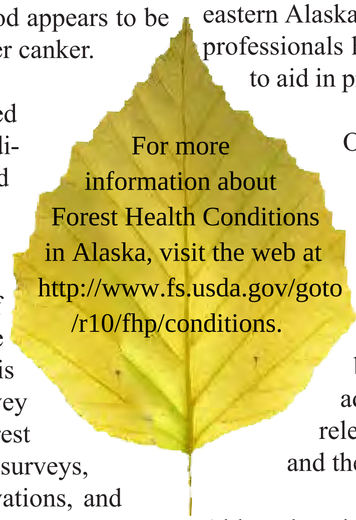
Alaska Forest Health Highlights - 2011

The Forest Health Protection (FHP) Program (State and Private Forestry, USDA Forest Service), together with the Alaska Department of Natural Resources (AK DNR), conducts annual statewide aerial detection surveys across all land ownerships. In 2011, staff and cooperators identified almost 680,000 acres of forest damage from insects, diseases, declines and selected abiotic agents on the 31 million acres surveyed (Maps 1 and 2, Table 1). The total damaged acreage is down by nearly half from that of 2010. Much of this change is due to substantial decreases in aspen and willow leaf mining and defoliation, less activity by spruce aphid in southeast Alaska, and reduced acreage of spruce newly-killed by bark beetles (Table 2). However, defoliator damage to alder, birch and cottonwood appears to be escalating, as does the acreage impacted by alder canker.



The acreage of aerially-detected damage reported here serves only as a sample of statewide conditions in a state with 127 million acres of forested land. Generally, the acreage affected by pathogens is not accurately represented by the aerial survey, as many of the most destructive disease agents (wood decay fungi, root diseases, dwarf mistletoe, etc.) are not readily visible from the air. The aerial detection survey appendix of this report provides a detailed description of survey methods and data limitations. Additional forest health information is acquired through ground surveys, monitoring efforts, site visits, qualitative observations, and reports from forestry professionals and the general public. This information is included in the report, where possible, to complement the aerial survey findings. Forest Health Protection staff also continually work alongside many agency partners on invasive plant issues, conducting surveys along roadsides and high-impact areas, public awareness campaigns, and general outreach and education efforts.

Insects

In 2011, internal defoliator damage (leaf mining) has been surpassed by external defoliator damage (leaf chewing), in terms of acres of defoliation. Aspen leaf miner and willow leafblotch miner defoliation decreased dramatically in comparison to 2010. However, aspen leaf miner remains the number one insect pest, affecting 140,000 acres. A variety of leaf chewing defoliators increased on birch, alder, cottonwood, and willow. Most of these pests experience cyclic population growth and decline, including geometrid moths, rusty tussock moth, and leaf beetles. Others, such as alder sawflies, have become a chronic pest on alder in riparian areas of southcentral Alaska.

The most significant pest increase between 2010 and 2011 was on alder. Over 123,000 acres of alder were defoliated. This represents a significant rise in observed alder defoliation, which has increased several orders of magnitude since 2008. While, historically, sawflies were responsible for the majority of alder defoliation, much of the defoliation in 2011 was caused by a complex of geometrid and tortricid defoliators. The current geometrid moth outbreak involves at least four moth species, and is most noticeable in the Anchorage Bowl. Rusty tussock moth has made a strong appearance in the Interior and was also found in high numbers at some locations in southcentral and southeast Alaska; it will be a pest to watch in the coming year. Outbreaks of these types are likely driven by host plant conditions, climate, and other factors.

Spruce beetle activity has declined to its lowest level in 35 years, with less than 50,000 acres affected. The most heavily impacted areas are within Katmai and Lake Clark National Parks and the Kenai National Wildlife Refuge. Similarly, northern spruce engraver populations are down, and the bulk of activity was detected along the main river drainages of the Upper Yukon in northeastern Alaska. During this lull in beetle activity, Forest Health professionals have been developing best management practices to aid in prevention and suppression activities.

Over the last few years, there has been a decline in damage caused by birch leaf miners. The birch leaf edge miner has surpassed the once more aggressive amber-marked birch leaf miner in leaf mining intensity. An ongoing biological control project has introduced a parasitoid wasp that has exceeded 50% parasitism of the amber-marked birch leaf miner on release sites. See full report for additional information on this project. A parasitoid release was conducted in the Fairbanks area in 2011, and the expectation for success in the Interior is high.

Although activity from invasive insects in Alaska has been limited to a few individual species (e.g., green alder sawfly, amber-marked birch leaf miner), recent introductions of devastating pests such as emerald ash borer and Asian longhorn beetles in other parts of the nation have caught the attention of land managers here in Alaska. Forest Health professionals have begun to focus additional resources on identifying vectors for the introduction of exotic species, and quantifying their potential risk. On top of expanding the existing Early Detection Rapid Response network, and working more closely with the Department of Homeland Security Customs and Border Protection, a variety of agencies have come together to evaluate firewood transport as a method of introduction of exotic insects to Alaska. Firewood is a well-documented vector in many parts of the world, but it was previously unknown if firewood importation represents a genuine and serious threat to Alaskan forests.

Diseases, Disorders and Abiotic Damage

Widespread alder damage ("alder browning") was first observed through aerial surveys in 2003, and damage from alder canker and insect defoliation is now known to be common throughout most of western, interior and southcentral Alaska. Alder canker, caused by the presumably native fungus *Valsa melanodiscus*, is one of the main causes of alder dieback and mortality (Figure 1), although other canker pathogens also contribute to alder dieback. Alder canker was mapped by aerial survey for the first

Figure 1. Alder canker (*Valsa melanodiscus*) on Sitka alder on the Kenai Peninsula.

time in 2010, when 44,230 acres were recorded. In 2011, damage from alder canker was up significantly to 142,005 acres. This substantial increase may be partly due to a more directed aerial sampling effort, but clearly indicates that damage and mortality has not abated and remains a significant concern throughout much of Alaska.

Dwarf mistletoe and stem decays are predominantly diseases of old forests with little annual fluctuation. Although important, these damage agents cannot be mapped through aerial survey. Hemlock dwarf mistletoe causes growth loss, top-kill and mortality on an estimated 1 million acres of western hemlock in southeast Alaska. The occurrence of dwarf mistletoe is apparently limited by climate, becoming uncommon or absent above 500 ft in elevation and 59°N latitude (Haines, AK) despite the continued distribution of western hemlock. Hemlock dwarf-mistletoe brooms (prolific branching) provide key wildlife habitat, and suppression or mortality of mistletoe-infested trees plays a critical role in gap-creation and succession in coastal rainforest ecosystems. Stem decays (heart rots) are primary disturbance agents in virtually every old-growth forest of coastal Alaska, where they cause substantial volume losses, play an important role in stand succession and nutrient cycling, and confer habitat benefits to wildlife.

Yellow-cedar decline has been mapped on approximately 500,000 acres over the years across an extensive portion of southeast Alaska, especially from western Chichagof and Baranof Islands to the Ketchikan area. This climate-driven decline is associated with freezing injury to cedar roots that occurs where snowpack in early spring is insufficient to protect fine roots from late-season cold events. In 2011, the aerial survey mapped 26,804 acres of active yellow-cedar decline (reddish dying trees), similar to the acreage mapped in 2010, but nearly twice as much as in 2009. Recent mortality was most dramatic on the outer and southern coast of Chichagof Island, indicating an apparent northward spread, consistent with the climate patterns believed to trigger tree mortality. A project is underway to measure forest succession in stands that have experienced yellow-cedar decline.

Forest Inventory Analysis re-measurement data from 2004 and 2008 revealed a 4.6% net loss in shore pine biomass, with no apparent geographic mortality pattern. Shore pine is a subspecies of lodgepole pine that occurs on bog and muskeg sites in southeast Alaska (Figure 2). Although it is not possible to know whether this loss is part of a continuing trend, it is alarming that mortality rates are higher for larger trees and that there is virtually

Figure 2. Shore pine on a muskeg near Juneau.

no baseline information on the insect and disease problems of shore pine. Work is underway to implement a systematic ground survey of shore pine in 2012 and 2013.

Spruce needle rust, caused by the fungus *Chrysomyxa ledicola*, occurs throughout Alaska on sites with both spruce and Labrador tea (the alternate host). Levels of disease fluctuate significantly from year to year depending on the favorability of weather conditions. Although negligible spruce needle rust was mapped in 2011, reports suggest that this was a moderate to heavy year for spruce needle rust. The aerial survey occurs weeks before symptoms reach their peak; therefore, the acreage mapped is unlikely to accurately represent disease levels. Rust outbreaks covering several square miles were reported between Anchorage and Palmer (Slide Mountain, John Lake and Marie Lake). There was spirited media coverage of rust spore masses washing onshore near the NW Alaska village of Kivalina (Figure 3), which have been tentatively identified as spores of a *Chrysomyxa ledicola* using scanning electron microscopy and spore morphology. The last major outbreak of spruce needle rust in Alaska was in 2008, when rivers were reported to run orange with fungal spores.

Figure 3. Millie Hawley, President of the Kivalina IRA Council, collects spores of a *Chrysomyxa* rust fungus near Kivalina, AK. This mystery substance was initially believed to be invertebrate eggs, but is now known to be rust fungal spores that entered the Kivalina Lagoon from the Wulik River. Photo credit: Stan Hawley, Kivalina IRA Council.

2011 was the most significant year for windthrow in southeast Alaska in recent memory. Nearly 3,500 acres were mapped, and the majority occurred on National Forest lands. It is likely that strong wind events in October and January caused much of this damage. More than 10,000 acres of winter damage was mapped in central Alaska along the Yukon River between the Nowitna Wildlife Refuge and the Tanana River. Damage was primarily observed on hardwoods, especially birch, and symptoms consisted of branch and bole breakage and deformation from heavy snow and ice loads. Depending on location, 10-70% of trees were impacted, and this was the most significant winter damage observed in over a decade.

Invasive Plants

The invasive aquatic plant *Elodea* was the subject of intense efforts in Alaska in 2011. Extensive surveys indicated that the distribution of *Elodea* in the Interior is limited to a significant infestation in one slough of the Chena River, a modest infestation in the Chena River itself, and a significant infestation in a land-locked recreational lake, Chena Lake. Late in 2011, *Elodea* was found to be heavily infesting three small lakes in Anchorage, including two that are used by float planes. The weed was also found in several small lakes near Cordova. More intensive surveys will be conducted in southcentral Alaska in 2012.

The $1.1 million Alaska Weed Management Project, funded through the American Recovery and Reinvestment Act, was successfully completed in 2011. Many of the 18 people employed in this project have found new jobs related to invasive plant management in the State.

The Alaska Division of Agriculture has generated a plan to address Canada thistle infestations in the Anchorage Borough. Forest Health Protection (R10) will continue its partnership with the Division to implement the plan, with a goal of preventing the spread of Canada thistle into the Matanuska-Susitna Valley (Figure 4).

In 2007, the Alaska legislature passed a bill that established, for three years, a Weed and Pest Management Coordinator position within the Division of Agriculture. The Coordinator has shown the importance and effectiveness of this position in many ways, including the development of the Division's first strategic plan for invasive plants and agricultural pests. In 2011, the sunset clause of this bill was removed, making the position a permanent part of state government. This was a long-needed and important development for Alaska.

University of Alaska Fairbanks researchers have been studying agricultural production in the Far North since 1906. In the process, several non-native plant species have been inadvertently introduced and are now recognized as invasive to interior and southcentral Alaska, including bird vetch (*Vicia cracca*), sweetclover (*Melilotus officianlis*) and yellow alfalfa (*Medicago sativa*). In partnership with Forest Health Protection, the University of Alaska Fairbanks completed a three-year project in 2011 to develop an invasive plant management plan for the campus.

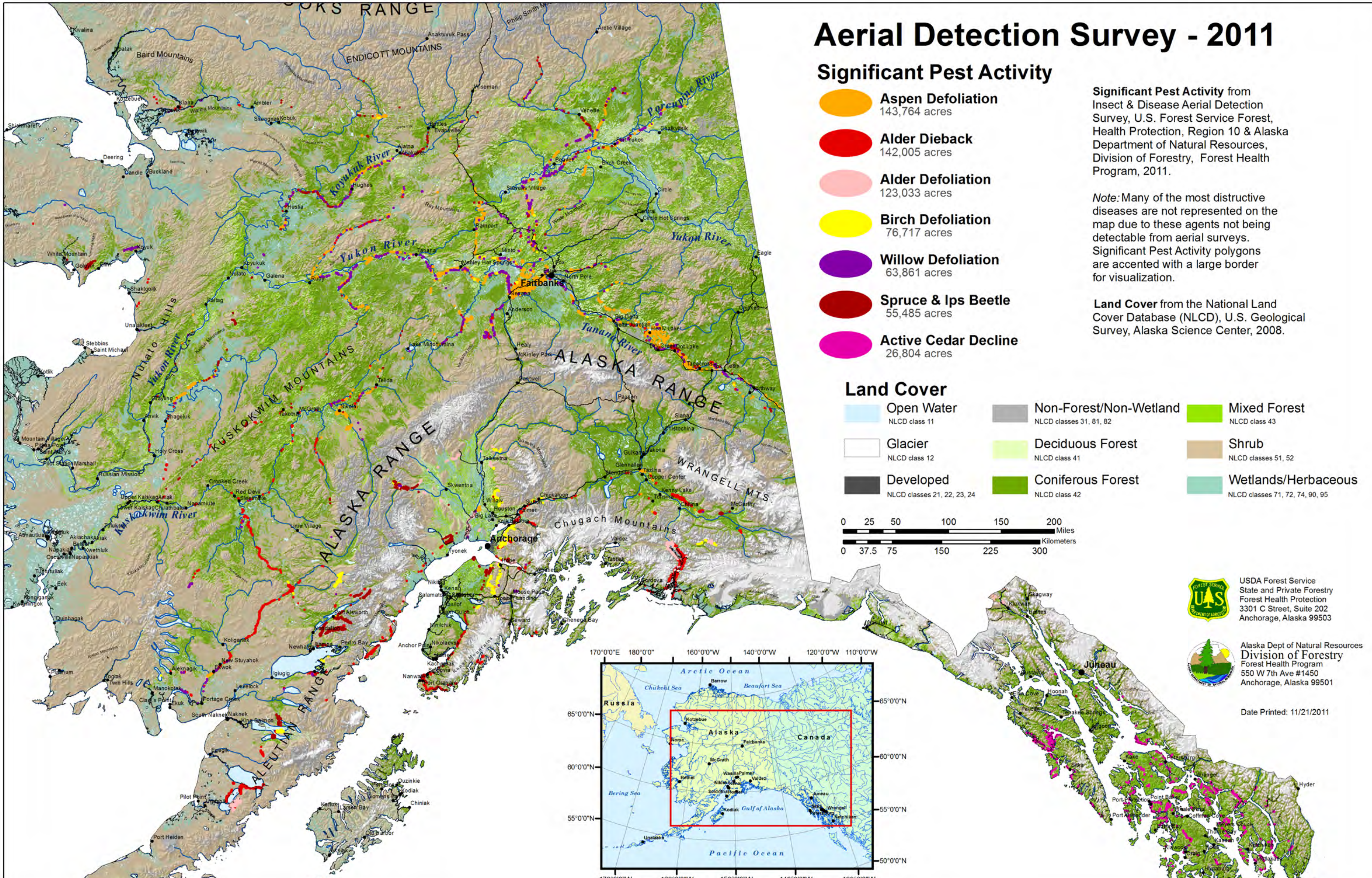
Figure 4. Canada thistle in flower.

European bird cherry (*Prunus padus*) is a short-statured, hardy ornamental that is widely planted from Homer to Fairbanks because of its ability to tolerate cold temperatures. This species is now recognized as highly invasive. A study of the impacts of this species on the wild populations of Pacific salmon (*Oncorhynchus* spp.) in two Anchorage creeks was completed this year. University of Alaska Fairbanks student David Roon determined that bird cherry litter decomposes more quickly than the litter of native riparian species, and that it supports less terrestrial invertebrate biomass than native vegetation. Comparison of stomach contents of fish in streams lined with bird cherry did not differ from fish in streams lined with native vegetation. European bird cherry may be at the early stages of disrupting ecological processes between linked stream-riparian ecosystems in southcentral Alaska. In a separate development, three moose calves died in the Anchorage area after browsing on bird cherry branches. Species of the genus *Prunus* are known to produce cyanide, but moose frequently browse on this species in Alaska without apparent ill effects. It is not known why these particular bird cherry trees or branches were so toxic, but one theory ties their concentrated toxin production to an unusual spell of thawing and freezing weather.

In 2011, competitive Weed Smackdown events were held at three locations around the state. These events serve to educate and engage the public and to facilitate invasive plant removal. Overall, Smackdown events highlight the importance of community involvement with invasive plant issues.

Forest Health Protection participates in ongoing efforts to control the single purple loosestrife and the small number of spotted knapweed infestations known to occur in Alaska. These efforts appear to be working: no new purple loosestrife stems were found this year, and only five of the original 23 spotted knapweed infestations are still producing plants. Three new knapweed infestations were discovered in 2011. ◘

Map 1. Aerial detection survey - 2011 significant pest activity. Map composition by Hans Buchholdt, AK DNR.



Map 2. Survey flight paths from 2011 aerial survey and general ownership. Map composition by Hans Buchholdt, AK DNR.

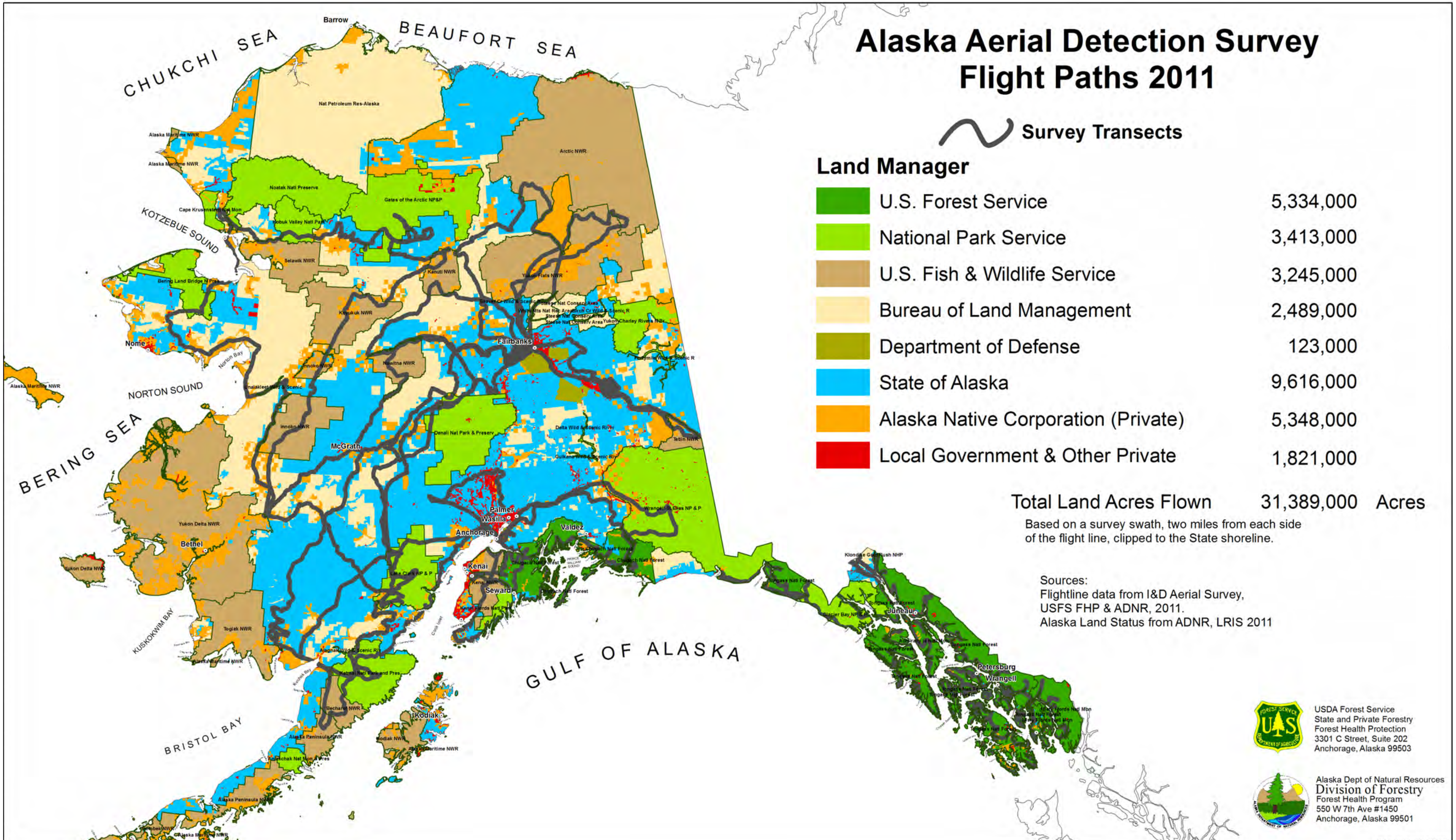


Table 1. Forest insect and disease activity as detected during aerial surveys in Alaska in 2011 by land ownership[1] and agent. All values are in acres[2].

	national forest	native	other federal	state & private	Total ACRES
Abiotic causes[3]	4,214	3,602	4,904	3,531	16,251
Alder defoliation[4]	11,753	27,016	60,057	24,195	123,021
Alder dieback[5]	11,761	51,488	46,785	31,971	142,005
Aspen defoliation[4]		279	1,329	2,933	4,541
Aspen leaf miner	17	43,690	23,903	71,614	139,223
Birch defoliation[4]	3,165	5,391	33,214	34,947	76,717
Cedar decline faders[6]	24,183	269		2,352	26,804
Conifer defoliation	1,407	1,802	730	467	4,407
Cottonwood defoliation[4]	1,331	13,564	5,472	3,011	23,379
Hardwood defoliation	799		2,958	1,691	5,448
Hemlock dieback	5,240	234		754	6,227
Hemlock sawfly	8,323	1,021	44	1,772	11,160
IPS and SPB[7]		197	146	214	557
Northern spruce engraver beetle (IPS)		2,827	2,024	1,222	6,073
Larch sawfly		107		4	111
Large aspen tortrix	127	39	53	1,629	1,848
Porcupine damage	115	6	22	73	216
Spruce aphid	1,661	952	74	1,437	4,123
Spruce beetle	189	6,093	27,913	14,659	48,853
Spruce broom rust		308	411	147	866
Spruce defoliation	278			182	460
Spruce needle rust			57	9	66
Subalpine fir beetle				3	3
Willow defoliation[4]	509	20,376	18,837	24,140	63,862
Willow dieback		380	127	306	814

1 Ownership derived from the 2008 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 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. The affected acreage is much more extensive then can be mapped. Table entries do not include many of the most destructive diseases (e.g., wood decays and dwarf mistletoe), which are not readily detectable in aerial surveys.

3 Damage acres from some types of animals and abiotic agents are also shown in this table. Mapped abiotic damage includes windthrow, freezing injury, flooding, snow slides and landslides.

4 Significant contributors include alder sawfly, leaf miners, and leaf rollers for the respective host. Drought stress and unrecognized alder canker also directly caused reduced foliation or premature foliage loss.

5 Alder dieback is the new description used to label the signature mapped during the survey for dying alder. Past reports have referred to it as alder canker, but verification of alder canker requires ground-checks and dieback symptoms are the damage signature observed from the air.

6 Acres represent only areas with actively dying yellow-cedars. Approximately 500,000 total acres of cedar decline have been mapped over the years in southeast Alaska.

7 These acreage values are a cumulative effect from Northern spruce engraver beetle (*Ips perturbatus*) and spruce bark beetle (*Dendroctonus rufipennis*) working in tandem on the same stand of trees.

Table 2. Affected area (in thousands of acres) for each host group and damage type from 2007 to 2011 and a 10-year cumulative sum. For a detailed list of pest species and damage types that compose the following categories, see Appendix II on page 65.

Host group / Damage type[1]	2007	2008	2009	2010	2011	Ten-Year Cumulative[2]
Alder defoliation	10.0	0.7	3.4	7.0	123.0	**161.3**
Alder dieback	0.0	15.0	1.3	44.2	142.0	**210.2**
Aspen defoliation	796.0	219.7	310.8	464.0	145.6	**3019.1**
Birch defoliation	1.5	0.1	14.3	33.3	76.7	**548.7**
Cedar mortality	26.2	9.0	16.3	30.5	26.8	**153.6**
Cottonwood defoliation	11.5	13.2	11.2	14.1	23.4	**151.3**
Hemlock defoliation	0.1	0.1	3.6	9.1	11.1	**26.2**
Hemlock mortality	0.0	2.0	2.1	0.4	6.2	**11.1**
Larch defoliation[3]	0.1	0.2	0.1	0.0	0.1	**36.4**
Larch mortality	0.0	0.2	0.1	0.0	0.0	**39.5**
Spruce defoliation	41.9	6.9	0.8	40.9	5.5	**361.1**
Spruce mortality	183.9	129.1	138.9	101.8	55.5	**936.5**
Spruce/hemlock defoliation	10.3	2.8	1.1	0.3	0.0	**82.5**
Spruce/larch defoliation	0.0	0.0	13.2	0.0	0.0	**16.3**
Subalpine fir mortality	0.1	0.0	0.0	0.0	0.0	**1.0**
Willow defoliation[3]	92.7	76.8	139.7	562.7	63.9	**1101.9**
Total damage acres - thousands	**1174.3**	**475.8**	**656.9**	**1308.3**	**679.8**	
Total acres surveyed - thousands	38,365	36,402	33,571	36,878	31,392	
Percent of acres surveyed showing damage	3.0	1.3	2.0	3.5	2.2	

1 Values summarize similar types of damage, mostly from insect agents, by host group. Foliar disease agents contribute to the totals for spruce defoliation, hemlock mortality and alder defoliation. Damage agents such as fire, wind, flooding, slides and animal damage are not included.

2 The same stand can have an active infestation for several years. The cumulative total combines all impacted areas from 2002 through 2011 and does not double count acres.

3 Although these acreage sums are due to defoliating agents, a large portion of the affected area has resulted in mortality.