

Alaska Forest Health Highlights

2007 Survey Year

State & Private Forestry, Forest Health Protection (FHP), together with Alaska Department of Natural Resources (DNR), conduct annual statewide aerial detection surveys across all land ownerships. In 2007, staff and cooperators identified over 1.2 million acres of forest damage from insects, disease, declines and select abiotic agents (table 1) out of over 38.3 million acres surveyed (map 2). This number underestimates the acres actually affected by pathogens since many of the most destructive disease agents (i.e. wood decay fungi, root diseases, dwarf mistletoe, canker fungi, etc.) are not visible by aerial survey. In fact, nearly every acre of mature Alaskan forests may harbor one or more of those disease agents. Therefore, additional information regarding forest health provided by ground surveys and monitoring efforts is also included in the report, complimenting the aerial survey findings.



Willow leaf miner was extensive in Alaska's north eastern interior.

Forest Health Protection staff also continually work alongside many agency partners on invasive plant issues, including roadside and high-impact area surveys, public awareness campaigns, and general education efforts. Trends continue to indicate both ongoing range expansion of established invasives and new species establishment in Alaska. However, public familiarity and agency participation in addressing the issue continue to increase.

Insects

Hardwood defoliators continued to be the most significant functional group of insect pests in 2007. The **amber-marked birch leaf miner**, an invasive pest from Europe, affected urban areas and some native forests throughout much of south-central and interior Alaska. Although not detected aerially in 2007, amber-marked birch leaf miner damage has been previously noted along nearly 20 percent of the road system south of Livengood. The biological control program initiated in 2003 was continued in 2007 with our partners from the University of Massachusetts, Amherst. Parasitism has been found in dissected larvae indicating that the parasitoid may have become established at one of the release sites. The largest outbreak of **aspen leaf miner** on record in Alaska has exceeded all previous years' acres of damage. In 2007, over 40,000 acres of **large aspen tortrix** defoliation were identified.

Nearly 92,000 acres of **willow leaf blotch miner** activity were recorded during the 2007 aerial surveys. This is the 15th year in a row that this insect has been observed—a period associated with large fluctuations of leaf blotch severity. *Sunira* in Katmai National Park was not observed in 2007. This follows a 38 percent drop in activity from 2006, the last record of the 7 year infestation.

Alder defoliation remains a concern in Alaska. A suite of insects are associated with alder defoliation, including the **woolly alder sawfly**, a European invasive that is well-established throughout the northern U.S. and Canada. Since the discovery of the **European yellow underwing** in Haines, Juneau, and St. Lazaria Island (near Sitka) in 2005, this non-native moth has spread throughout southeast Alaska as well as north and west to Anchorage in 2006. Based on the rapid movement of this species, it is likely to be found in the Mat-Su Valley in the next year and will likely be in Fairbanks within 3 years.

Only 170 acres of **birch leaf roller** activity were observed during the survey this year. This represents a 95 percent decline from 2006 levels. However, low-level leaf roller populations are often difficult to ascertain during aerial surveys, and it is quite likely that the current cycle of leaf roller activity is considerably more extensive than it appears to be from the air. A substantial amount of leaf roller activity was observed at ground level as casual observations in Anchorage and on the Kenai Peninsula.

Spruce aphid defoliation in southeast Alaska occurred on approximately 3,400 acres scattered throughout southeast Alaska. In 2006, extremely low unseasonable temperature events occurred in southeast Alaska causing a collapse on the 8-year infestation.

Table 1. The 2007 forest insect and disease activity as detected during aerial surveys in Alaska by land ownership¹ and agent^{2, 5}.

Damage Agent	National Forest	Native Corp.	Other Federal	State & Private	Total Acres 2007
Alder defoliation ³		770	7,843	1,426	10,039
Aspen defoliation ³				246	246
Aspen Leaf Miner		145,587	112,303	497,504	755,393
Birch defoliation ³		165	1,118	4	1,287
Birch leaf roller			171		171
Black-headed budworm	4,813	3,897	96	1,538	10,344
Cedar decline faders ⁴	24,322	953		930	26,204
Cottonwood defoliation ³		3,194	2,181	6,093	11,467
Hemlock sawfly				131	131
Ips engraver beetle	53	11,799	16,777	4,182	32,811
Landslide/avalanche	930	26	49	142	1,147
Larch beetle		15	10		25
Larch sawfly			105		105
Large aspen tortrix		3,107	17,585	19,703	40,395
Spruce aphid	1,499	417	209	1,308	3,433
Spruce beetle	2,945	30,948	63,503	53,661	151,057
Spruce budworm		5,763	801	30,876	37,441
Spruce needle rust			110	867	977
Sub alpine fir beetle	32			59	92
Willow defoliation ³		35,484	30,321	26,870	92,676

¹ Ownership derived from 2004 version of Land Status GIS coverage, State of Alaska, DNR/Land records Information Section. State & private lands include: state patented, tentatively approved, or other state acquired lands, and of patented disposed federal lands, municipal, or other private parcels.

² Acre values are only relative to survey transects and do not represent the total possible area affected. Table entries do not include many of the most destructive diseases (e.g., wood decays and dwarf mistletoe) which are not detectable in aerial surveys. Damage acres from animals and abiotic agents are also not shown in this table.

³ Significant contributors include leaf miners and leaf rollers for the respective host. Drought stress also directly caused reduced foliation or premature foliage loss.

⁴ Acres represent only spots where current faders were noticed. Cumulative cedar decline acres can be found in Table 10.

⁵ All values are in acres.

Spruce budworm was mapped on over 37,000 acres of the Interior, concentrated along the hills and ridges around Fairbanks. Ground surveys indicate that populations are still active and that the outbreak may continue to intensify.

Western black-headed budworm populations increased in 2007, with over 10,000 acres of defoliation mapped in Prince William Sound, southeast Alaska, and hemlock type on the Kenai Peninsula.

Larch sawfly defoliation decreased to just over 100 acres in 2007. The special aerial survey initiated in 2006 to document the extent of healthy stands of larch in Alaska, continued in 2007 covering a total of 8,106,933 acres over the two years. This survey found over 700,000 acres of healthy larch stands, with 11,000 acres outside the known range of larch.

Spruce beetle activity in Alaska has increased for the fourth time in the past 6 years, with over 151,000 acres mapped in 2007. This makes spruce beetle once again the leading mortality agent of spruce in Alaska. More than 23,000 acres of activity were recorded along the Kuskokwim River between McGrath and Sleetmute including new movement of the beetle into the lower Holitna and Hoholitna Rivers. Although beetle activity declined by 60 percent of 2006 levels, to only 847 acres in the Lake Clark area, concern about growth of this infestation and movement into the vast and relatively untouched spruce forests surrounding Lake Clark is high. Spruce beetle activity on the Kenai Peninsula increased in 2007 to approximately 13,000 acres as beetles continue to move into previously uninfested stands. In the Municipality of Anchorage, new and growing infestations were recorded in the Girdwood Valley and along the east coast of Turnagain Arm toward the Portage Valley. In the Mat–Su Valley, infested area increased 43 percent to nearly 25,000 acres, with the largest single infestation along the Iditarod Trail from Skwentna to Rainy Pass. Widespread beetle activity was mapped along the Yukon River and its major tributaries from Eagle to Circle. These infestations are evenly distributed throughout the valley suggesting that this may eventually develop into a large-scale infestation.

2007 aerial surveys identified over 43,000 acres of **engraver beetle** damage statewide. *Ips* remains primarily a pest of interior spruce forests, generally in areas disturbed by erosion, harvest activities, or wind events, and in areas damaged by wildfire.

Diseases

A ***Phytophthora*** disease of alder, *Phytophthora alni* subsp. *uniformis*, was detected in the soil beneath alders at two riparian locations in south-central and interior Alaska in 2007. A very closely related pathogen is responsible for widespread mortality of alder across Europe. No alder *Phytophthora* subspecies were known to exist in natural alder ecosystems in North America before the Alaska findings. The significance of this finding and impact to Alaskan alder species is not yet understood. Monitoring and research are underway.

Table 2. Affected area for each host group and damage type over the prior five years and a 10-year cumulative sum⁴.

Host Group/ Damage Type¹	2002	2003	2004	2005	2006	2007	Ten Year Cumulative²
Alder Defoliation ³	1.8	2.8	10.5	17.3	10.6	10.0	59.3
Aspen Defoliation	301.9	351.4	591.5	678.9	509.5	796.0	2,826.2
Birch Defoliation	83	217.5	163.9	47.5	13.2	1.5	455.3
Cottonwood Defoliation	19.9	13.1	16.7	8	24.6	11.5	110.3
Hemlock Defoliation	1.4	0.2	0.5	0.2	0	0.1	17.1
Hemlock Mortality	0.2	0	0	0.1	0	0.0	0.6
Larch Defoliation	0	0.6	14.2	16.8	2.7	0.1	875.3
Larch Mortality	4.8	22.5	11.8	0	0	0.0	69.6
Spruce Defoliation	11	61.5	93.4	31.9	68.1	41.9	658.0
Spruce Mortality	53.6	92.8	145.2	93.8	130.6	183.9	2,041.7
Spruce/Hemlock Defoliation	3.4	15.1	1.5	1.4	1.5	10.3	80.1
Spruce/Larch Defoliation	0	0.3	0	0.3	2.8	0.0	3.8
Sub Alpine Fir Mortality	0.2	0	0.2	0.8	0.5	0.1	1.7
Willow Defoliation	0.3	83.9	111.2	44.5	50.7	92.7	623.3
Total damage acres	481.5	861.7	1,160.50	941.5	814.8	1,148.1	7,822.30
Total acres surveyed	24,001	25,588	36,343	39,206	32,991	38,365	
Percent of acres surveyed showing damage	2	3.4	3.2	2.4	2.5	3.0	

¹ Summaries identify damage, mostly from insect agents. Agents affecting multiple host types, particularly abiotic agents are not represented. Foliar disease agents contribute to the spruce defoliation and hemlock mortality totals. Damage agents such as fire, wind, flooding, slides and animal damage are not included. Cedar mortality is summarized in Table 10.

² The same stand can have active infestation for several years. The cumulative total is a union of all areas from 1997 through 2007 and does not double count acres.

³ This total includes defoliation on alder from alder canker, drought, and insects.

⁴ In thousands of acres.

Except for yellow-cedar decline and foliar pathogens, most disease agents in Alaska are rarely detected by aerial surveys and underestimated for their presence and impacts. Most native diseases and declines are chronic factors that significantly and annually influence the commercial value of timber resources and alter key ecological processes such as forest structure, composition, nutrient cycling, and succession.

Statewide, **wood decay** and **root rot** of live trees occur on every tree species across millions of acres and, on an annual basis, substantially reduce tree volume and contribute to tree mortality. In southeast Alaska, for example, approximately one-third of the gross volume of forests is defective due to stem and butt rot fungi. Also, wood decay fungi annually cause considerable defect in mature white spruce, paper birch, and aspen stands of south-central and interior Alaska. Statewide cone diseases were generally at low levels in 2007.

In southeast Alaska, **hemlock dwarf mistletoe** continues to cause growth loss, top-kill, and mortality but also provides wildlife habitat in old-growth forests. **Yellow-cedar decline** has been mapped on approximately 500,000 acres across an extensive portion of southeast Alaska. Active tree mortality occurred in many of these locations in 2007, indicating an intensification of the problem on previously-impacted acres. Although still not completely understood, the cause appears to be related to spring freezing injury in open canopy forests characterized by reduced snowpack. In 2007, **spruce needle rust** (*Chrysomyxa ledicola*) occurred at the highest levels in memory in southeast Alaska.

In south-central and interior Alaska, widespread alder mortality caused by *Valsa melanodiscus* and other alder canker fungi continue to intensify in all alder species. Unusually high levels of **red needles on white spruce** were noticeable across the Kenai Peninsula in fall 2007, likely due to various unidentified environmental stressors. **Hardwood canker fungi** continue to be widespread, contributing to growth loss and stem breakage. **Birch dieback** was noted in aerial and ground surveys in south-central Alaska; drought stress was a likely factor contributing to symptoms, but stand age and history were also contributing factors. **Saprophytic decay** continues to degrade spruce beetle-killed trees. A deterioration study on Kenai Peninsula indicated a relatively slow overall decomposition rate (1.5%/year). Thus, beetle-killed trees are likely to influence fire behavior and present a hazard for over seven decades.

Invasive Plants

It was clear in 2007 that the need for a coordinated statewide approach to invasive plants prevention and management in Alaska is greater than ever. Ongoing survey work uncovered numerous new invasive plant infestations, while documented infestations continued to expand. Forest Service inventory work in 2007 focused on ongoing surveys in southeast Alaska, with roadside surveys of the Sitka/Hoonah area (Baranof, Chichagof, and Kruzof Islands), and in the regions of Juneau and Haines.

Many notoriously problematic invasive plant species have become established in recent years, including **spotted knapweed** and **purple loosestrife**. Several species of non-native invasive **thistles** (*Cirsium arvense* and *C. vulgare*), **hawkweeds**, and **knotweeds** (*Polygonum cuspidatum* and *P. bohemicum*) have become regionally widespread in

Alaska. Additional focus species of concern in 2007 in southeast Alaska include **cypress spurge** and **Robert geranium**. The introduction and spread of **Scotch broom** poses a threat to southeast and south-central Alaska, and was detected on the Kenai Peninsula in summer 2007. Other “new” high-priority species of concern statewide included **creeping buttercup** and **leafy spurge** which has not yet been reported in Alaska, but which now infests portion of neighboring Yukon Territory.

Exotic plant survey data is available online through the **Alaska Exotic Plant Clearinghouse** (AKEPIC) database, hosted by the UAA Alaska Natural Heritage Program, as well as a list of exotic plant invasiveness rankings. **Cooperative Weed Management Areas** (CWMA) are making progress in the areas of invasive plants public education, early detection, and management; addressing regionwide invasive plant problems across geopolitical boundaries in collaboration with the NRCS Soil and Water Conservation Districts and the Alaska Association of Conservation Districts. CWMA's in Fairbanks, the Matanuska–Susitna Valley, and the western Kenai Peninsula have actively addressed invasive plants prevention and management in their regions of the state since 2004. An alternative form of CWMA, supported by a nonprofit organization in lieu of a Soil and Water Conservation District, was formed in Anchorage in 2007.

The State and Private Forestry, the UAF Cooperative Extension Service, and a range of partner organizations have worked to increase private and state land manager's awareness of the threats posed by non-native invasive plants to the state's economy and natural resources, including forestlands. In response, the Alaska Department of Natural Resources, Division of Agriculture added two new species, purple loosestrife and orange hawkweed, to the state Prohibited Noxious Weed List in spring 2007. The Alaska Department of Natural Resources, Division of Agriculture is currently working to expand and update the state noxious weed lists, and to draft state regulations specific to noxious weeds prevention and management.

Aerial Survey

Dustin Wittwer

Aerial detection surveys have traditionally been the primary tool for collecting and documenting the location and extent of many active insect infestations and some disease damage occurring in Alaska's forests. Most of the pest distribution descriptions that follow are based on aerial surveys.

Aerial detection survey, also known as "aerial sketch-mapping," is a remote sensing technique for observing forest change events from an aircraft and documenting those events manually onto a map base. Trained observers recognize and associate damage patterns, discoloration, tree species, and other subtle clues that distinguish a particular type of forest damage from the surrounding, healthier forest areas. These clues serve as damage "signatures," which are often pest specific. However, a sketchmapper's abilities are challenged by time limitations and other external factors such as flight speed, altitude, and atmospheric conditions.

Due to the nature of aerial surveys, the data collected provides only estimates of location and intensity for damage that is detectable from the air. Sketchmapping is considered an art as much as a science. No two sketchmappers will interpret and record an outbreak or pest signature in the same way but the essence of the event should be captured. While some data is ground checked, most of it is not. Because most of Alaska's rugged, unroaded terrain is largely inaccessible, often the only opportunity to verify the data on the ground is during the survey missions when there is an option to land and examine the affected foliage. Many of the most destructive diseases are not represented in aerial survey data because these agents are not detectable from an aerial view.

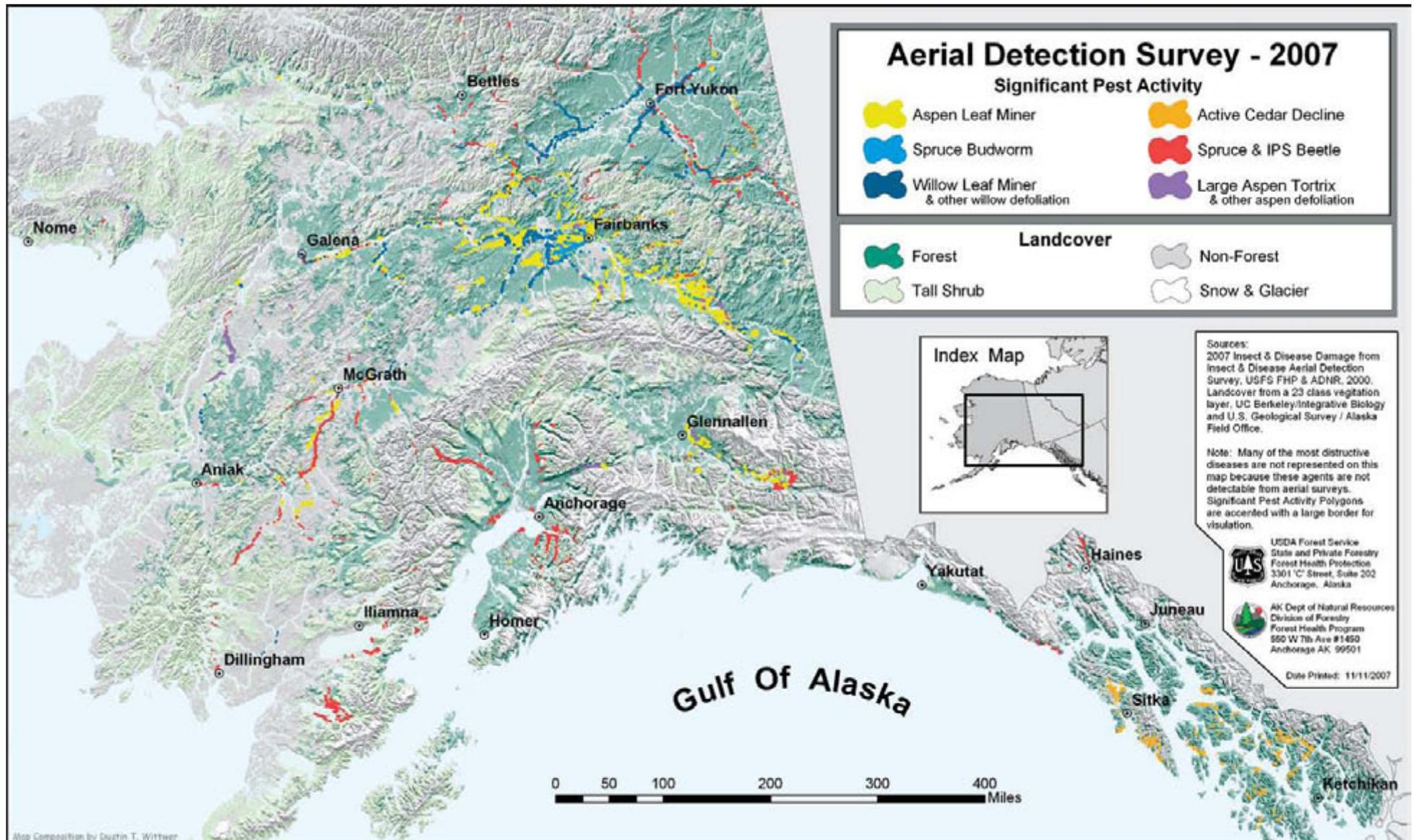
The surveys we conduct provide only a sampling of the forests via flight transects. Unlike many other areas in the United States, full 100 percent coverage of forested lands in Alaska is not possible. The short Alaska

summers, vast area, high airplane rental costs, and short windows of time when pest damage signs and tree symptoms are most evident all require a strategy to efficiently cover the highest priority areas with available resources. Each year we survey approximately 25 percent of Alaska's 127 million forested acres. Due to survey priorities, client requests, known outbreaks, and a number of logistical challenges some areas are rarely or never surveyed while other areas are surveyed annually. We are careful to avoid extrapolating conditions of surveyed acres to those not surveyed. The reported data should only be used as a partial indicator of insect and disease activity for a given year. Establishing trends from aerial survey data is possible, but care must be taken to ensure that projections are comparing the same areas and sources of variability are considered.



Figure 1. Aerial view of interior forests.

Map 1. General forest pest activity from 2007 aerial survey



Map 2. Survey flight paths and general ownership, 2007

