Yukon 2006

The annual pest survey of the Yukon Territory was completed between July 3rd and 27th. The purpose of the survey was to provide an annual assessment of pest activity throughout the southern Yukon and to update the status of the ongoing spruce beetle infestation in the southwest. In addition to these core activities, a week was spent installing four additional Forest Assessment (FA) plots in support of the Kluane Ecological Monitoring Project (KEMP), a long-term co-operative study between Kluane National Park and the Arctic Institute. This brings the total number of FA plots to 31.

The early spring weather was much cooler than last year with the first recording over 11° C in Haines Junction occurring on the 16th of May, nearly a month later than in 2005. Spring was also somewhat wetter with 10 days of measurable precipitation in May and 6 in June, compared with 0 and 1 respectively last year. Despite this the peak flight of the adult spruce beetles occurred in the second week of June (Table 2) similar to last year.

Spruce beetle

Reduced attacks by spruce beetles in 2005 resulted in a reduced area of mapped mortality this year. Stands containing recently killed trees were mapped over an area of 41 170 ha (38 800 ha of light[1] intensity and 2370 ha of moderate) (Figure 1) (Map 1) compared with the 82 620 ha mapped in 2005. This year was marked by the sharp reduction in mortality in the Mush Lake area within Kluane National Park and the area between Dezadeash Lake and the B.C. border. Though the reduction was inevitable due to host attrition the 2005 attacks were far less that what were expected considering the high overwintering population. This year that population collapsed almost entirely as almost no current attacks could be found despite the fact that nearly 20% of the susceptible healthy white spruce remained.

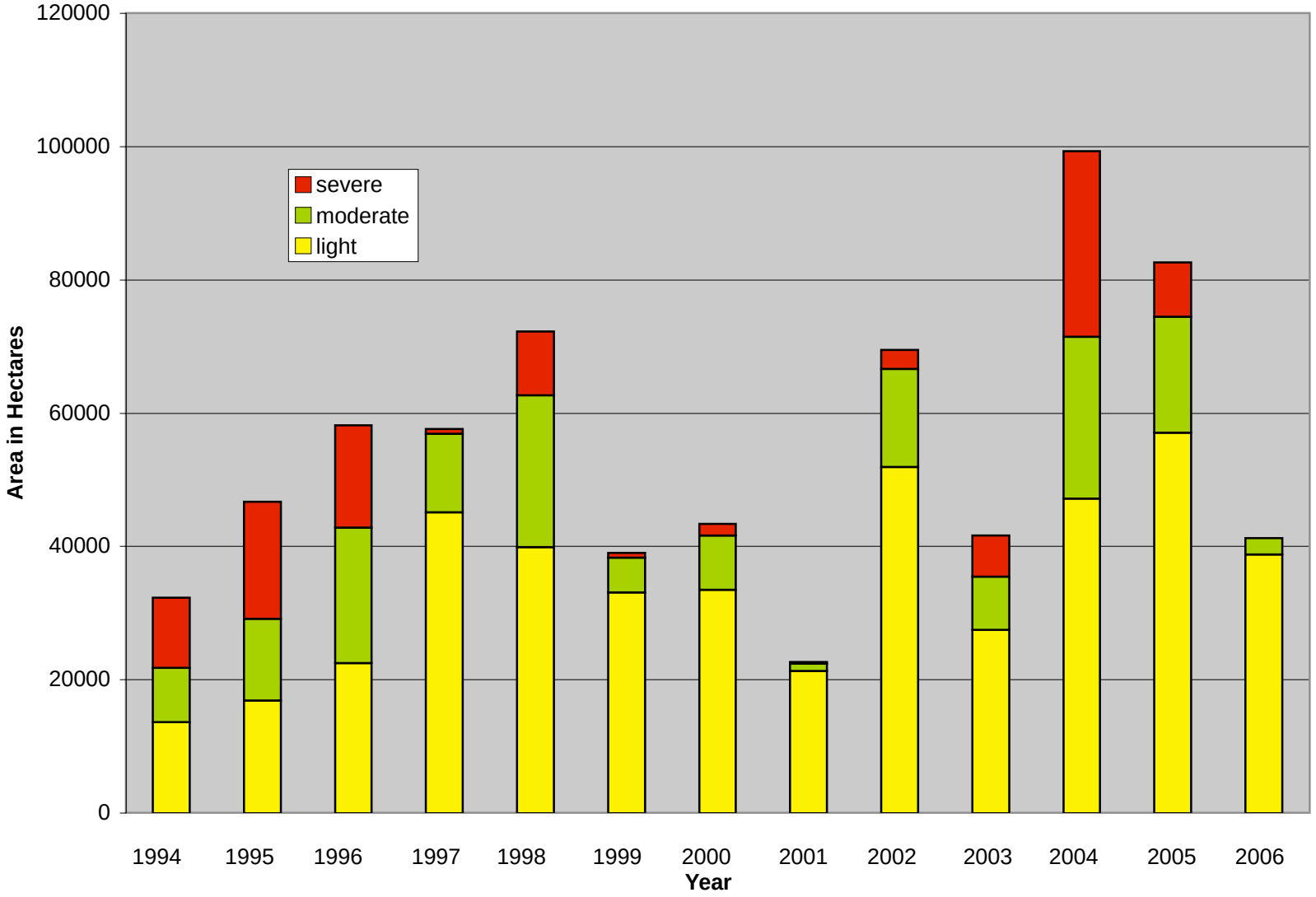
The Scene in 2006

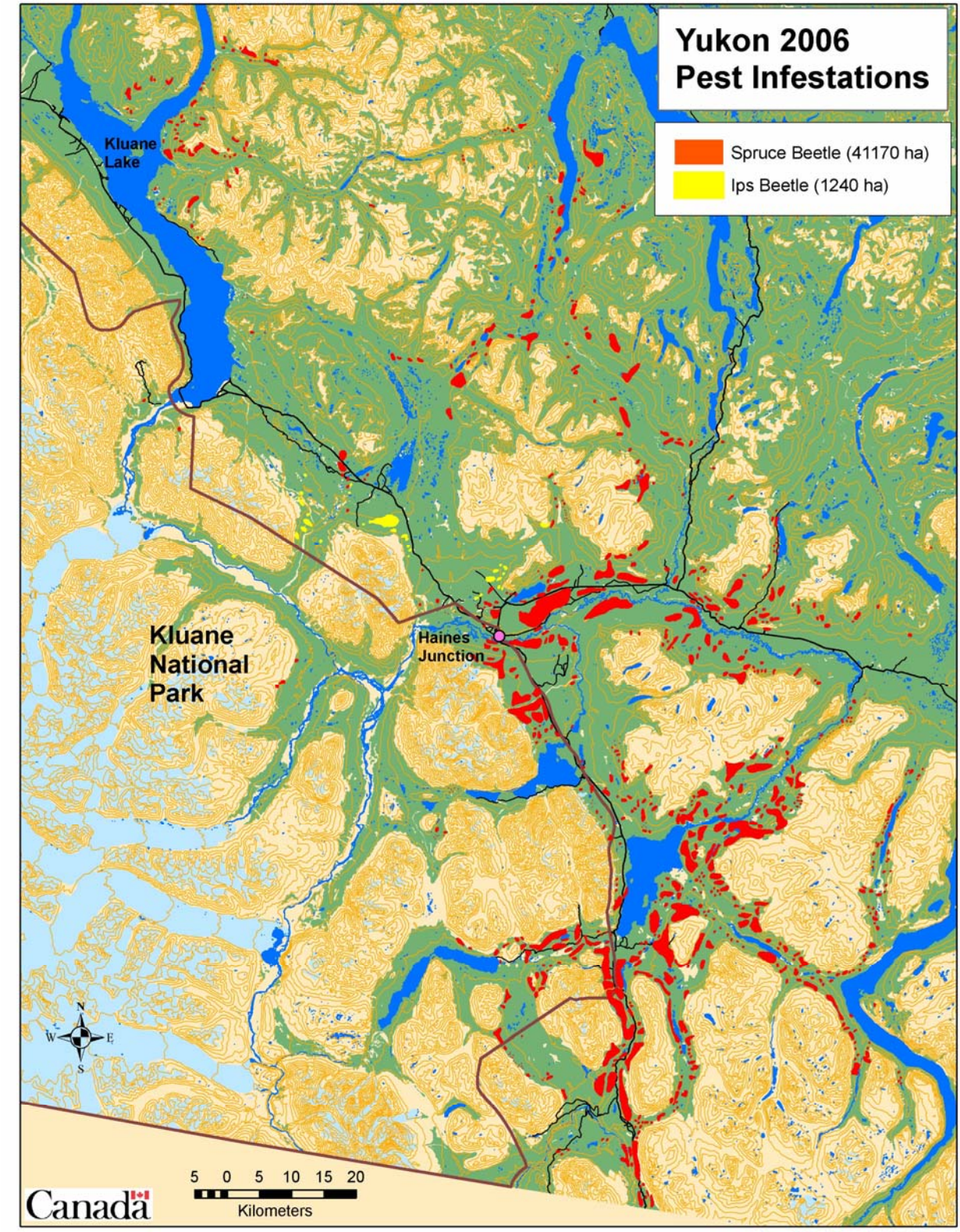
This year with the cooler temperatures and increased moisture the tree crowns faded later than last year so aerial surveys were delayed until the fourth week in July to allow the colour change to progress. The breakdown of this year's aerial surveys results were as follows:

In the northeast, infestations in the West Aishihik River valley were much diminished, especially at the south end of Sekulmun Lake where numerous small patches of light mortality replaced the widespread continuous light and moderate mortality from the year before. A few small patches of light attack were seen at the northwest end of the lake near Thatchell Cr.; a little farther north than last year, indicating that there is still potential for continued expansion northward. Scattered patches of mortality were mapped along both sides of Isaac Cr. from a population that had migrated eastward via the Gladstone River six years ago. The mortality however was significantly reduced from last year.

Farther south in the West Aishihik Valley mortality was mapped The only area of increase was in Killermun Pass in an area first infested in the same areas as 2005, but the patches were significantly smaller and lighter in intensity. Numerous patches of moderate intensity

Area by year and severity code of spruce beetle-caused white spruce mortality in the southwest Yukon





Map 1. Areas where recent spruce beetle- and Ips-caused mortality were mapped in 2006

mapped through the pass with the largest, about 200 ha in size, adjacent to McKinley Cr. just south of Shutdunmun Lake. Just west of here in the Jarvis River drainage four small patches of moderate intensity were mapped on both sides of Ruby Creek. This was the first activity seen in the upper Jarvis River since the early years of the infestation. It may be yet another example of beetles attacking trees that have grown to a size that renders them susceptible to attack in the more than ten years since the infestation first swept though the area.

Across the Ruby Range from the Aishihik scattered small patches of mortality were still visible along the Gladstone drainage at Venus and Swanson creeks. Downriver small infestations continued along the north side intensifying near the mouth where a number of patches were moderate in intensity. The area and intensity, however, were significantly less than was recorded last year. Numerous small infestations were mapped along both sides of Talbot Arm with concentrations for the third consecutive year along Taft Creek. Areas and intensities here were similar to last year. Where last year there were small scattered patches of mortality at the head of the arm, none was visible this year. South of here there was lingering activity between Long Point and Thorsen Bay. The largest infestation totalling about 60 ha of light mortality was adjacent to Cyr Creek. Only a few small groups of trees were killed near the mouth of Cultus Creek, significantly less than last year.

South of Kluane Lake the most significant activity in the Shakwak Trench north of Haines Junction was once again near Sulphur Lake in a 50 year-old stand. Moderate and severe mortality had been mapped here in each of the past two years, but the damage was only light this year as the spruce beetle population had dropped significantly. This was the first area within the original infestation that was re-infested as much as 10 years after the beetle had killed the entire overstory. Since then the understory trees had grown, in this case quick due to the richness of the site, and become susceptible to attack. All other mortality in this section of the Shakwak Trench was attributed to the engraver beetle, *Ips perturbatus* (Map 1).

Some of the more persistent infestations have been around Haines Junction itself, particularly those adjacent to both sides of the highway from the village east to Canyon. Some of the largest polygons mapped anywhere this year surrounded light mortality and enclosed an area of over 3000 ha. These large areas of attack have been consistent in size and location since 2001, but because the intensity of attacks has been consistently light, even now more than half of the trees remain healthy. Among the influences limiting the success of beetle populations in this area, two are related to moving air. First, these stands have not experienced the wind-induced deposition of adult beetles that has caused the quick buildup of populations elsewhere, and, second, they are situated in the valley of the Dezadeash River that serves as a sink for cool katabatic air falling off the surrounding hills. This pooling of cool air has likely slowed progeny development and helped to maintain the infestation at a low intensity. Complementing this phenomenon is the high elevation temperature inversion that has marked the pattern of progression of this spruce beetle outbreak from the beginning. Infestations have almost always started and quickly intensified in the high elevation stands and then moved downward in subsequent years.

On the north side of the Dezadeash River Valley scattered small infestations were mapped in the upper reaches of Marshall Creek for the thirteenth consecutive year. Nowhere else has the infestation persisted this long, though this year the 15 spot attacks and small polygons totaled

less than 50 ha in area. In 1999 beetles migrated across the pass connecting upper Marshall Creek and the West Aishihik River Valley. Form here beetles moved northward coalescing with populations emerging from Killermun Pass and across the valley to the lower slopes of The Three Guardsmen. A portion of the population also moved south into Emery Creek. Light and moderate mortality was mapped in each of these areas though the areas were again reduced from last year. For the first time scattered small groups of trees were killed in the vicinity of the Aishihik Dam and farther south along the Aishihik River. East of Canyon numerous areas of mortality were mapped on both sides of Cracker Creek and farther north to just beyond Morraine Lake. Numerous small polygons were mapped along the south face of Shaneinbaw Mountain and adjacent hills and east almost to the Mendenhall River. The most northeastern extent of the infestation was four small groups of red trees just northeast of Taye Lake.

On the south side of the Dezadeash River numerous patches of light attack were mapped on the north-facing slopes of the Dezadeash Range from Nayton Creek east to Mount Bratnober, though, now, as much of the mortality was mapped in valley bottom stands as in the high elevation stands where local beetle populations have thrived for the last six years since migrating though Granite Pass from the west. Light mortality was almost continuous south of the river from the Dezadeash River Bridge, just south of Haines Junction, to the Kathleen River and across the Haines Road on the slopes of the Auriol Range. Moving south from Haines Junction some of the most intense and surprising activity covered over 1000 ha on both sides of Quill Creek between the highway and the Auriol Range. The stands adjacent to Quill Creek were first mapped in 1994. As at Sulphur Lake, the recent resurgence, is suspected to have been fostered in trees that were too small to have been susceptible the first time around. In the intervening years not only have they become attractive to the beetles they have supported beetle broods for the two years (usually) required for maturation.

Attacks in the Kathleen River Valley have diminished greatly with only small patches just north of Kathleen Lake and across the valley. South of Kathleen scattered patches across the Valley to Dezadeash Lake. One of the few areas to witness significant increases this year was the Dezadeash River Valley between Dezadeash Lake and Champagne. This was especially true on the southeast side of the valley from the lake through Undie Creek to beyond Asumbo Creek. Twenty five polygons of infested trees were mapped totaling over 3000 ha where almost nothing was seen last year. Beyond Mount Kelvin scattered small groups of red trees were seen, mostly along the east side of the river to within 4 km of Champagne. Infestations on the northwest side of the valley were similar to last years stretching from the Dezadeash Lake to near Dune Creek.

East of Dezadeash Lake numerous polygons from 10 to 150 ha in size were mapped, particularly in the high elevation stands northeast of the Kluhini River, on both sides of Frederick Lake and eastward, dividing at Kusawa Lake to follow the western shore to the north and south. To the south, as in 2005, infestations of light intensity were almost continuous as far as Devilhole Creek but small spot infestations within the next drainage to the southeast indicated that beetle populations were continuing to advance. If, in the next few years, beetles can bridge the zone of marginal host between Arc Mountain and the lower Takhini River, they will have a clear run of susceptible host south into the Kusawa River and across the border into British Columbia. Equally significant was the intensification of mortality to the north, where more than 50 scattered

small polygons of attack were mapped, some of moderate intensity, through Jo Jo Creek to beyond the north end of Jo Jo Lake.

Infested area on the east side of Dezadeash Lake was slightly greater than last year, totaling about 2000 ha, but mortality was significantly less intense averaging between 5 and 10%. South of Dezadeash Lake the mapped area was also similar to last year, but, where in the past two years almost all polygons were mapped as severe, this year intensity averaged less than 5%. This was due partially to host attrition, the beetle having killed about 80% of the susceptible spruce in 2002 and 2003. But last year's ground surveys found that most of the population had died and only about one remaining tree in six was attacked. Some of the mortality was due to winter cold but more of the population reduction occurred just prior to, or during the flight period, due to marginal temperatures. I had an opportunity during an unusually warm period in early May to check the condition of pre-flight adults at the base of some trees attacked the previous year (up to 80% of the population had cycled in a single year instead of the normal two). The warm weather had stimulated the beetles to become active under the bark but before they could emerge the weather turned cool again and for the next few weeks fluctuated around the minimum 15° C required to activate the beetles for flight. This had the effect of prolonging the flight period, dispersing the population and interfering with their ability to mass attack the remaining host. These factors alone, however, were probably not sufficient in themselves to explain the dramatic drop in the population observed in the south. Considering the enormous population that entered the winter of 2004/2005 even with the observed overwintering mortality and the dispersion there should have been more than enough beetles to kill the remaining trees. This adds but one more unknown to the many that have ordered the dynamic of this infestation.

Infestations within Kluane National Park have all but collapsed. The only area of recent intense activity on both sides of Alder Creek between Mush and Dezadeash lakes had diminished to patches of light mortality. Farther south in the Fraser Creek drainage activity had diminished to small scattered polygons limited to the southwest side of the valley.

Population assessments

For the first time in four years there were signs that populations were once again on the decline. This time, however, the conditions that resulted in a resurgence like that which happened in 2002 (see Yukon Forest Health Report 2003) have not been repeated and the decline is expected to continue.

In mid July seven stand assessments were made at 10 km intervals between Haines Junction and Champagne (Table 1). Though at individual sites the attack patterns were different from last year, overall the average current attack densities in the past two years were identical at 7%. What has changed, however, is the increase in the populations of the engraver beetle, *I. perturbatus.* East of Haines Junction there appears now to be as many engraver beetles in the attacked tress as there are spruce beetles. In some areas most notably site 4 many small trees on the fringes and in the understory have been killed by Ips alone.

For the second year pheromone baited Lindgren® funnel traps were deployed during the month of June to determine the size and timing of the flight of adult spruce beetles. A total of 20 traps

were placed at approximately 10 km intervals between the Kusuwa Lake Road and Haines Junction and south of Haines Junction as far as Klukshu. Results are summarized in Table 2. Beetles were trapped in 17 of the 20 traps as opposed to only 12 in 1995. The greatest number, totaling 499, were caught about 15 km south of Haines Junction at Quill Creek, was significantly higher than the highest catch of 138 beetles at the north end of Dezadeash Lake in 2005. The higher catch reflects the normal two-year cycle of this insect and, despite the recurrent one-year cycling which has resulted in beetles flying every year, the trend since the beginning of the infestation has been for a substantially larger flight in the even year.

Table 1. Spruce beetle stand assessments between Haines Junction and Champagne.

		UTM[1]			% of trees				
Plot no.	Location	Zone	Easting	Northing	Healthy[2]	Current	Red	Grey	Partial
1	10 km -E- Haines Junction	8	368117	6744158	21	1	3	21	7
2	20 km -E- Haines Junction	8	377631	6747360	38	7	8	8	1
3	30 km -E- Haines Junction	8	390003	6743194	57	3	1	5	4
4	36 km -E- Haines Junction	8	395120	6745544	13	27	4	17	8
5	40 km -E- Haines Junction	8	397395	6743828	26	12	6	24	4
6	50 km -E- Haines Junction	8	408497	6743171	50	0	0	0	0
7	60 km -E- Haines Junction	8	415902	6742331	50	0	0	1	0

[1] Universal Trans-Mercator grid system

[2] Healthy - not attacked
Current - killed by spruce and/or Ips beetles in current year
Red - attacked the previous year
Grey - attacked two or more years previously
Partial - attacked but not killed

Spruce engraver, *Ips perturbatus*

In 2006, recent white spruce mortality attributed to *Ips perturbatus* was mapped during aerial surveys in 33 separate polygons totaling 1240 ha (Map 1).

This species of engraver beetle is common throughout the range of its white spruce host. They have often in the past been found during outbreaks of spruce beetle attacking the tops of spruce beetle-attacked trees. In this infestation they have been observed in spruce beetle-infested trees almost from the beginning. As the infestation continued engraver beetle populations steadily increased until the year 2000 when they started to kill trees independently. This occurred especially in young stands where the smaller trees were not attractive to the spruce beetle. Since then many small patches of severe mortality have been mapped in these younger stands attributed solely to *I. perturbatus*. Almost all of the attacked stands have regenerated after fires and most are under 50 years old.

Spruce engravers are successful in smaller trees because they complete their life cycle in a single season instead of the two seasons (normally) required for spruce beetle. In fact they spend only a few months inside the tree. The reminder of the year generally from August until late May or early June of the following year, they hibernate in the duff. In the spring they fly between late May and mid June as soon as the duff warms to 15° C, so they normally fly just before or during

the spruce beetle flight period. The results of the pheromone trapping (Table 2) testify to the number of Ips beetles that were flying between the first and third week of June. Whereas the spruce beetles were attracted to the traps by a species-specific pheromone the Ips were probably random catches. I say "probably" because there is no published data suggesting that *Ips perturbatus* is attracted to the spruce beetle pheromone.

Table 2. Numbers of spruce beetles and engraver beetles caught in Lindgren® traps baited with spruce beelte pheromone at 20 locations during the month of June 2006

			Number of beetles in traps				
Trap #	**Location**	**Geog. co-ordinates**	**May 25-June1**	**June 1-8**	**June 8-14**	**June 14-21**	**June 21-29**
4	Km 7 - Kusawa Lake Rd	8 441709 6731004	0	2 Ips[1]	7	1Ips	0
24	Km 1.3 Mendenhall Tower Rd	8 441628 6738414	0	0	12	0	0
23	Km 1495 Alaska Hwy	8 436353 6736375	0	4	126	1	0
22	Km 1514 Alaska Hwy	8 419822 6742854	0	0	1	0	0
21	Km 1528 Alaska Hwy	8 406854 6743375	0	0	0	0	0
20	Km 1535.8 Alaska Hwy	8 398291 6743525	0	0	0	0	0
19	Km 22 Aishihik Lake Road	8 387334 6657427	0	0	4	0	0
18	Km 10 Aishihik Lake Road	8 389981 6787898	0	0	1	1	0
17	75m up Aishihik Rd	8 389565 6748439	0	3 Ips	3	1	0
16	Km 1557.4 Alaska Hwy	8 359004 6747720	0	1	7	5	1
15	Km 1567.3 Alaska Hwy	8 368887 6744544	0	2 Ips	3	2	4
14	Haines Junction Airport Road	8 362790 6741339	0	0	0	0	0
13	10 km E of HJ Muffin	8 370774 6743057	0	2	28	4	0
27	Km 243.4 Haines Rd	8 364070 6736799	4	5 (2 Ips)	19	1	1
12	Km 240 Haines Rd	8 367784 6735019	*0*	1	1	1	2
26	Km 234.5 Haines Rd	8 371120 6729204	0	2	30	3	1
11	Km 228 Haines Rd	8 373759 6724570	0	0	44	37	6
10	Km 206 Haines Rd	8 386718 6707582	3	10 (3 Ips)	152 (5 Ips)	31 (2 Ips)	8
9	Km 189 Haines Rd	8 387097 6691099	11 Ips	6 Ips	3	0	0
25	Km 182.2 Haines Rd: Quill Cr.	8 388906 6685513	1	25	454	16	3

[1] *Ips perturbatus.* These secondary beetles were likely not attracted by the pheromone but, like many other incidental insect catches, blundered into the traps by chance and were killed by the insecticide.

Elsewhere in the Yukon

The annual circuit of the Yukon takes me from Haines Junction north to Tetlin Junction, Alaska, and across the Top of the World Highway to Dawson City. Since the fir-spruce budworm, *Choristoneura orae* infestation collapsed on 2004, there has been no notable pest activity along this stretch aside from the mysterious chronic dieback of roadside trees that has been ongoing here and elsewhere since it was first noticed in the 1970s, and the odd instance of *Ips perturbatus* attacks in windfallen or decked logs associated with highway projects.

From Dawson City with its chronic aspen serpentine leafminer *Phyllocnistis populiella*, activity and frequent birch leafminer/leafroller (these insects remain unidentified because they complete their life cycle and fly before I arrive in mid July) damage, the survey proceeded up the Dempster Highway as far as Km 220 where the first eastern larch can be found. I could find no evidence of current larch sawfly, *Prisiphora erichsoni* damage, nor was there any two-year cycle

spruce budworm, *Choristoneura biennis*, feeding damage on the white spruce between Km 50 and 70. Both of these pests have caused light damage in the past.

South from the Dempster the Klondike Highway, often runs adjacent to the right-of-way that was cleared for the transmission line strung between Mayo and Dawson City. For about three years following the clearing there were numerous *Ips perturbatus* attacks, first in the decked logs and later in the trees adjacent to the clearing. Many hundreds of small white spruce were killed in 2002 and 2003, but, the infestation followed the normal pattern for Ips and died out the following year. Between Stewart Crossing and Mayo the aspen serpentine leafminer damage reaches its highest levels. By early July almost 100% of the leaves of the trembling aspen were silver, as all of the active leaf tissue had been consumed. The cottonwoods also sustain some lesser feeding damage.

From Stewart Crossing to Carmacks there was little of note aside from the aspen leafminer, though damage levels diminished progressively as one traveled southward. East of Carmacks along the Robert Campbell Highway there was evidence of ongoing dieback and mortality of roadside white spruce and lodgepole pine from (probably) similar unknown chronic environmental agents mentioned earlier. A small pocket of spruce beetle activity reported last year in and adjacent to the Little Salmon Campground appears to have ended. Some infested trees had been removed and no current attacks could be found. Considering, however, the two year life cycle of the insect, no final judgement on the status of the population will be made until the summer of 2007.

South of Carmacks the serpentine leafminer was still active as was an unidentified miner of willow leaves. Up to 80% of the leaves of roadside willow clumps were affected. Because they feed within a limited more-or-less circular space within the leaves, creating “blotches” of discoloration within the leaves, these insects are known as blotch miners, and there are a number of species that feed in this way. Unfortunately, as with the birch miners, the larvae began feeding as soon as the leaves expanded in May and had completed their life cycle and moved on by mid July.

Continuing south, the striped alder sawfly, *Hemichroa crocea* was reported to have caused moderate and severe defoliation of Sitka alder along the shore of the Yukon River at Whitehorse. It is a common Holarctic species that feeds on alder and birch. Outbreaks resulting in alder defoliation are common farther south, but there is no record of this insect having been collected previously in the Yukon. This may be yet another example of a heretofore uncommon indigenous insect being more successful in a moderating climate.

East of Whitehorse little was seen until, southeast of Watson Lake, the chronic infestation of eastern spruce budworm, *Choristoneura fumiferana*, caused trace-to-light defoliation of white spruce at Irons Creek. This was similar to the damage seen last year.