest Tent Caterpillar, Large Aspen Tortrix, Aspen Two Leaf Tier, Leaf Rollers, Willow Blotch Leafminer, Birch Leafminers.

Damage caused by bark beetles typically results in tree mortality. The numbers reported for these agents represent the current status of affected areas (tree stands) and percentage (%) of tree mortality. Often, pests act in larger groups or concentrations rather than a singular attack, resulting in tree mortality. Most abiotic disturbance observed in the NWT is associated with tree mortality, e.g., flooding mortality or blowdown (wind damage) mortality.

Most common insect pests causing tree mortality in NWT: Western Balsam Bark Beetle, Spruce Beetle, Eastern Larch Beetle, White Spotted Sawyer Beetle (pest complex).

Most abiotic disturbance observed in the NWT is associated with tree mortality: e.g. flooding mortality or blowdown (wind damage) mortality.

1. Insects

Trembling Aspen and Balsam Poplar Defoliation

Only trace amounts of trembling aspen and balsam poplar defoliation were found across all surveyed areas. The primary free-feeding defoliators observed in 2023 were the Pale-Headed Aspen Leafroller *(Anacampsis niveopulvella),* Oblique-Banded Leafroller *(Choristoneura rosaceana),* Cottonwood Leaf Beetle *(Chryosmela scripta),* Aspen Leaf Beetle *(C. crotchi),* Large Aspen Tortrix *(Choristoneura conflictana),* and Aspen Leaftiers *(Enargia sp.).* The only aspen defoliation damage observed from the air and recorded spatially throughout the NWT was caused by the Aspen Serpentine Leafminer (ASL; *Phyllocnistis populiella)* (Fig. 5-7). It was mapped separately due to its outbreak size and the stark damage symptoms that were easily visible from the air.

A total of 0.45 M ha of light-to-severe leaf mining damage was recorded, which is an approximately 60% decrease from 1.04 M ha in 2022 (Fig. 8). For the most part, this decrease is a direct result of poor visibility that limited detection and forcing route changes. A legitimate population decline also occurred in most areas of the Sahtu Region, while slight increases were noted in both the South Slave and North Slave Regions.

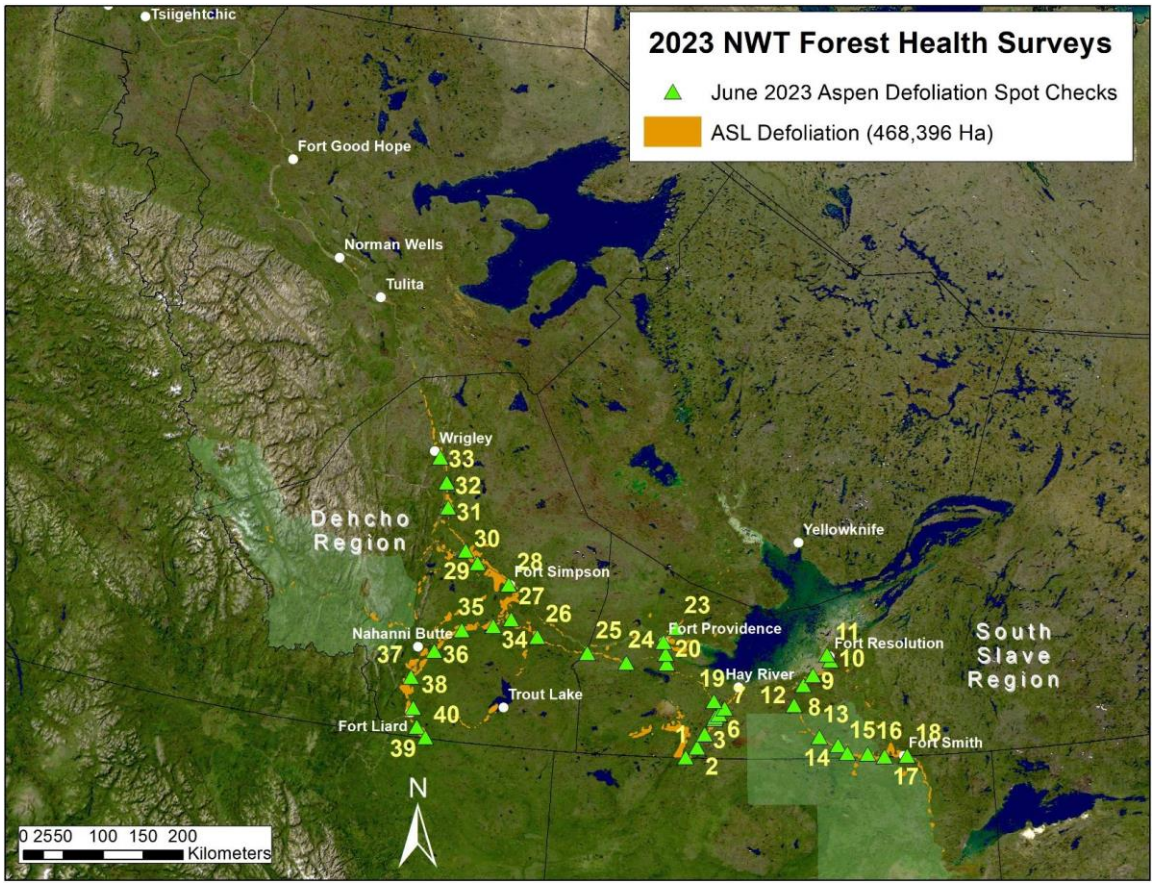

Figure 5. 2023 Aspen Defoliation Survey spot check locations and Aspen Serpentine Leafminer defoliation

Figure 6. Aspen Serpentine Leafminer Pupa, Highway 5 near Klewi River, 2023.

Figure 7. Severe Aspen Serpentine Leafminer defoliation, near Fort Smith, 2023.

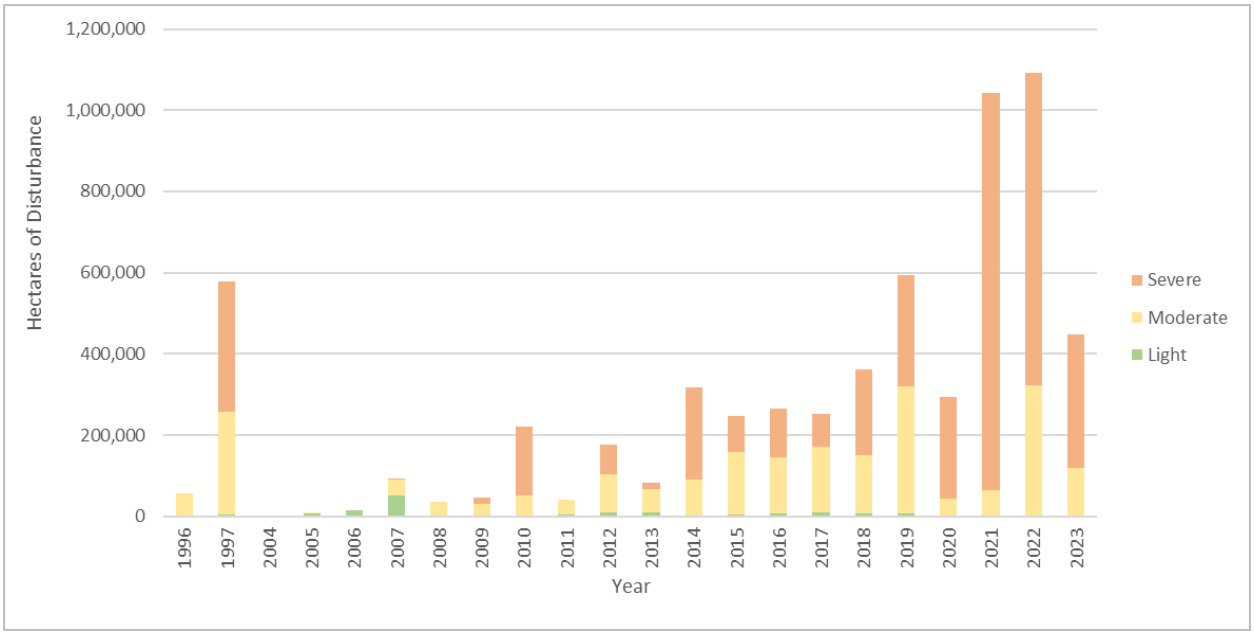

Figure 8. Temporal dynamics of aspen serpentine leafminer defoliation; 448,964 hectares in 2023 in the NT, including Parks areas

Spruce Budworm (SBW) and Spruce Coneworm (SCW) Defoliation

A total of 0.54 M ha of Eastern Spruce Budworm (SBW; *Choristoneura fumiferana)* defoliation was recorded during the 2023 forest health surveys (Fig. 9). The area of white spruce defoliation decreased in every region in 2023 compared to the 1.38 M Ha recorded in 2022 (Fig. 10). The primary reason cited for this was poor visibility, resulting from elevated wildfire activity throughout survey routes. However, in some areas where visibility was sufficient, a general decrease or spruce budworm population collapse was confirmed.

SBW recorded areas decreased by 70% in both the Dehcho and Sahtu Regions in 2023. Only 272,380 ha of SBW defoliation were recorded in the Dehcho (not including Nahanni), and 16,833 ha in the Sahtú—both substantial decreases from 2022 levels. In the Dehcho, legitimate declines were noted in Nahanni National Park, along the North Nahanni River and Camsell Bend areas, and along the Mackenzie River between Camsell Bend and Wrigley. In the Sahtu, declines were observed along the Mackenzie River from the Dehcho border to the Fort Good Hope area, and along parts of the Rampart and Hume Rivers. Visibility issues affected most other areas.

In the South Slave, approximately 225,121 ha of SBW defoliation were recorded, representing a 35% decrease from the 350,559 ha mapped in 2022. In the North Slave, there was an approximate 60% decrease, and only 3,443 ha were recorded. Some small new areas of defoliation were recorded in the Dettah area near Yellowknife. In the Beaufort Delta Region, SBW defoliation recorded in 2023 also decreased by approximately 50%, primarily along the Arctic Red River. The declines in this area were legitimate population

declines. It was noted large areas of SBW-caused spruce mortality have been observed along the Arctic Red River.

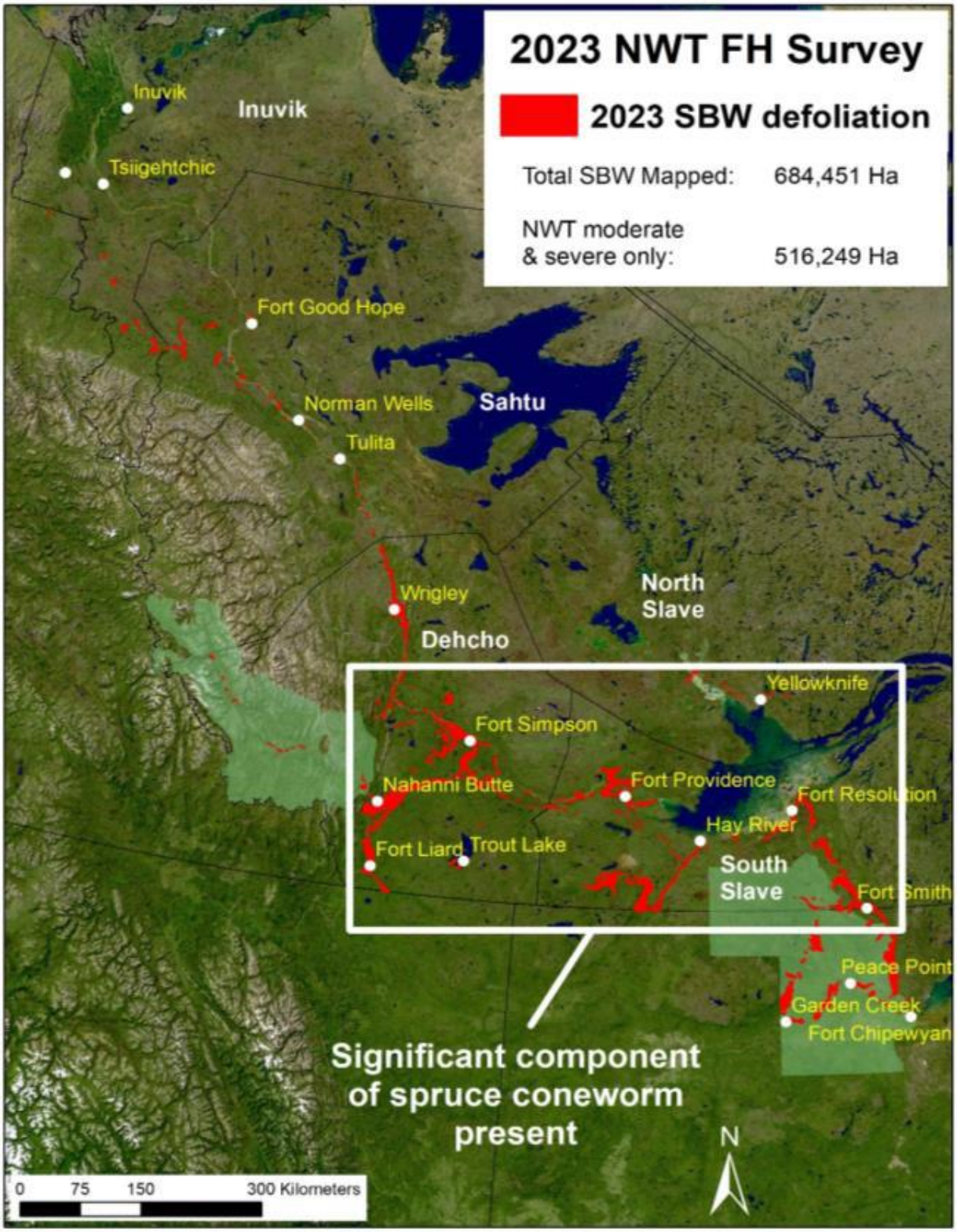

Figure 9. 2023 SBW and SCW defoliation

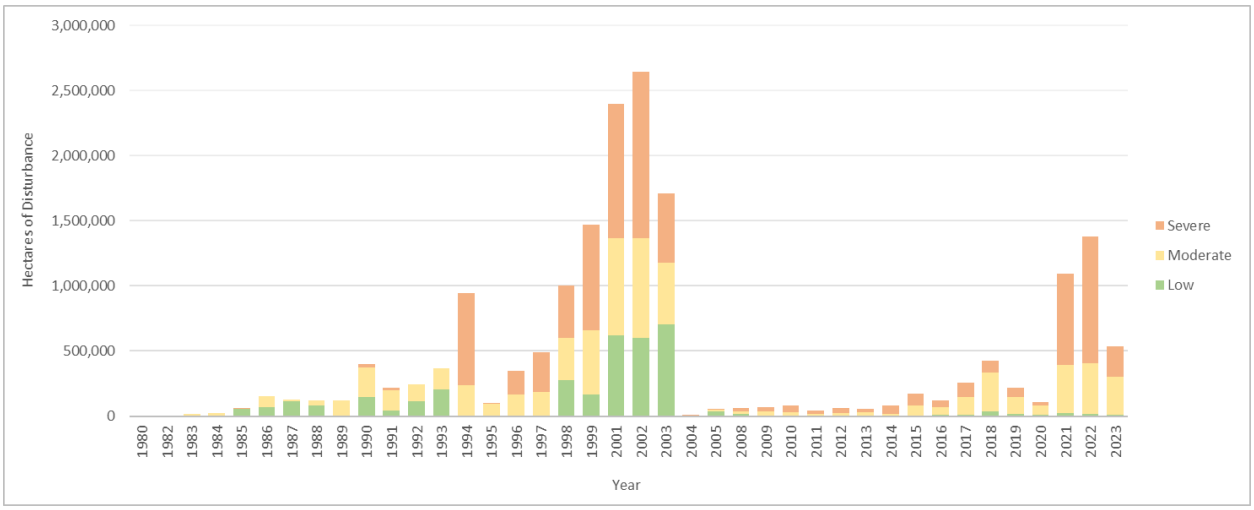

Figure 10. Temporal dynamics of spruce budworm defoliation; 535,235 hectares in 2023 in the NWT, including Parks areas

Spruce Coneworm (SCW)

It is important to note that much of the spruce defoliation in the South Slave, Dehcho, and North Slave Regions in 2023 included a new pest at outbreak levels, called the Spruce Coneworm *(Dioryctria reniculelloides)* that contributed significantly to defoliation (Fig. 11 and 12). This was especially evident in the South Slave, Dehcho, and North Slave Regions where substantial populations of this pest are mixed in with SBW. Unfortunately, both the SBW and SCW cause similar defoliation, which makes defoliation between the two pests nearly impossible to differentiate from a distance.

The highest proportions of Spruce Coneworm are around Fort Smith (65%) followed by the South Slave (50%), the Dehcho (30%), and then the North Slave Region (<20%). This may suggest a requirement of this species for warmer temperatures.

Figure 11. Larvae: Spruce Coneworm (left) and Sprucebudworm (right), Highway 6 near the Little Buffalo River, 2023.

Figure 12. Pupae: Spruce Coneworm (top) and Spruce Budworm (bottom), Highway 2, near Hay River, 2023.

SCW is suspected to be native to Canada, though it was only first documented in 1937. It is commonly found alongside SBW during budworm outbreaks, feeding on cones, flowers, buds, and needles. It can cause very similar defoliation to that of the Spruce Budworm, so it is easily missed or mistaken for budworm defoliation during outbreaks. The Coneworm both feeds alongside and competes with Spruce Budworm. It can be aggressive and has been known to feed on other phyllophagous larvae, such as the Budworm, when populations are high, and food is scarce. Spruce Coneworm populations increase during high-yield cone crop years, which is what occurred in 2022 as large, stress-induced cone crops were observed throughout northern and western Canada induced by the extreme heat dome (a large long-lasting stable air mass of high pressure and temperature) experienced in 2021.

Willow Blotch Leafminer (WBLM)

Unlike other pests, the Willow Blotch Leaf Miner (*Micruapteryx salcifoliella),* increased in its presence by approximately 63% in 2023, with 26,333 ha of mining damage recorded across the NWT (Fig. 13). This increase was observed in all areas except for the Beaufort Delta Region, where only 221 ha were mapped—half of what was recorded in 2022. The majority of WBLM damage continues to be observed in the South Slave (16,896 ha) and Dehcho (4,731 ha). Given the drought conditions faced this summer, drought damage and excessive roadside dust also rendered aerial detection of this pest very difficult.

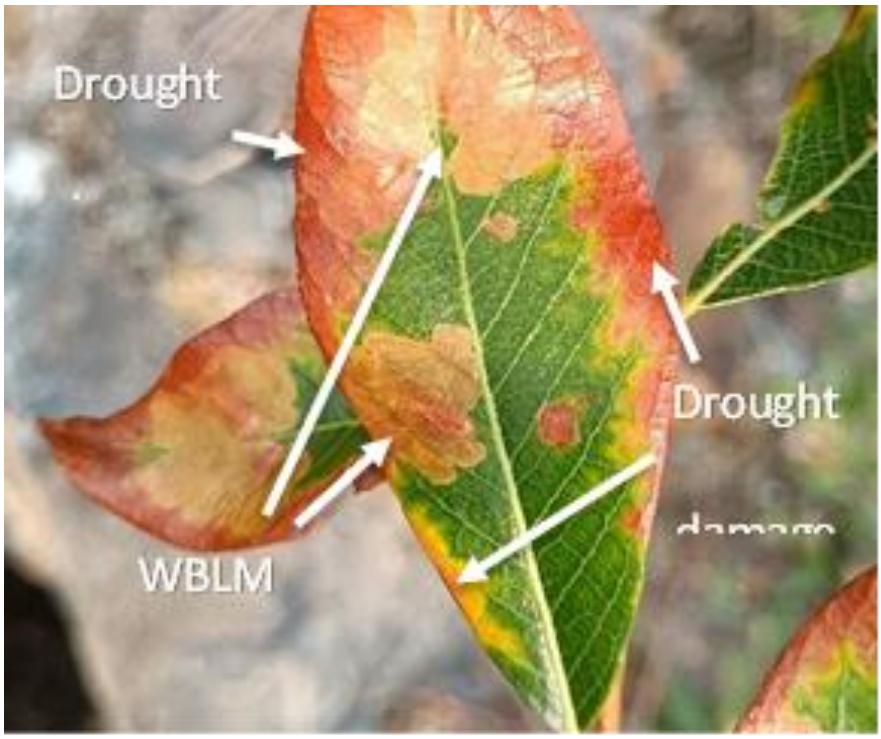

Figure 13. Willow Blotch Leafminer and drought damage, Mackenzie Highway, 2023.

Suspected Bark Beetle in White Spruce (Unknown Bark Beetle, UNKBB)

Two areas of suspected Bark Beetle were observed during aerial surveys in 2023. In the Dehcho, two light patches (<10% mortality) totalling 624 ha were recorded just outside of the Nahanni Park border west of the Nahanni Range, roughly 27 km north of the Nahanni Butte. The White spruce mortality that occurred is relatively young and open-grown, so it may have been previously weakened by the 2021 heat dome, increasing susceptibility to attack. If true, the bark beetle attacks are likely a secondary rather than primary damaging agents.

In the Beaufort Delta Region, four small areas totalling 32.7 ha were mapped on the west side of the Peel River near the Fort McPherson ferry crossing. Mortality is present within mature white spruce stands among the ponds beside the river. In both cases, the bark beetles suspected of causing the mortality could include any combination of Ips sp. *(I. perturbatus, I. borealis),* Dendroctonus punctatus, or many other secondary Bark Beetles and Wood Borers. To confirm this, ground sampling is required to ascertain the agents involved.

Jackpine Resin Midge (JPRM)

Damage from this pest was first observed in 2021 but went undiagnosed until 2023. The Jackpine Resin Midge (*Cecidomyia Resinicola)* is suspected of contributing to Jackpine branch tip mortality in the South and North Slave Regions in 2023 (Fig. 14). Though the areas recorded were very small (approximately 18 ha and 3.6 ha respectively), it is suspected the true areas being affected are likely much higher. From a distance, the damage resembles symptoms from other damaging agents such as drought conditions, western gall or blister rust, squirrel damage, and blights, making the detection and mapping of infested areas difficult without substantial ground surveys.

Damage from this pest first manifests as resin droplets at the base of new green shoots. Larvae live within the droplets and feed upon the resin at a rate that is eventually enough to kill plant shoots. This insect is not known to feed directly on cambium tissues. When outbreaks do occur, tip mortality can be as high as 75%, however, the midge rarely causes tree mortality. It is suspected that when severe populations are combined with droughts, very young regeneration may be affected.

Figure 14. Jackpine Resin Midge exit hole from resin droplet, near the Jct. of Highway 5 and 6, 2023

Jackpine Tube Moth (JPTM)

The Jackpine Tube Moth (*Argyrotaenia Tabulana)* (Fig. 15). was found causing light shoot tip defoliation across approximately 29.4 ha of Jackpine regeneration along Highway 9, near the Yellowknife Highway Junction. This pest is native to North America; however, it is unclear if an NWT record exists. It is suspected that it has been present in the past, but has gone unnoticed due to its subtle, nondescript symptoms. Only one known outbreak from this pest was recorded in Canada in the northeast corner of Alberta and northwest corner of Saskatchewan in the 1960s. Another smaller record of moderate to severe damage is documented from Prince Albert, Saskatchewan. Light infestations will not have any long-term health impacts for the Jackpine, but moderate to severe defoliation could reduce radial growth and cause twig or branch mortality. Like the Jackpine resin midge, it is also suspected of causing mortality in young regeneration if severe defoliation coincides with drought.

Figure 15. Jackpine Tube Moth damage, Jct. of Highway 9 & 3, 2023.

Bead-Like Cottonwood Gall Aphid (BLGA)

The Bead-like Cottonwood Gall Aphid *(Thecabius Populimonilis)* was found in every region throughout the NWT, however, it was at lower levels than in previous years (Fig. 16). This was not the case near Whatì, where approximately 209 ha of young roadside Balsam Poplar regeneration were severely infested with the aphids causing substantial galls on foliage. Another smaller area (5.6 ha) was recorded along Highway 3 south of Frank Channel. Premature leaf drop on affected trees was likely to occur in these areas.

Figure 16. Severe Beadlike Cottonwood Gall Aphid damage near Whati

Eastern Larch Beetle (ELB)

A total of approximately 23.6 ha of larch mortality, caused by the Eastern Larch Beetle (*Dendroctonus Simplex)* was recorded in the South and North Slave Regions in 2023 (Fig. 17). This included 15.4 ha of small patches along Highways 1 and 5 in the South Slave 8.3 ha along Highway 3 in the North Slave. Populations have persisted for several years in these regions in small, scattered pockets of 2-12 trees.

Figure 17. Eastern Larch Beetle adults, Highway 5 near Highway 6 Jct., 2023.

Yellow-Headed Spruce Sawfly (YHSS)

Approximately 16 ha of young white spruce defoliation, caused by the Yellow-Headed Spruce Sawfly (*Pikonema Alaskensi),* were mapped in small, scattered pockets within the Dehcho, South Slave, and North Slave Regions (Fig. 18). Its presence is sporadic, but common in the NWT. This pest prefers young trees growing in open areas; trees in closed forests are not generally attacked. Since the Yellow-Headed Spruce Sawfly feeds on both new and older growth, damage can be quite severe when it occurs annually, causing leader and tree mortality.

Figure 18. Yellow-headed spruce sawfly larva and damage, Fort Providence.

Poplar Twiggall Fly (PTGF)

Twiggalls formed by the Poplar Twiggall Fly *(Euhexomyza Schineri)* were observed on several young, roadside aspen regen in the Dehcho and South Slave Regions (Fig. 19). The galls form during the feeding process of maggots, which can cause branch mortality and the development of multiple new leaders over time. A heavily infested area that totalled 15 ha was mapped along Highway 3, just south of the Highway 9 Junction.

Figure 19. Poplar Twiggall Fly damage, Highway 7 south of Birch R., 2023.

2. Diseases

Western Gall Rust (WGR)

Western Gall Rust *(Endocronartium Harknessii)* is commonly found on Jackpine branches and stems throughout the range of Jackpine in the NWT (Fig. 20). Galls form due to the rust infections stimulating abnormal tissue growth that helps protect the rust from the tree's defences. The galls restrict water and nutrient flow which, in severe infections, can weaken trees, causing significant growth loss. Branch and tree (stem infections) mortality can result, especially when combined with droughts. The larger, more noticeable rust infections were recorded in the spatial data throughout the Dehcho (55 ha) and the South Slave (40 ha), while the vast majority (571 ha) were recorded within the NWT side of Wood Buffalo National Park (WBNP). Smaller, scattered individual infections were also noted in the North Slave. Many of these infected areas experience branch mortality each year.

Figure 20. Western gall rust branch and stem infections, Jct. Highway 5 & 6, 2023

Comandra Blister Rust (CBR)

Comandra Blister Rust *(Cronartium Comandrae),* is also common in the NWT, though not as much as the Western Gall Rust (Fig. 21). It causes similar branch and stem galls, though the gall shape is more oblong and elongated rather than round. The impact on trees is also similar and can cause branch and stem mortality. Approximately 7.5 ha were recorded in several light to moderate patches in the North Slave Region, specifically along the Ingraham Trail, and Highway 9, near Whati. Other smaller infections were noted along Highway 9 in the North Slave and along Highway 5 in the South Slave.

Figure 21. Comandra blister rust branch infections, Jct. Highway 5 and 6

Aspen & Poplar Shoot and Leaf Blight (VLB)

Several roadside patches of Aspen Shoot Leaf Blight ***(****Venturia Macularis),* totalling approximately 13.4 ha, were recorded along the WBNP border in the South Slave by the Little Buffalo Falls Territorial Park (Fig. 22). It was also observed along roadside aspen regen at trace levels throughout ground surveys in the Dehcho, South and North Slave Regions. Another species of the same genus is Poplar Shoot Leaf Blight *(Venturia Populina),* which affects Balsam Poplar. Although no infections were large enough to map areas, it was observed along the Hay Camp Road in WBNP and along Highway 6 west of the Buffalo River at trace levels. Both species also share the additional common name "Shepherd's Crook," which refers to the 'crooked' shape of the infected branch tips and terminals.

Figure 22. Aspen Shoot Leaf Blight north of Muskeg River, Highway 7, 2023.

Diplodia Canker (DIPTUM)

Diplodia Canker, *(Diplodia Tumefaciens)*, was found infecting aspen stands in the South Slave and WBNP (Fig. 23-25). Areas were large enough to be documented in the spatial data records, which totalled roughly 0.2 ha and 8 ha, respectively. The small, infected area in the South Slave was found along Highway. 1 located south of Alexandra Falls, while the WBNP area was found along the Hay Camp Road.

Figure 23. Diplodia Canker, south of Alexandra Falls, Highway 1, 2023.

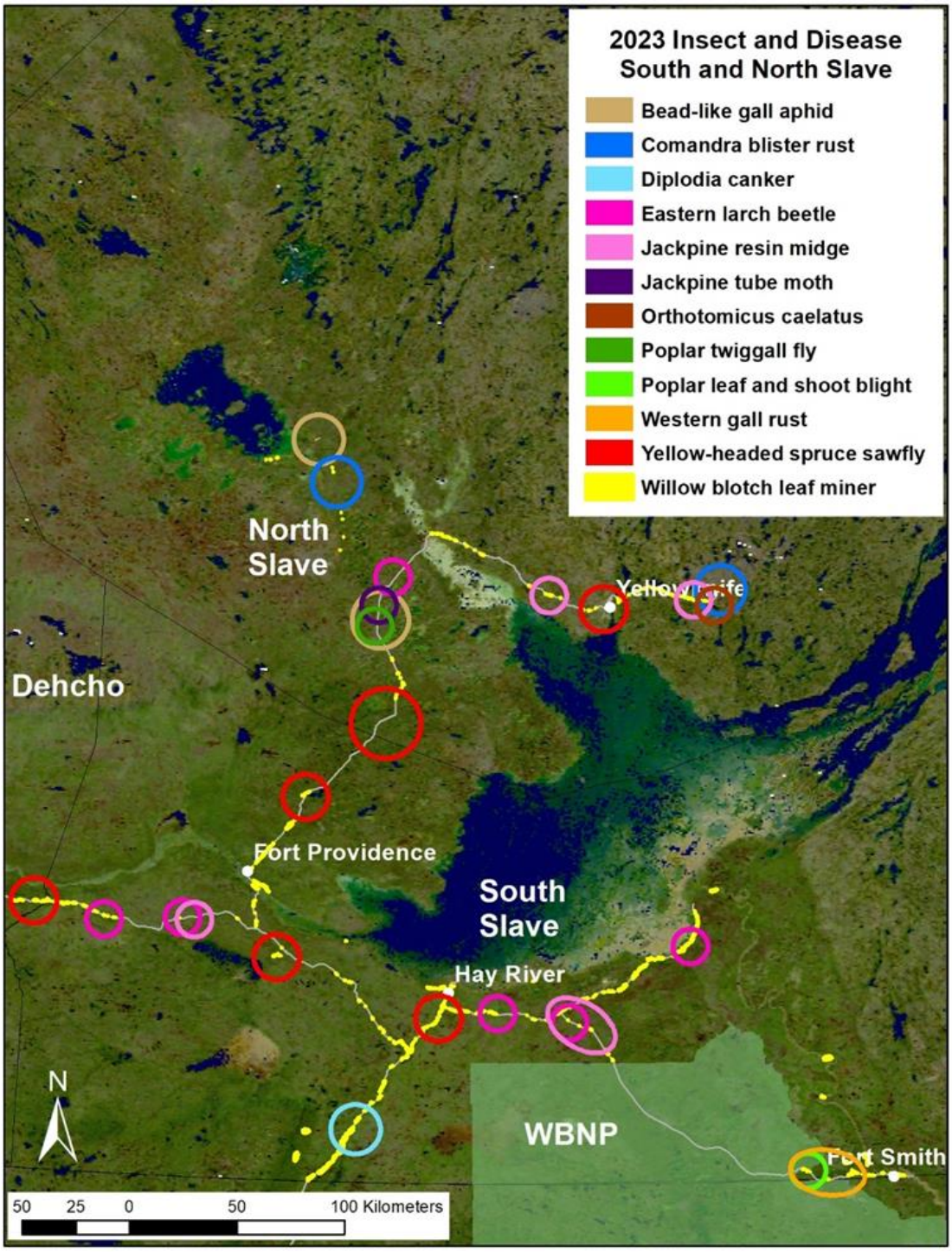

Figure 24. Other 2023 FH primary insect and disease issues, South and North Slave Regions.

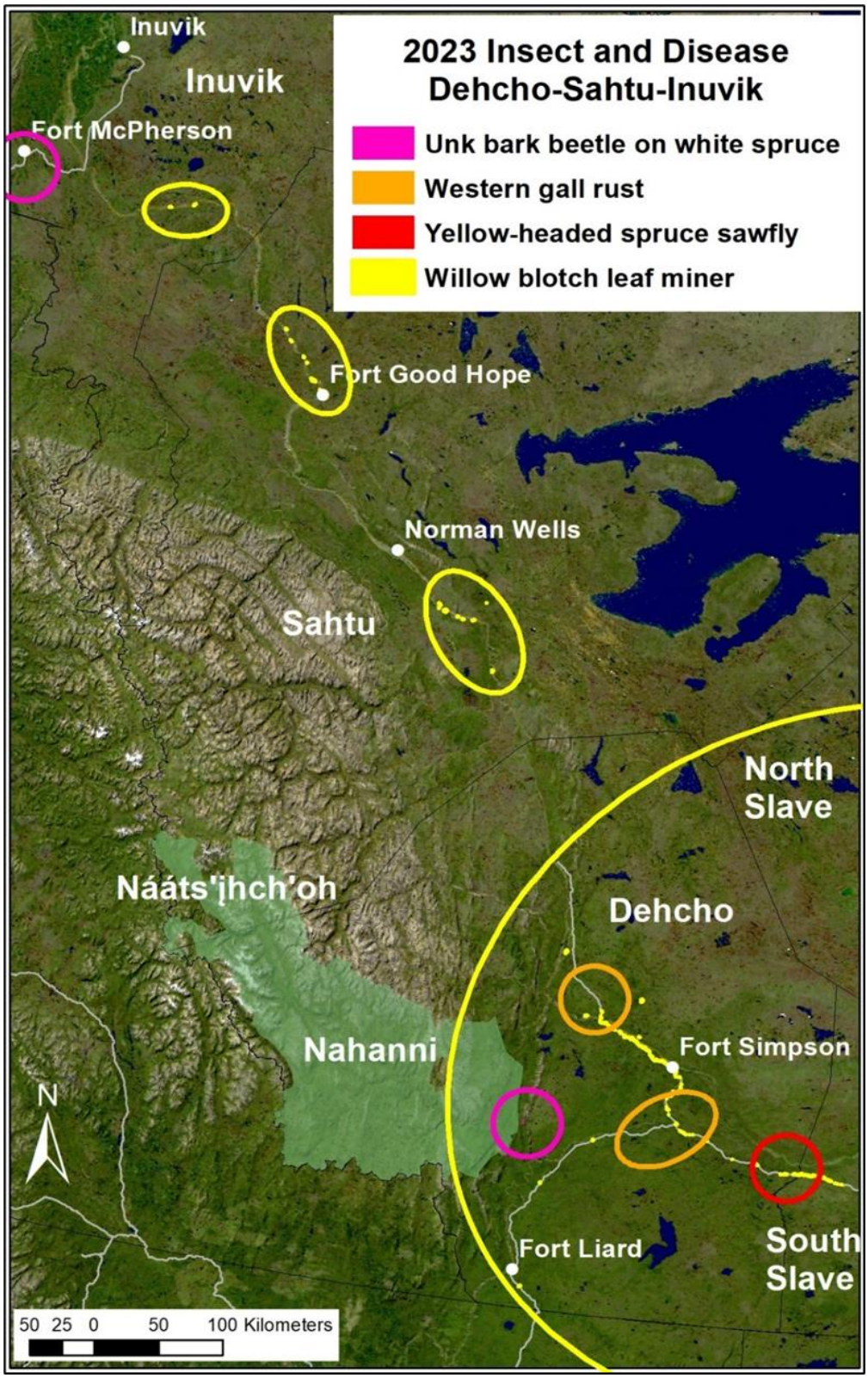

Figure 25. Other 2023 FH primary insect and disease issues, Dehcho, Sahtu, and Inuvik Regions.

3. Animals and Abiotic Damage

Bison Damage (BISON)

Bison damage is commonly found affecting roadside saplings along many of the highways in the NWT, especially along Highway 3 north of Fort Providence, Highway 5 in WBNP, and parts of the Liard Highway. Several significant patches of bison-caused Jackpine mortality, totalling 76 ha, were recorded along Highways 3 and 9 in the North Slave Region. It is suspected that drought played a significant role in exacerbating this mortality in these areas.

Porcupine (PORC)

Porcupine also damaged two mature Jackpine stands causing mortality in two small patches, which totalled 7 ha. These were found along Highway 1 to Wrigley, just south of the Willowlake River crossing (Fig. 26).

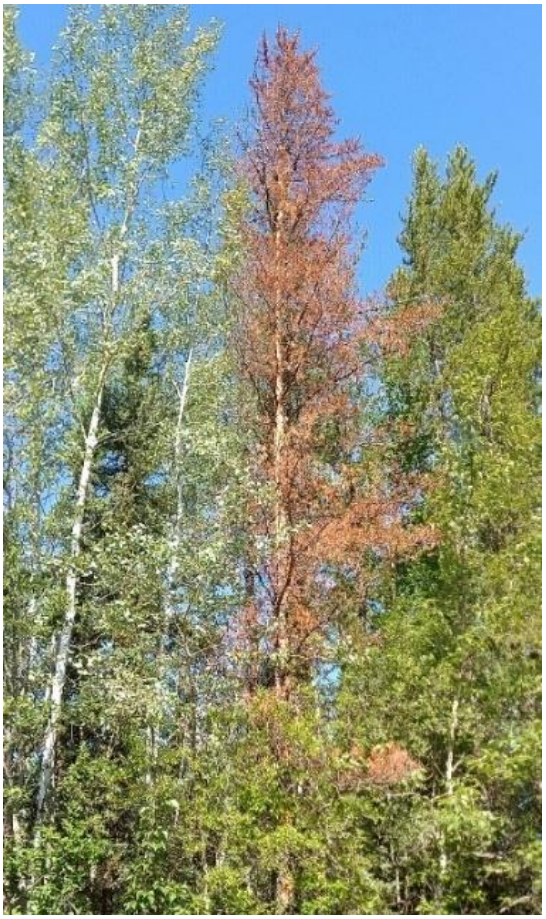

Figure 26. Porcupine damage, Willowlake River, Highway 1, 2023.

Wind Damage (WIND)

Strong winds are suspected of causing substantial damage to white and black spruce (Fig. 27) in the northern end of the Sahtu Region in 2023. Approximately 30,157 ha of broken tops and bent-over trees, most facing east, were recorded throughout a large area between the Arctic Red River Valley, west to the Mackenzie River. The damage observed was not blowdown but rather involved standing trees that were either bent over or had broken tops. It is suspected that heavy cone crops that developed in 2022, aided in the tops being broken. This may have been caused by the sheer weight of the cone-laden terminals combined with strong winds or possibly by the accumulation of winter ice or snow loads plus winds.

Additional areas of blowdown and broken tops, totalling 873 ha, occurred in several scattered patches along the Muskeg River and by Trout Lake in the Dehcho Region. The blowdown occurring in these locations is being observed primarily along the perimeters of the previously impacted stands affected by the extensive 2021 blowdown event. In Nahanni National Park, another 43 ha of blowdown and broken tops occurred east of Margaret Lake in Nááts'ihch'oh National Park.

Figure 27. Bent and broken tops caused by wind

Slumping (SLUMP)

Permafrost thaw slumping events in the NWT typically occur along riverbanks, elevated lake shores, or on the slopes of hills and plateaus (Fig. 28). Slumps are more common in higher latitudes due to the increased frequency of permafrost areas. This year, a total of 949 ha of slumping damage was mapped throughout all regions, except for the North Slave. Naturally, most were recorded in the far north, along the Arctic Red and Mackenzie Rivers in the Inuvik Region (478 ha).

Figure 28. Slumping damaged forest, south of Tsiigehtchic.

Flooding (FLOOD)

Approximately 2,049 ha of flooding damage was recorded in 2023, where most observations were areas missed the previous year or were past flooding events with delayed symptoms and/or new edge mortality. Although 2023 was a drought year with lakes and rivers having very low levels, some new areas of flooding damage occurred, including an area along the Wrigley Highway where standing water was observed stressing a black spruce stand (Fig. 29). These various new flooding events may have been caused by beaver dams, or excess groundwater from previous large fires and/or possibly melting permafrost.

Figure 29. Standing water yellowing black spruce, south of Wrigley

Drought Stress, Decline, and Mortality Summary (DRO)

Due to the unseasonably warm early spring and summer and lack of precipitation, 2023 brought severe and extreme drought conditions to the Dehcho, North Slave, and South Slave Regions (less than 25% of normal precipitation) and moderate drought in the rest of the NWT (25-50% of normal precipitation). This resulted in an unprecedented wildfire season and significant physical stress, damage, and mortality to NWT forests. The National Agroclimate Information Service reported that as of the end of August, more than 80% of the NWT had drought classes between abnormally dry to extreme drought conditions (Fig. 30).

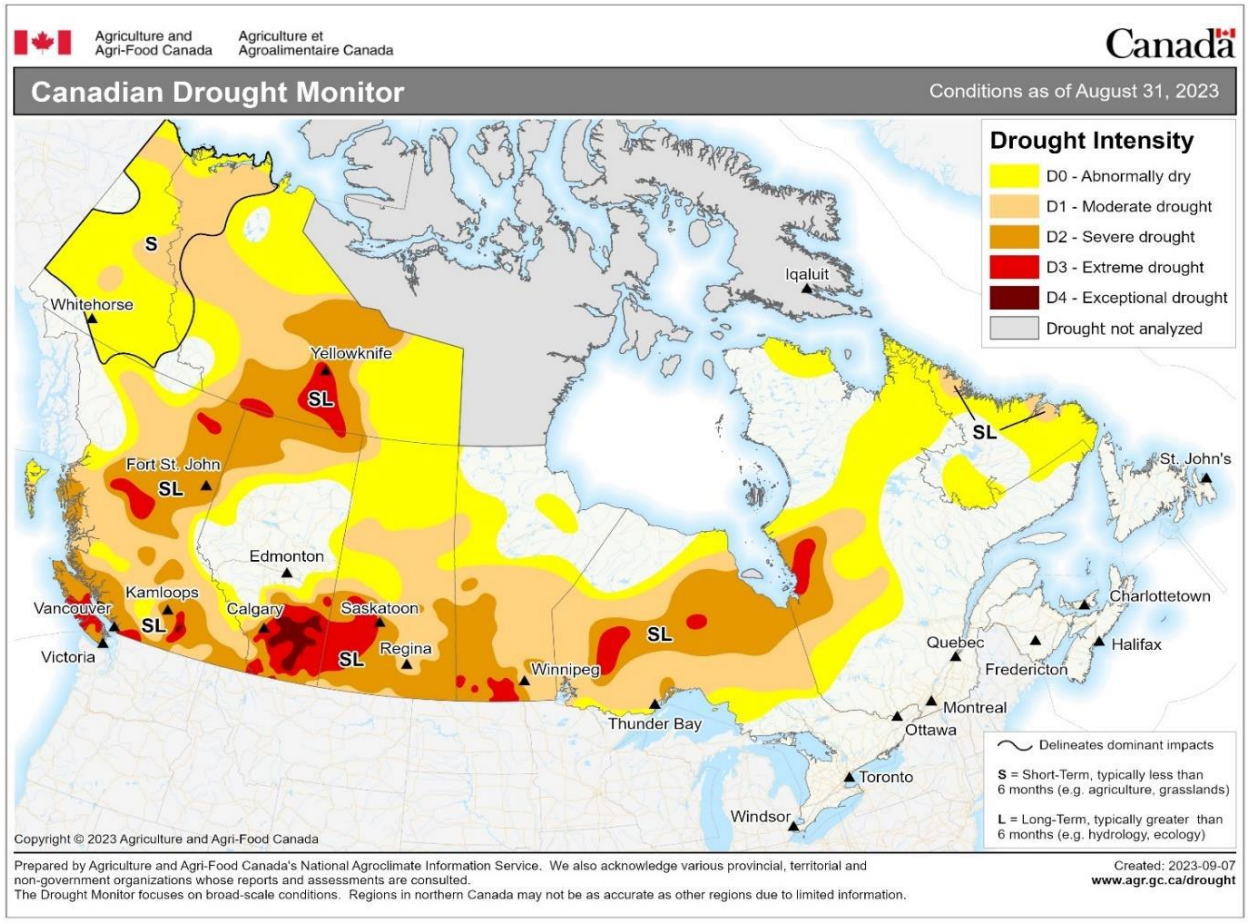

Figure 30. 2023 Drought map of Canada, Agriculture and Agrifood Canada, Aug 31, 2023.

Drought symptoms included the yellowing, browning, and reddening of leaf margins and needle tips, stunted foliage, dead branch tips, crown dieback, and even tree mortality (Fig. 31-35). Since GNWT FH Surveys occurred in June and July, symptoms likely continued to worsen throughout August and September. Therefore, it is very unlikely that the true extent of 2023 drought damage was captured. Secondary damaging agents attracted to the tree's condition will inflict further damage and contribute to its mortality for years to come. In total, 68,428 ha of drought stress and mortality were recorded in 2023. Although the drought damage recorded only represents approximately 1.4% of the total FH aerial survey, it is suspected that much more damage went unsurveyed due to visibility conditions, limited route coverage, and the fact that drought symptoms likely continued to accumulate well into August and September.

Roughly 4,076 ha of moderate to severe drought-induced jackpine mortality—6% of the total drought damage mapped—occurred within the Dehcho and South Slave Regions. Although this mortality was easily observed in many areas along Highways 1, 5, and 6, other pockets were also observed during aerial surveys. Two of the largest and most severe areas of Jackpine mortality occurred along Highway 1 between Enterprise and McNallie Creek, and along the south shores of Great Slave Lake in the Dawson Landing – Pine Point area.

Most of these drought mortality arease involved open-grown or low-density stands, often surrounding a gap or bordering an opening. This allowed for greater sunlight and wind exposure, increasing moisture loss in the soil and trees. This is also an issue if warm winds occurred during early spring or winter when roots were still frozen, then winter desiccation could have occurred. It is quite possible given, the recent climate, that both drought and winter desiccation occurred to cause the mortality. Considering the critical lack of precipitation in 2023, it is highly likely drought conditions will persist into autumn and into next year, along with the potential for additional mortality caused by secondary damaging agents attacking the drought-weakened trees.

Figure 31. Drought-stress affecting multiple species, Norman Wells, 2023.

Figure 32. Drought-stress affecting multiple species, Ingraham Trail near Tibbit Lake, 2023.

Figure 33. Drought-induced jackpine mortality, Highway 1 near McNallie Creek, 2023.

Figure 34. Drought-induced jackpine mortality, Pine Point, south shore of Great Slave Lake, 2023.

Figure 35. Jackpine drought mortality and general drought-stress affecting multiple species throughout the NWT, 2023.

Aspen Decline (AD)

Approximately 2,770 ha of moderate aspen decline were recorded in the North Slave, South Slave, and Dehcho Regions in 2023, however, this is by no means all that is occurring in the NWT (Fig. 36). Since Aspen decline tends to expand over time, a more accurate assessment of the full extent can be compiled over a period of years. Although aspen decline can occur for various reasons, most of what is occurring in western North America is believed to be caused by droughts in combination with stressors, such as insect and disease outbreaks. This is true for northern stands as well, but with the addition of decline occurring due to rising water tables from extreme, large fires and the melting of discontinuous permafrost zones. Given the decline events that occurred after the 1996 and 2014/15 droughts, it is fully expected the 2023 drought will induce more aspen decline in the coming years.

Figure 36. Aspen decline in mature aspen, near Fort Providence.

Spruce Mortality and Decline (SMORT)

Spruce mortality caused by the accumulation of moderate to severe SBW defoliation, or by an environmental factor, are included under this category. Older mortality events are also recorded if they are found to be expanding or if they are believed to have been missed in the past. In 2023, a total of 4,457 ha of spruce mortality was recorded, which included 2,104 ha in the Sahtu Region and 119 ha in the South Slave Region. An additional 44 ha was also recorded in Nahanni National Park. Much of the mortality mapped in these regions is due to ongoing SBW defoliation and flooding/drought events. The remaining 2,190 ha was recorded in the Mackenzie Delta in the Beaufort Delta Region (Fig. 37-39). The ongoing mortality in the Delta appears to be caused by high water tables. The mortality occurs on the inside of forest stands that are surrounded by delta oxbows, ponds, and lakes. It has been observed that there is much more mortality occurring on the west side of the delta, near the Richardson Mountains, than on the east side.

Figure 37. Spruce mortality and decline in Mackenzie Delta

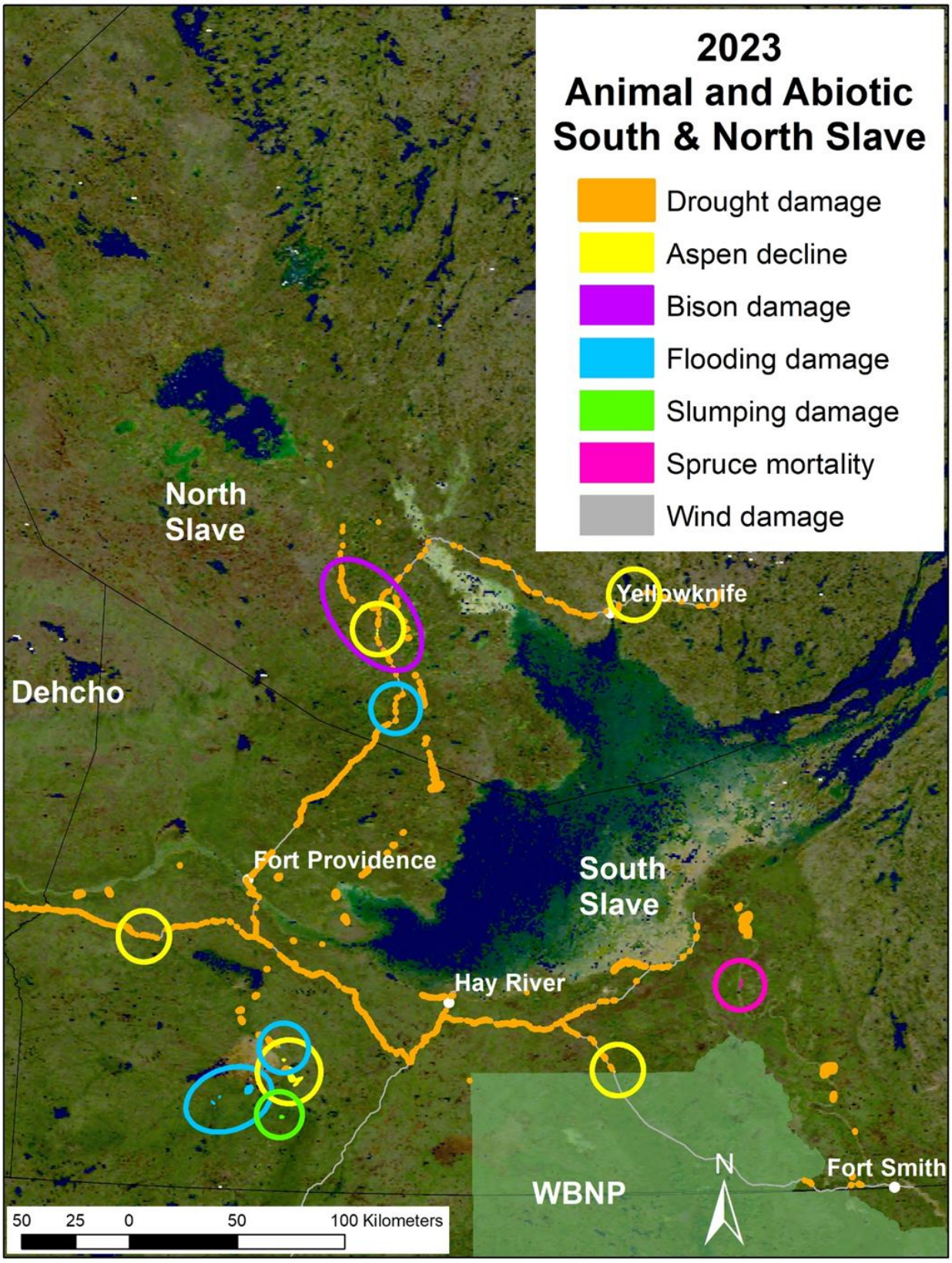

Figure 38. 2023 Abiotic and Animal FH Issues in the South and North Slave Regions.

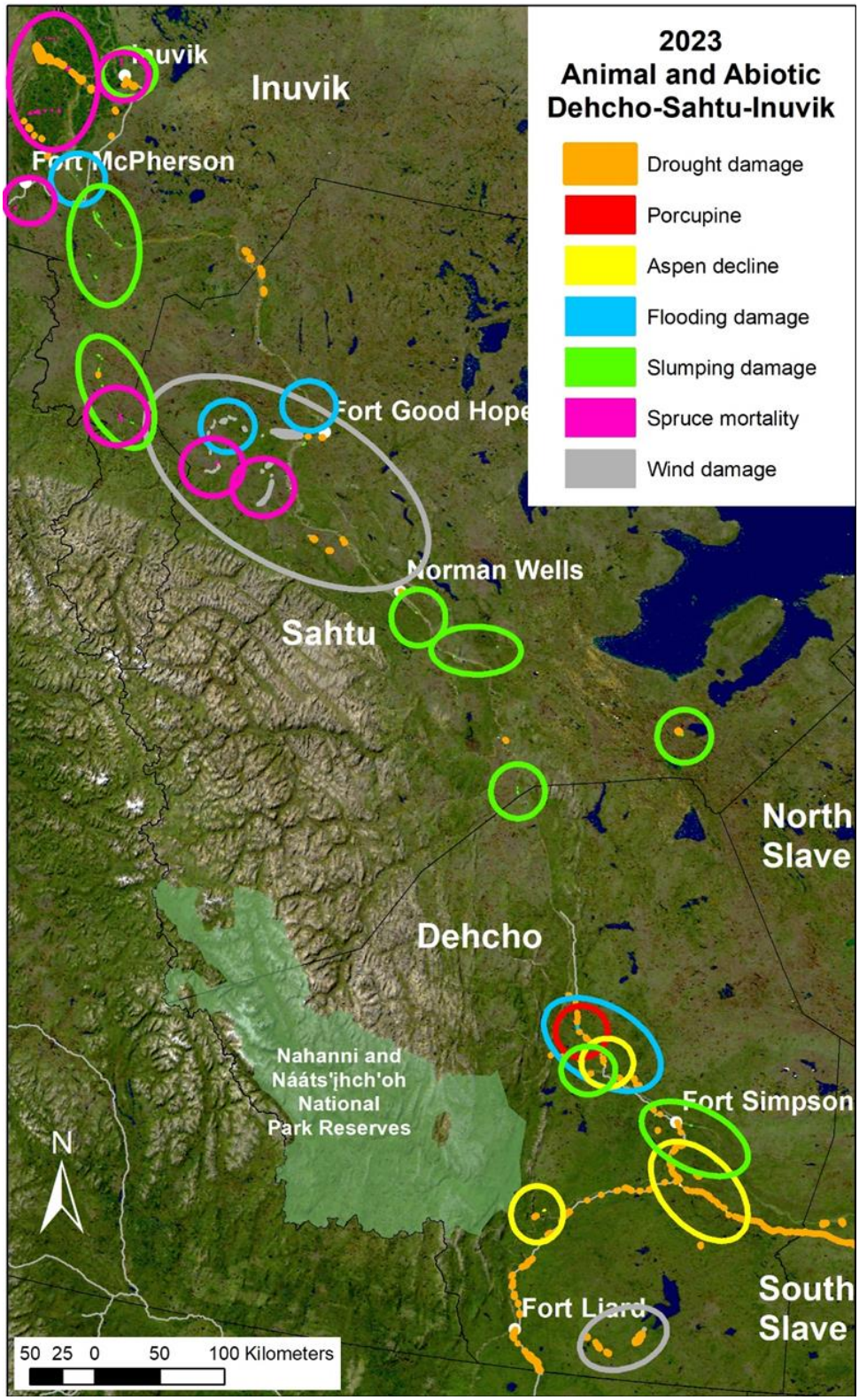

Figure 39. 2023 Abiotic and Animal FH Issues in the Dehcho, Sahtu, and Inuvik Regions.

Roger Brett[1]

Oleg Melnik[2]

[1] Skog Forest Health

[2] Forest Resources, Forest Management Division, Environment and Climate Change, GNWT

Acknowledgements

Fieldwork and Surveys:
Roger Brett, Skog Forest Health

GNWT Logistical Assistance:
Mike Gravel, Lisa Smith, Jakub Olesinski, Tyler Rea

PCA Logistical Assistance:
Jean Morin, Colleen Murchison, David Tavernini, Dean MacDonald, Jennifer Carpenter, Chelsea Hill

NRCan CFS NoFC Diagnostics:
Greg Pohl, Dr. Tod Ramsfield

Aviation services:
Simpson Air