Yukon Forest Health Report

2002

Yukon
Energy, Mines and Resources
Forest Management

Natural Resources Canada
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Yukon 2002
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Summary

The annual Canadian Forest Service survey of Yukon forests was conducted between June 27 and July 30, 2002. The purpose of the annual surveys is to identify and assess forest damage and damage agents, including insects, diseases and climatic stress. Most of the field time this year was devoted to the ongoing survey and analysis of a large epidemic of the spruce beetle, *Dendroctonus rufipennis* in the Shakwak Trench and Kluane National Park. This infestation has resulted in the death of mature white spruce over an area in excess of 250 000 hectares since first identified in 1994.

There was a general increase in insect activity throughout the southern half of the Yukon, especially in the southwest where, in addition to the spruce beetle, Ips engraver beetles, *Ips perturbatus* continued to kill young spruce. High populations of spruce budworm were seen throughout the upper Alsek River Valley and as far north as Congdon Creek. An unidentified Geometrid (looper) caused severe defoliation of willows in the alpine tundra south of Haines Junction and the aspen serpentine leafminer, *Phyllocnistis populiella*, infestation continued throughout the south. The eastern spruce budworm, which causes chronic defoliation of white spruce in the southeast significantly increased in terms of area but levels of damage remained similar to previous years.

This year also marked the end of the establishment phase of a forest health assessment project designed to objectively characterize the impact of spruce beetle on the ecology of timber stands within the Shakwak Trench and Kluane National Park. An additional 12 plots were established in 2002, bringing the total number to 27.

Spruce Beetle

Current status

Following two consecutive wet years, the spring and summer of 2002 saw a return of the drought conditions that had predisposed mature white spruce stands in the southwest to the attack of the spruce beetle in the early 1990s. The increased moisture in 2000/2001 was expected to relieve the severe drought stress and restore some vigour to the spruce beetle-infested stands of the Shakwak Trench and Kluane National Park, and in turn to precipitate the collapse of the spruce beetle epidemic, that had been in significant decline since 1998. Consistent with the established pattern for this infestation this northern population has repeatedly contradicted predictions based on historical

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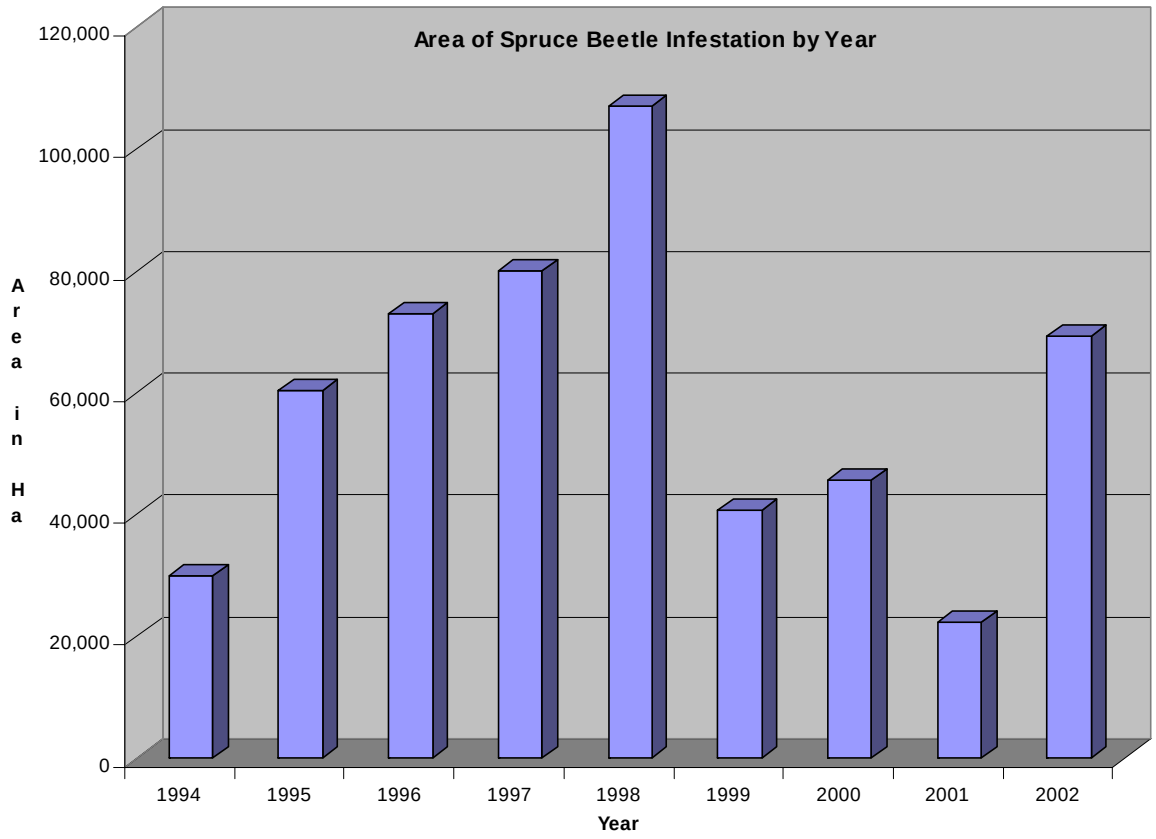
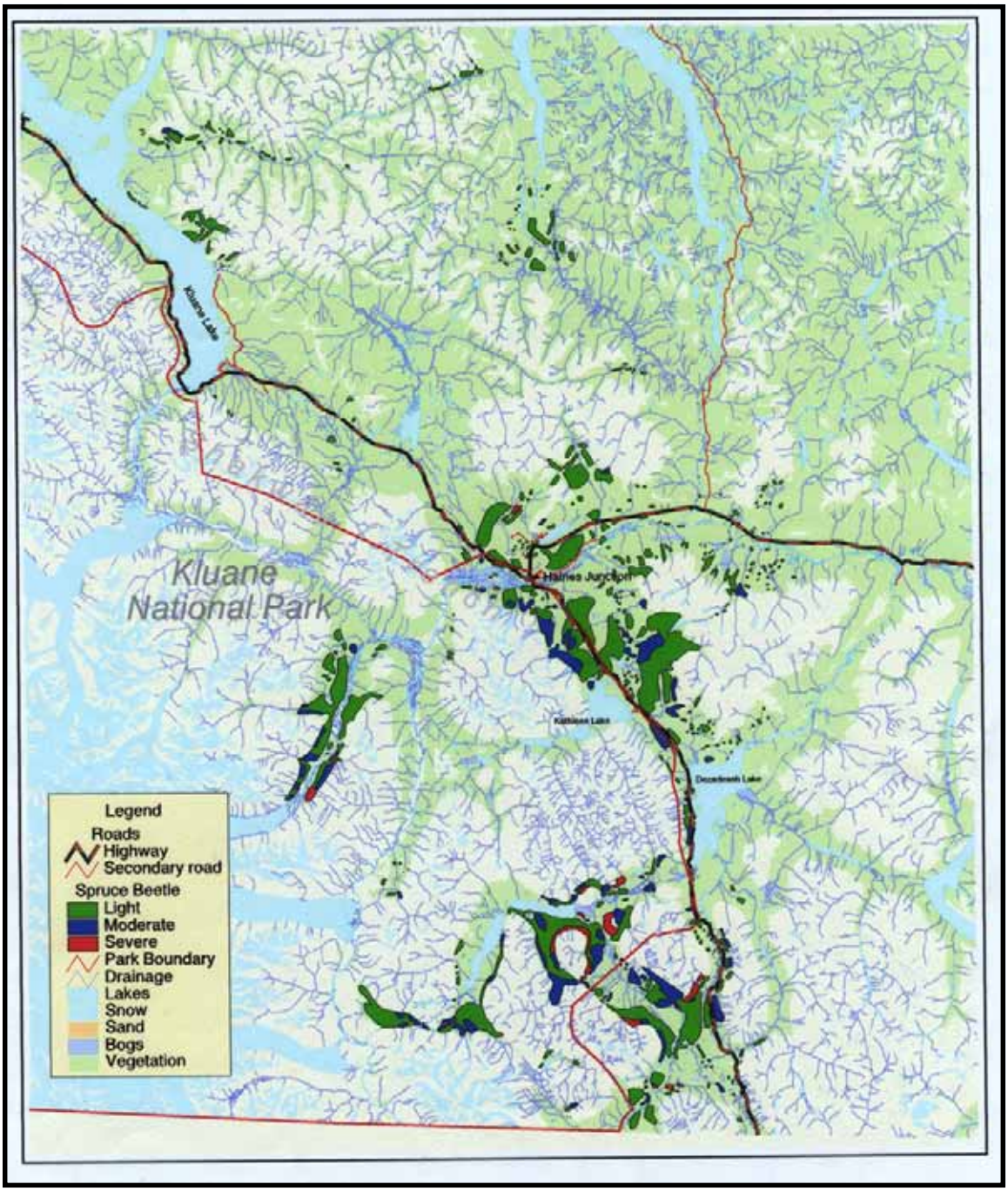
behaviour. The trend toward population decline was reversed this year. Instead of a collapse, **aerial surveys recorded a 300% increase** in infested area as well as an increase in the severity of attack. A total of 69 415 ha was mapped in 2002 (Figure 1, Map 1), compared with 22 600 last year. On the positive side, despite the dramatic increases, **there are no new areas of infestation**. This year's increases constituted a simple expansion and intensification of mortality in areas infested for two or more years.

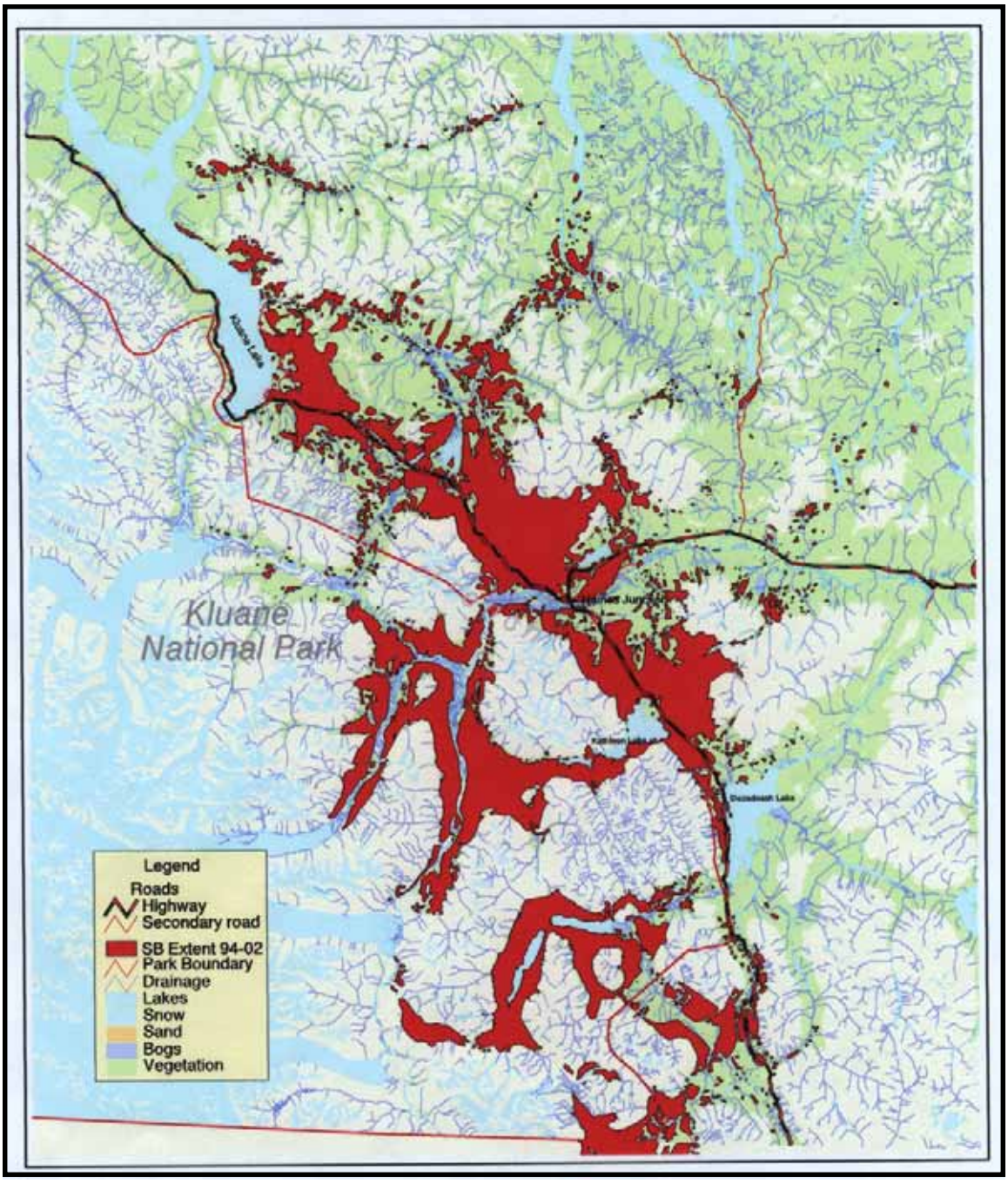
Figure 1: Area of recent spruce beetle-caused white spruce mortality from 1994 - 2002





Spruce Beetle Infestation - Yukon 2002

Map 1: Areas of recent spruce beetle attack recorded during aerial surveys in July, 2002.



Spruce Beetle Infestations - Yukon 1994 - 2002

Map2: Cumulative area of spruce beetle infestation.

There was evidence that recent increases in rainfall have improved the vigour of the remaining white spruce stands. There was a greatly increased frequency of "pitch-outs" wherein attacking beetles were washed from their galleries by copious flows of resin (Photo 1). Until recently the trees had lacked the resources to produce enough resin to defend against attacking beetles. It appears, however, that the improved vigour has benefited the beetles more than the trees. Re-invigorated trees were nevertheless overcome by mass attacks of beetles that actually enhanced the survival and vigour of beetle broods. Broods were also aided by the cool moist weather that slowed the drying of the attacked trees.

Photo 1: "pitch-out" of spruce beetle

The cool moist conditions also delayed the fading of the tree foliage from green to yellow-red. Many trees attacked in 2000 were still green when aerial surveys were conducted in late July 2001 and were not recorded. Instead they were mapped this year, somewhat inflating this year's mortality figures. Despite this however, the 2001 mortality mapped this year, is significantly greater than that which occurred in 2000.

Beginning in the north over 2600 ha of mostly light mortality was mapped in the lower Gladstone River Valley and farther south in the hills above Thorsen Bay and Cultus Creek. To the east scattered patches of light mortality were again seen along Isaac Creek

and between Killerman Pass and Sekulmun Lake. In all of these locations the area and severity of attack were not significantly different from last year. There was a large gap between these infestations and the next nearest activity to the south. In the Kluane Lake area the low levels of attack were do to the loss of susceptible hosts, i.e. prior beetle attacks have killed the majority of spruce in this area. In the Aishihik the gap contains still living susceptible host that may become progressively infested in succeeding years. The West Aishihik and Aishihik valleys remain the areas most susceptible to expansion of the infestation.

Further south mortality has increased significantly in stands around Haines Junction. Large patches of mostly light mortality (<10%) were mapped between Bear Creek and Paint Mountain in the lower reaches of Marshall Creek and south and east of Pine Lake. The most significant intensification in this area occurred on the east-facing slopes of the Auriol Range, southwest of Haines Junction. Until this year these stands remained conspicuously green while intense infestations, largely directed by prevailing winds, spilled out of the Alsek River Valley to the north and the Kathleen Lake corridor to the south. Fully half of the 6000+ ha of recent mortality mapped in these stands were of moderate intensity (10-30% of trees killed in 2001) indicating a large beetle population. Mortality is expected to further intensify here in the next few years.

Equally significant but less dramatic were increases on the north facing slopes of the Dezadeash Range east of Haines Junction. The beetle population has moved northward along the Kathleen River and westward from a population established near Moose Creek, an area that drains the north end of Granite Pass. The beetles had moved through the pass from Granite Lake two years ago to establish a strong emergent population in the Dezadeash River Valley. Patches of light recent mortality are now almost continuous on the northwestern sub-alpine slopes of the Dezadesash Range between these two areas. Stands of green mature spruce are scattered throughout this section of the Dezadeash River Valley. The infestation is also expected to intensify in this area.

Further west, within Kluane National Park, few living mature spruce remain within the Alsek River drainage. The spruce in this area was killed by the beetle in the mid-to-late 1990s with one exception, stands in the Dusty River Valley. This was primarily due to outflow winds in the valley. This year's mortality however, was mapped at over 6800 ha (a 40% increase) with light and moderate mortality almost continuous on both sides of the River beyond Profile Mountain.

Large areas of light and moderate mortality in the Shakwak Trench between Kathleen Lake and Granite Lake increased in both area and intensity, especially in the lower elevation stands just east of Rainbow Lake. At higher elevations around Granite Lake, beetles have already killed most of the mature spruce. In fact the standard pattern in most areas during the course of this outbreak is marked by infestations beginning in high elevation stands and then dropping to the lowlands.

For the first time this year mortality was mapped along the north shore of Dezadeash Lake as far east as Six Mile Lake. On upper treed slopes above the west shore of Dezadeash Lake, infestations continued to intensify. The most dramatic intensification occurred between Dezadeash and Mush lakes and south of Mush Lake on the slopes above Mush and Fraser creeks. The majority of this year's severe mortality (>30% of stand recently attacked) was mapped in stands surrounding the highlands between these two creeks.

Southeast of Dezadeash and Mush Lake, in higher elevations on both sides of Fraser Creek, moderate patches of infestation were continuous as far as Dalton Post. Similar dramatic increases have occurred from Klukshu Village south as far as Blanshard Camp, in the lower Takhanne River Valley, and to the west in the Tatshenshini River Valley south of Dalton Post. The final area of significant increase was south and west of Bates Lake along Bates Creek stretching northward in a narrow band above the east side of the Lake. Red trees were mapped in over 5000+ ha in this area.

The Future

From a containment standpoint it is fortunate that the dramatic increase in mortality seen this year occurred south of Haines Junction rather than north. Natural barriers largely surround the south and the remaining mature host is limited. However, there were slight increases in the north as well and a re-vitalization of that population could still occur. One indication of accelerated increase was the level and intensity of current attack (Photo 2) seen in Forest Health Assessment (FHA) plots established this year. Of the twelve plots, ten had current attack in between 2 and 18% of the trees. The highest levels of attack (Table 1) were seen in plots established at: Plot 26 on the Mush Lake Road (18%); Plots 25 and 26 at the west end of Mush Lake (17% on the north side and 11% on the south side); Plot 29 adjacent to Cultus Creek (11%); Plot 21 - Quill Creek (south of Haines Junction) (11%); and Plot 27 near the confluence of the Dezadeash and Kaskawush rivers (10%).

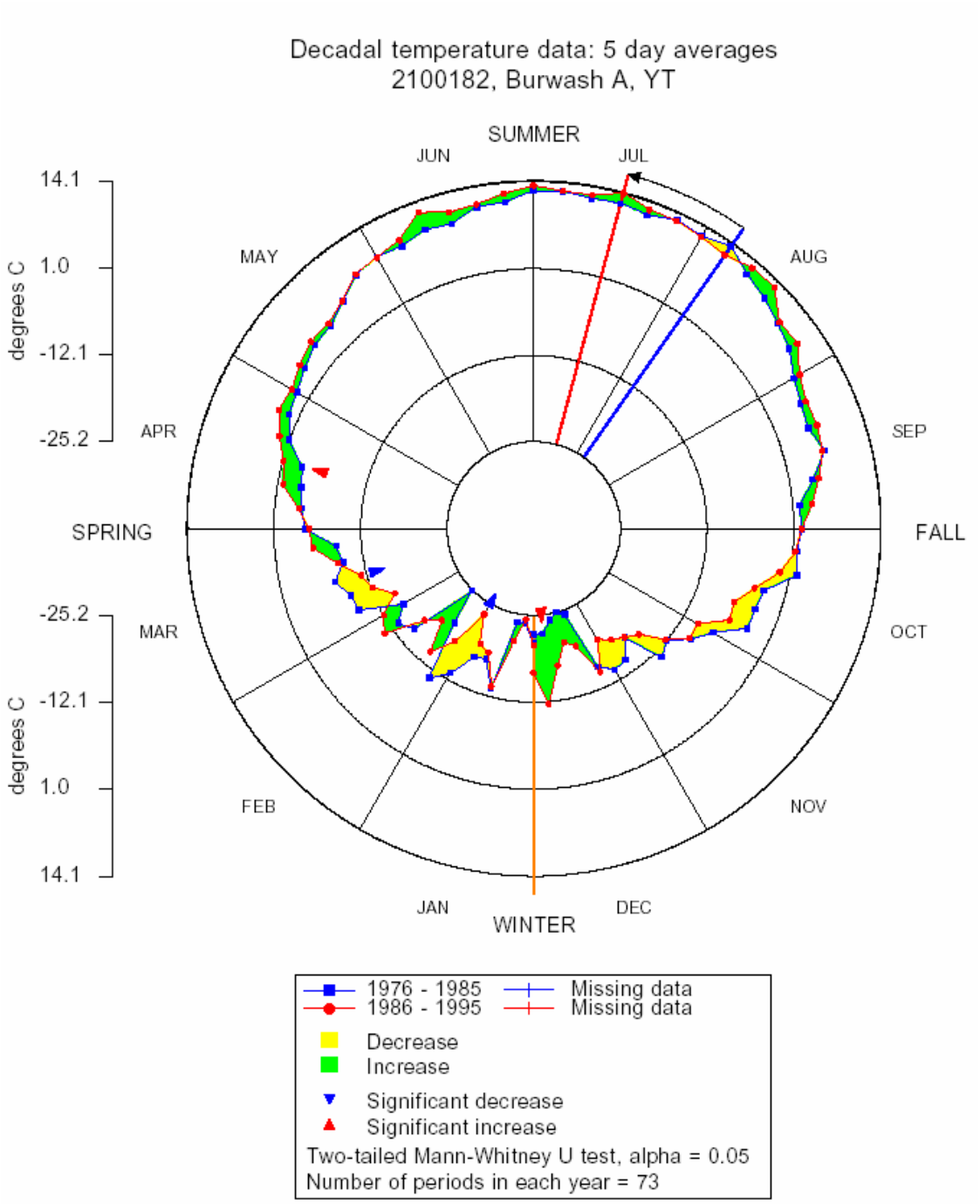
The aforementioned increased tree resistance was evidenced by the number of pitch-outs seen in the plots. Pitch-outs were recorded in 8 of the 12 plots, averaging 8.5%, only slightly less than current attack levels. In contrast, red trees (those attacked last year and mapped from the air this year) occurred in only 7 of the plots, ranging from 2 to 7% of the trees and averaging 4%. If accepted as a valid indicator these figures suggest a doubling of the number of red trees next year. Considering the small sample size and non-random establishment criteria (i.e. plots with already established infestations were favoured), these plots cannot be seen as entirely representative. The results suggest continued and likely accelerated population resurgence.

Table 1: Yukon 2002 Plot Tree Status

Plot no.	Location	No. trees	No. Healthy (%)	* Beetle Attack Status					Dead other causes (%)
				Current (%)	Red (%)	Grey (%)	Partial (%)	Pitch-outs (%)	
21	Quill Cr.	28	7 (25)	11 (39)	2 (7)	4 (14)	3 (11)	0	1 (4)
22	Dezadeash	34	12 (35)	0	0	19 (56)	3 (9)	0	0
23	Macintosh sub div	28	8 (28)	1 (4)	0	13 (46)	0	5 (18)	1 (4)
24	Mush Lake #1	66	28 (42)	11 (17)	4 (6)	9 (14)	8 (12)	5 (7)	0
25	Mush Lake #2	45	12 (27)	5 (11)	1 (2)	16 (36)	6 (13)	5 (11)	0
26	Mush Lake Road	28	18 (64)	5 (18)	0	2 (7)	2 (7)	1 (4)	0
27	mouth of Alsek R.	30	4 (13)	3 (10)	0	17 (57)	4 (13)	2 (7)	0
28	Cultus Creek #1	53	9 (17)	0	2 (4)	34 (64)	2 (4)	2 (4)	4 (8)
29	Cultus Creek #2	27	11 (41)	3 (11)	1 (4)	0	7 (26)	4 (15)	1 (4)
30	Kaskawulsh R.	31	10 (32)	1 (3)	1 (3)	19 (61)	0	0	0
31	Congdon Cr.	34	24 (70)	1 (3)	0	1 (3)	0	0	8 (24)
32	Silver City	88	13 (15)	2 (2)	2 (2)	61 (69)	2 (2)	2 (2)	13 (15)
**Average (%)			34	12	4	39	11	8.5	10

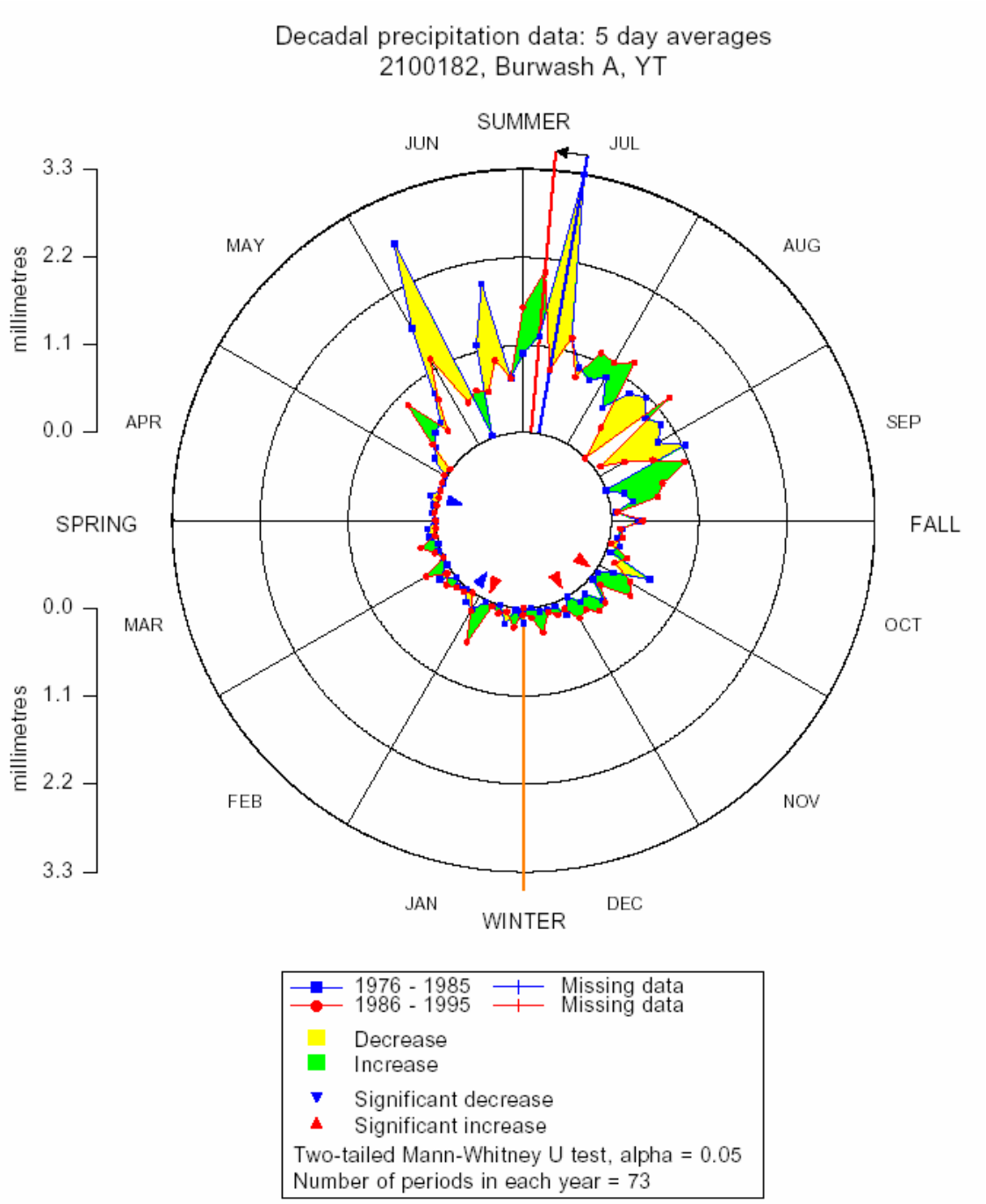
* Current = attacked in 2002: red = attacked in 2001; grey = attacked prior to 2001; Partial = attacked but not killed; pitch-out = attack repelled by tree

**affected stands only



Precipitation data for the same time periods (Figure 3) is less definitive. There have been alternate increases and decreases throughout the year but significant changes involving small amounts only in the winter. It is clear from the data, however, that a large majority of precipitation occurred as rain in the summer months, and that there was a net decrease in the latter decade.

Figure 3. Graphic representation of average precipitation at Burwash over two decades, 1976-1985 and 1986-1995. From Paul H. Whitfield, Environment Canada Meteorological Service.


Decadal precipitation data: 5 day averages
2100182, Burwash A, YT
SUMMER
JUN
JUL
AUG
SEP
FALL
OCT
NOV
DEC
WINTER
JAN
FEB
MAR
APR
SPRING
MAY
millimetres
3.3
2.2
1.1
0.0
0.0
1.1
2.2
3.3
millimetres
1976 - 1985
1986 - 1995
Missing data
Missing data
Decrease
Increase
Significant decrease
Significant increase
Two-tailed Mann-Whitney U test, alpha = 0.05
Number of periods in each year = 73

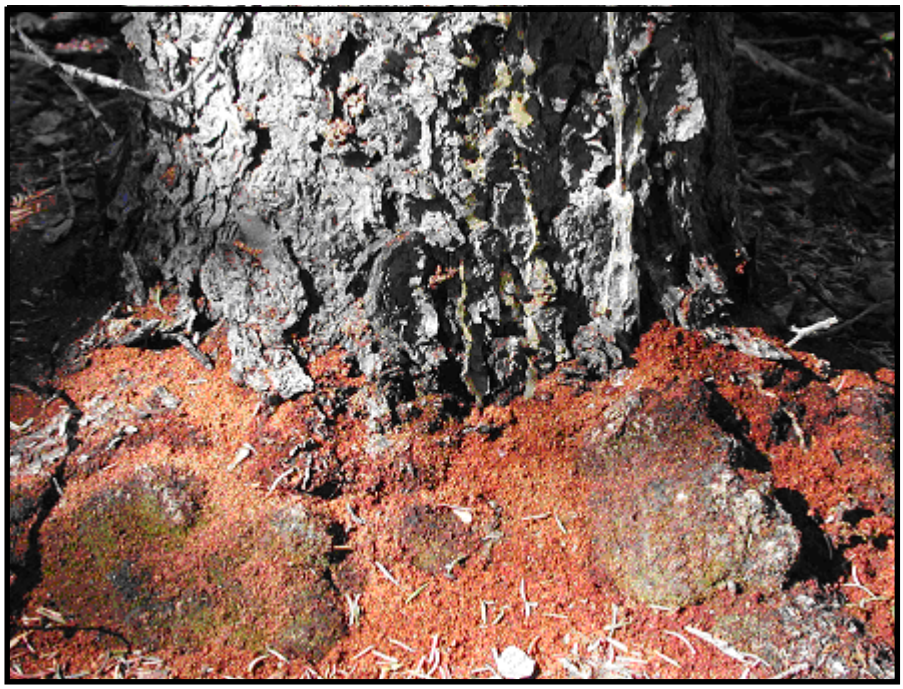


Photo 2 – Heavy current attack with associated boring dust

It is unlikely in an El Niño year that winter temperatures will be cold enough to adversely affect population survival. Though average winter temperatures (with the exception of early-mid December) don't appear to have been significantly warmer, successive winters without prolonged periods of severe cold have played a significant role in fostering the intensity and duration of this infestation. Possibly the most important climatic change has been the warmer temperatures during the early spring and throughout the growing season especially in April where increases were statistically significant.

Precipitation data for the same time periods is less definitive. The data clearly shows that although the majority of precipitation occurs in the summer the over all amount has decreased in the last decade. There was also a significant increase of snow during the winter.

Eastern Spruce Budworm, *Choristoneura fumiferana*

Southeast

Infestation by this insect is chronic in the southeastern Yukon. Budworm populations at least in recent years never seem to collapse with observable damage fluctuates between trace and severe defoliation. The most severely affected areas include the LaBiche and Beaver River valleys in the extreme southeastern corner of the Yukon. High budworm populations also inhabit the Liard River Valley where it descends into B.C. and turns west and then north again to enter the Yukon south of Watson Lake. Though populations have never been as high around Watson Lake as in the LaBiche/Beaver area, the damage has been slowly increasing and spreading incrementally year by year. In 2002, bad weather prevented an aerial survey to map the damage but roadside observations determined widespread trace to light defoliation in the Liard River corridor south of

Watson Lake and in all major tributaries such as the Smith and Coal rivers and Contact and Irons creeks. Similar damage was also seen at Upper Liard over a larger area than last year. Most significantly, budworm populations have now moved westward from the Liard along the Dease River and into the Blue River and have caused light damage for about 40 km along Hwy 37 south of the Blue River crossing. Though this occurred in B.C., it is indicative of a potential for the spread of the budworm into the Liard River tributaries.

Southwest

Trace levels of observable defoliation were seen for the first time in Kluane National Park within the Alsek and Kaskawulsh river valleys and farther north near Congdon Creek. It is not known at this time if the damage was caused by the one-year-cycle eastern spruce budworm or the two-year-cycle budworm, *Choristoneura biennis*. The insect will self-identify next year when it is determined if it is life-cycling is one or two years.

Spruce engraver beetle, *Ips perturbatus*

Infestations of spruce engraver beetle continued in the southwest. The most severe infestation mapped was a single 13 ha patch of immature spruce mortality near the confluence of the Dezadeash and Alsek rivers. Populations of this insect rose sharply in the 1900s in direct association with the spruce beetle by co-infesting spruce beetle-killed trees. Unlike spruce beetles that require two years to complete their life cycle, engraver beetles cycle every year and are thus able to thrive in much smaller trees. In the late 90s with populations high and spruce beetle-killed mature spruce becoming scarce in the northern Shakwak Trench and Alsek River Valley, engraver beetles began targeting scattered patches of immature spruce that had regenerated following wildfires. Engraver beetles however evolved as secondary attackers, and infestations involving the attack of healthy trees rarely last more than a few years.

A small infestation of spruce engraver was reported on private property on an island in the Klondike River just south of Dawson City. According to the owner the infestation appeared to have been initiated in trees stressed by rising perma-frost. These populations then attacked green firewood bolts and trees that had been girdled to provide firewood the following year. This year, in addition to the other host material, more than 50 healthy trees on the property were attacked this June, but by late July contained only scattered brood. However broods in the firewood bolts will likely be more successful, and there is potential for an incremental increase in the number of healthy trees attacked in 2003. The property owner was advised to fell trap-trees in early spring to attract and absorb the bulk of the attacking beetles and then either burn or peel the trees in June/July to kill the broods.

Geometridae

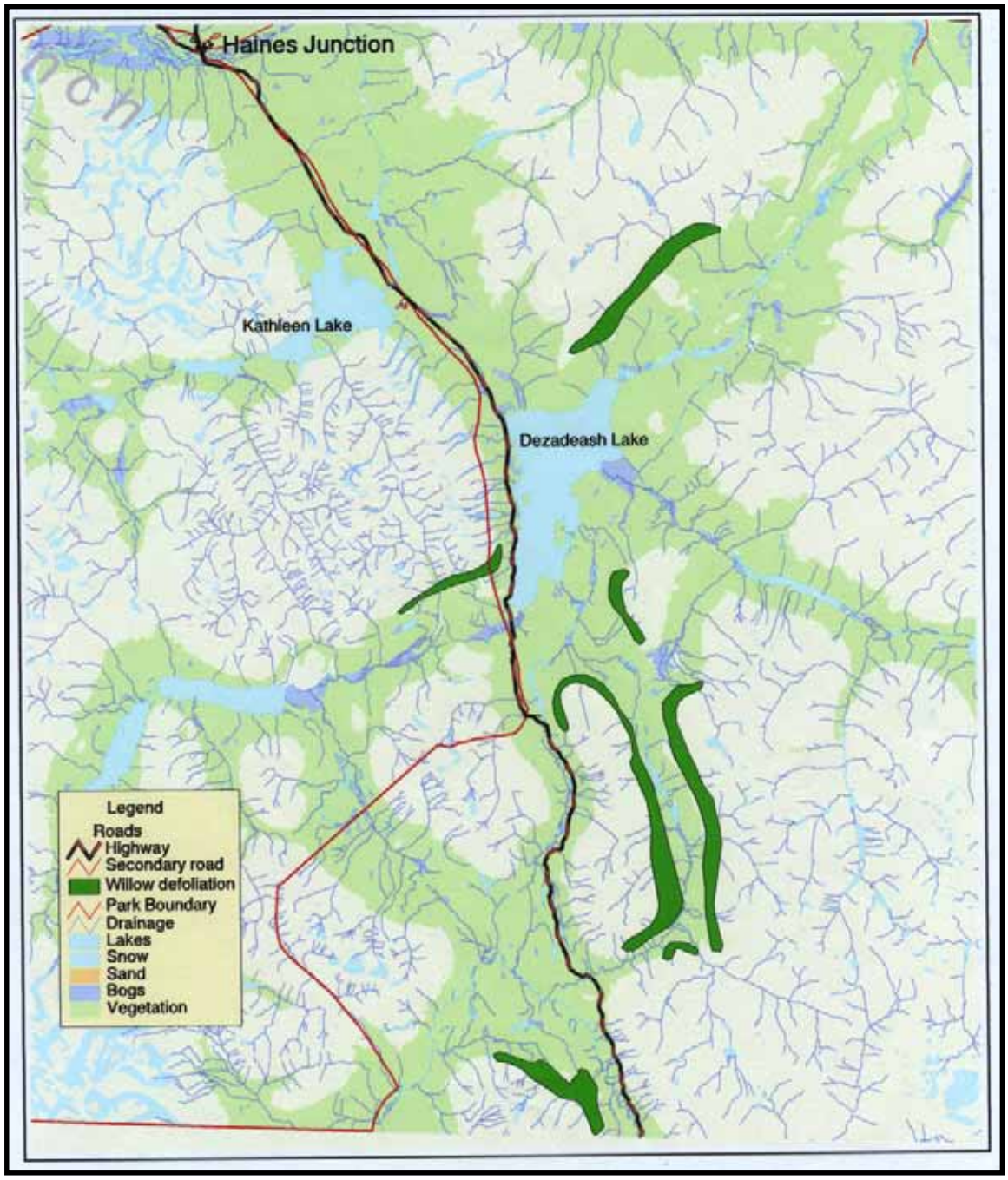
Willow shrubs in the sub alpine zone over an area of 9400 ha were severely defoliated by an as yet unidentified Geometrid (looper) in six separate patches just north and south of Dezadeash Lake. The damage was confined to narrow elevational bands just below the alpine zone. About half of the damage was mapped on both sides of the Takhanne River Valley, stretching north as far as Frederick Creek (Map 3). A larval sample collected in mid July and sent to Victoria mysteriously disappeared so no identification was possible. Subsequent efforts to collect later life stages have proven unsuccessful but further sampling is planned for the spring.

Large aspen tortrix, *Choristoneura conflictana*

For the first time in many years no large aspen tortrix defoliation was seen in the Territory.

Aspen serpentine leafminer, *Phyllocnistis populiella*

Damage to trembling aspen foliage from this pest intensified in the southwest around Haines Junction. Often every leaf was infested and by mid-summer the trees had turned from green to silver-grey. This chronic pest has been at outbreak levels for over 10 years in the Territory, starting in the Mayo-McQuesten area and moving steadily south. Aspen stands throughout the whole southern Yukon are now also affected. The damage, though showy, appears to have little effect on tree vigour. Aspen, and to a lesser extent affected Balsam poplar along the Mayo Road, have been infested for all over 10 years and still appear to be healthy.



Willow Defoliation - Yukon 2002

Map 3: Severe defoliation of sub alpine willow by an unidentified Geometrid (looper).

Birch leafroller (unid.)

Patches of birch were severely defoliated by an unidentified leafroller adjacent to the Alcan Hwy. just west of the Hwy. 37 junction. By the time the damage was seen on June 27 the insect had completed its life cycle and was not seen. In the 1950s and 1960s, when Forest Insect and Disease Rangers began their Yukon survey in early June, similar damage was frequently seen and the insect responsible was identified as the Spearmarked black moth, *Rheumaptera hastata.*

Climatic damage

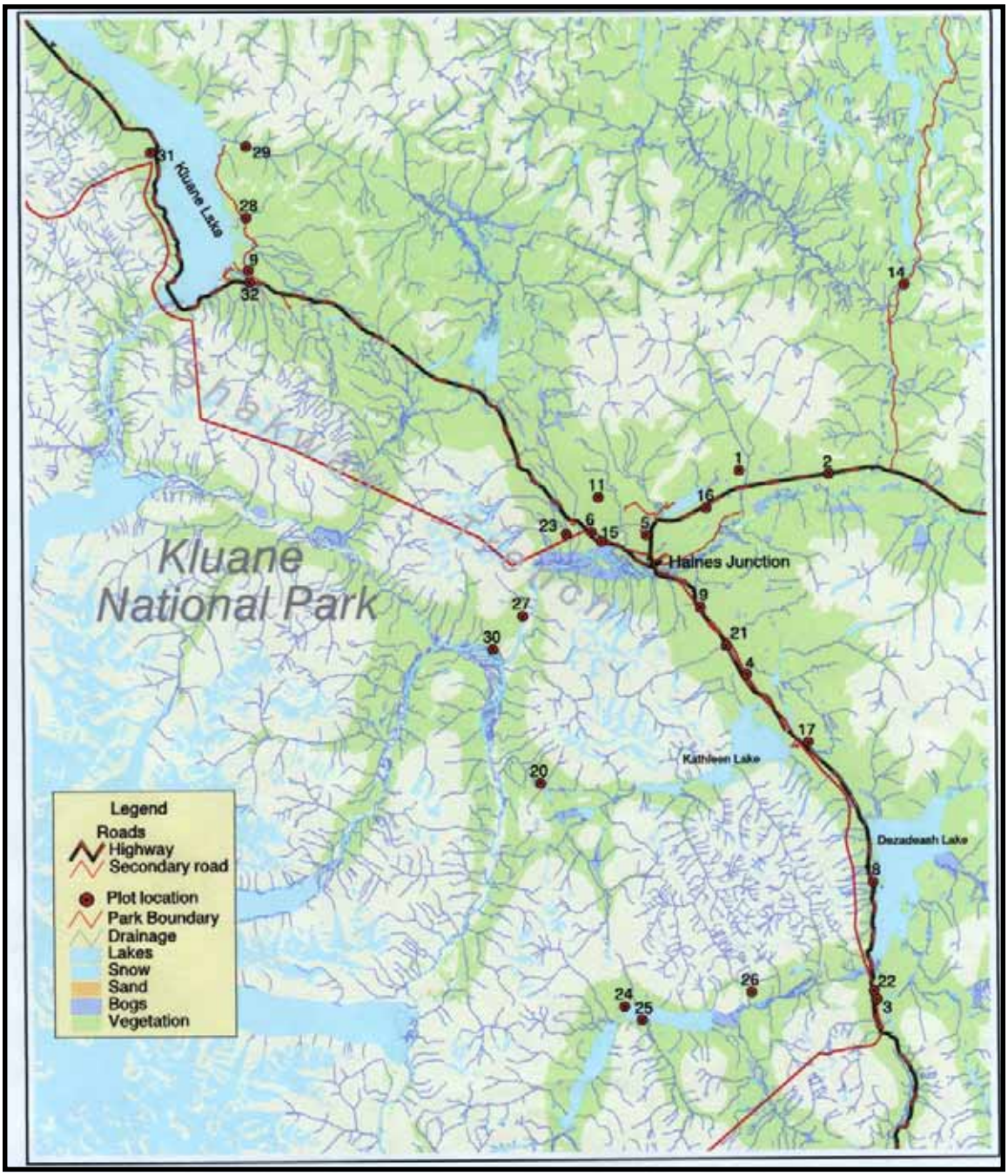
Historically, the most widespread and severe damage to Yukon forests was caused by the severe cold of northern winters. Climate warming has caused a change in the character of the damage but not diminished its impact. Recently the drought in the southwest killed lodgepole pine, white spruce as well as herbs and shrubs between Whitehorse and Champagne. The cool wet summers of 2000/2001 brought and end to the drought and the damage. In 2002 a late spring frost damaged buds and delayed or prevented leaf opening of a number of deciduous species in at least two areas. The most severe example of this type of damage affected all age classes of trembling aspen and white birch at mid elevation in the hills east of Watson Lake. Photos taken by Don White of Yukon Government, Forest Management Branch, and (Photo 3) showed mature aspen in June looking like they did in December. These trees adventitiously budded a smaller crop of leaves later in the season. Sub-alpine dwarf birch, *Betula glandulosa,* at Km 80 Dempster Hwy. were similarly affected by frost over an area of about 80 ha. Unlike the other instance however these shrubs had not leafed out by mid July.

Forest Health Assessment

This project was initiated in 2000 with the purpose of determining the effect of the ongoing spruce beetle epidemic on vegetative ecology and stand structure, including an analysis of available tree and ground fuels in the event of wildfire ignition. The establishment phase of this project was completed in 2002 with the installation of 12 new plots, bringing the total to 27 (see Map 3 for plot locations). Of the 12 new plots, 5 were located within Kluane National Park, and the remainder in the Shakwak Trench. For the next 5-7 years the plots will be re-visited annually to check for current spruce beetle activity. At the end of this time all parameters will be re-measured and the data analyzed to determine the degree and direction of ecological change following the beetle infestation.

An establishment report containing the data and preliminary results will be released in 2003.

Photo 3. Mature white birch failed to leaf out following spring frost. Photo taken in June 2002 by Don White of the Yukon Government, Forest Management Branch.



Spruce Beetle Plots - Yukon 2002

Map 4: Locations of 27 Forest Health Assessment plots in the Shakwak Trench and Kluane National Park overlaid on cumulative extent of the spruce beetle infestation.

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