2013 Alaska State Highlights

The Forest Health Protection (FHP) Program (State and Private Forestry, USDA Forest Service), together with the Alaska Department of Natural Resources Division of Forestry, conducts an annual, statewide Aerial Detection Survey across all land ownerships. In 2013, staff and cooperators identified over 849,000 acres of forest damage from insects, diseases, declines and abiotic agents on the 31.5 million acres surveyed (Maps 1 and 2, Table 1). The total damaged acreage observed is up by 42% from 2012. Much of the change since last year is due to substantial increases in spruce, alder and birch defoliation, with a combined increase of over 367,000 acres mapped in 2013 (Table 2). The warm and dry conditions experienced throughout most of the state contributed to this increase in defoliator activity.

Figure 5. Our office in July.

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, since many of the most destructive disease agents (e.g. wood decay fungi, root diseases, and dwarf mistletoe) are not readily visible from the air. Additional forest health information is acquired through ground surveys, monitoring plots, 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 work alongside many agency partners on invasive plant issues, conducting roadside and urban surveys, public awareness campaigns, and general outreach and education efforts.

Insects

The amount of insect damage detected by aerial survey in 2013 increased from 2012 for alder and birch. Over 536,000 acres of external feeding damage were observed on Alaskan hardwood trees and shrubs in 2013, particularly birch and alders, an increase from the 280,000 acres observed last year. A variety of insects contributed to this defoliation, including several geometrid moth species, the rusty tussock moth, leaf rollers, and leaf beetles. One major contributor to this damage was the birch leaf roller, which was mapped on 331,000 acres across the state. The green alder sawfly, a non-native defoliator of alder, was found feeding on red alder in Sitka, Ketchikan, and Juneau. Defoliation of aspen, cottonwood, and willow detected by aerial survey was down in 2013 compared to 2012. The aspen leaf miner, which was previously ranked as the number one pest in terms of acreage damaged, increased in activity from last year but is still not at the level seen in 2010.

Figure 6. Green alder sawfly.

Spruce defoliation from insects and disease decreased by half in 2013. However, there was a dramatic outbreak of western black-headed budworm damage, with 121,000 acres mapped, in and around the Wood-Tikchik State Park in Southwestern Alaska. The acreage affected by spruce aphid continues to decrease; another cold winter may push this pest to undetectable levels next year. Spruce beetle was observed on 27,000 acres during aerial surveys this year representing a 227% increase over 2012. While this increase seems significant, in 2012 forest health specialists recorded the lowest annual figure for spruce beetle-caused mortality since the systematic surveys began in the early 1970s.

Hemlock defoliation continues to increase in Southeast Alaska. Over 13,300 acres of hemlock sawfly defoliation were mapped during the aerial detection survey in 2013. The acreage is more than double that of 2012, however, hemlock sawfly damage did not become apparent in many locations until after completion of the aerial survey last year. The only areas with hemlock sawfly damage detected in both 2012 and 2013 were Etolin and Revillagigedo Islands in Southeast Alaska.

Diseases

A 2-year Evaluation and Monitoring project on shore pine health funded by the USFS Forest Health Monitoring Grant Program was completed in 2013. The goal of this project was to investigate the insect and disease agents of shore pine, a subspecies of lodgepole pine typically found on peatland sites in Southeast Alaska. Forest Inventory Analysis data had detected a significant decline in shore pine biomass, highlighting critical knowledge gaps for this non-timber species. FHP installed

a network of 46 permanent plots across five locations in Southeast Alaska. Western gall rust, foliage disease and bole wounding were important damage agents of shore pine. Work is needed to determine the key causes of bole wounding, which probably include a variety of animals (porcupines, beavers, bears and deer), mechanical breakage from snow loading, and a possible bole canker pathogen (samples have been collected for molecular diagnosis). Secondary insects and fungi caused extensive localized mortality of western gall rust infected boles and branches. Final results of the project will be reported in 2014 and permanent plots will be revisited at regular intervals to track change over time.

Dothistroma foliage disease of pine was confirmed as the cause of severe but localized damage to shore pine in Gustavus and Glacier Bay National Park. Three consecutive years of this outbreak has been sufficiently damaging to cause mortality of affected pines, since shore pine frequently retains three or fewer needle cohorts in Alaska. Most damage occurred in dense pine-cottonwood-spruce stands, where pine regeneration is limited. Survival of affected tagged trees will be assessed in 2014. Aerial and ground surveys will help to determine whether the outbreak continues or expands in coming years. Approximately 5,000 acres were sufficiently damaged to have a signature detectable by aerial surveyors.

A hemlock canker outbreak occurred along roadsides and riparian areas of Prince of Wales Island in 2012 and 2013. Hemlock canker causes periodic mortality and branch dieback of western hemlock in Southeast Alaska, but the causal fungus is unconfirmed. Samples were sent to Gerry Adams (Associate Professor of Practice, University of Nebraska) for culturing and genetic sequencing, which yielded several potential fungal pathogens. Inoculation trials with these fungal isolates were initiated near Thorne Bay and Staney Creek on Prince of Wales in May 2013, and additional diseased tissue samples were collected for culturing and sequencing. Inoculated trees will be evaluated in spring 2014. If inoculations have resulted in symptom development and the inoculation fungi can be re-isolated from infected tissue, we will have identified the causal fungus and gained valuable insight into hemlock canker epidemiology.

Rhizosphaera needle cast on Sitka, white, and Lutz spruce was severe throughout many areas of the state in 2013. Older needles became symptomatic in late summer, leaving trees with thin crowns. The disease was particularly evident in late August on Sitka spruce in the Juneau area. The outbreak on white and Lutz spruce was moderate with severe pockets extending from the Kenai Peninsula to the interior near Fairbanks and Tok.

Hemlock dwarf mistletoe and stem decays (heart rots) are important diseases of coastal forests that do not vary year-to-year. They cause tree growth loss and mortality, but also have important ecological functions such as initiating disturbance, altering carbon and nutrient cycles, and providing wildlife habitat. Stem decays cause unseen damage that increases the risk of tree failure. These hazard trees are an important consideration in urban and recreational settings.

A project was initiated with the Cooperative Alaska Forest Inventory (CAFI), an existing network of boreal forest permanent plots. This project will investigate tree disease and mortality in Southcentral and Interior Alaska by utilizing CAFI plots to: (1) monitor disease agents of forest trees and evaluate the extent of mortality and damage; (2) assess correlation between disease agents and tree damage and mortality to determine the primary causal agent/s; (3) evaluate geographic, plant community, or age-class trends associated with disease damage and mortality through assessment of ground-based plots, (4) evaluate correlations of individual diseases with tree growth and volume loss, and, (5) facilitate ground-truthing of the Aerial Detection Survey. A severe, but localized outbreak of aspen canker was discovered in the course of this project.

Figure 7. Aspen canker debarked.

Non-infectious Disorders

Yellow-cedar decline has been mapped on more than 400,000 acres over the years across an extensive portion of Southeast Alaska, and the 2013 aerial survey mapped almost 14,000 acres of active yellow-cedar decline (reddish dying trees). This climate-driven decline is associated with freezing injury to fine cedar roots that occurs where snowpack in early spring is insufficient to protect fine roots close to the soil surface from late-season cold events. In 2013, decline injury was documented for the first time in portions of two adjacent young-growth stands on Zarembo Island. Wet-site indicator plants in the understory of these stands suggest that shallow rooting due to poor soil drainage predisposed yellow-cedar to decline at this location.

A comprehensive yellow-cedar strategy is being developed in collaboration with the Regional Office, the National Forest System and other cooperators (expected 2014). This document will provide information on yellow-cedar biology and decline, and guidance on yellow-cedar management for specific regions and Ranger Districts in Alaska.

There was a large amount of snow damage reported during December 2013. Heavy snow loads caused small hardwood trees and conifer trees with a high height to diameter ratio to snap at the bole or break limbs. The abundance of host material could aid in building populations of woodboring insects. Alternatively snow falling from branches can strip overwintering eggs off the foliage, as is the case with the hemlock sawfly.

Invasive Plants

University of Alaska Cooperative Extension Service (CES) staff have developed an outreach program for middle school and high school students in Anchorage. The program focuses of the spread of European bird cherry in Anchorage parks and examines how it affects the availability of browse to Anchorage's urban moose population.

Members of the Fairbanks Cooperative Weed Management Area (CWMA) are working with local residents to combat the spread of bird vetch into residential subdivisions.

A three-day invasive plant workshop held in Bethel, Alaska, brought together the CES, the UAF Biology and Wildlife Department and the Kuskokwim River Watershed Council. The workshop jump-started invasive plant interest and activity in the Yukon Kuskokwim delta.

In an important development, the Alaska Department of Transportation and Public Facilities (ADOT&PF) released a new Integrated Vegetation Management plan in June. The plan will assist ADOT&PF in "its responsibility to manage the vegetation upon its lands to improve safety and control invasive plant species."

FHP staff working on aerial survey found a dense infestation of the invasive aquatic plant Elodea when they landed on Martin Lake, in the Copper River Delta. Though they carefully removed strands of Elodea from the floatplane's rudders before taking off, once in flight a staff member glanced back and saw Elodea still clinging to the rudder assembly. He quickly snapped a photo. As the plane approached Hinchinbrook Island, the staff member looked back again and found the Elodea was gone. The photo has proven to be influential in the Elodea discussion, silencing people who were skeptical that this aquatic plant could be spread by floatplane.

In cooperation with the Alaska Association of Conservation Districts (AACD), work on developing invasive plant management plans and forming new cooperative weed management areas continues in Southeast Alaska. AACD continues to address the garlic mustard infestation in downtown Juneau, and the Juneau CWMA has had success in reducing a major perennial sowthistle infestation at Outer Point.

CES continued its series of live webinars in 2013. The theme of the webinar series is Integrated Pest Management, and one of the goals is to help certified pesticide applicators across the state earn continuing education units that will help them maintain their certifications. More than 100 people participated in the webinar series.

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Table 1

Forest insect and disease activity detected during aerial surveys in Alaska in 2013 by land ownership[1] and agent. All values are in acres.

Agent	National Forest	Native	Other Federal	State & Private	Total
Abiotic causes[3]	864	1,925	2,190	3,894	8,872
Alder defoliation[4]	4,542	32,853	16,275	79,414	133,083
Alder dieback[5]	2,473	6,130	4,547	13,339	26,489
Aspen leaf miner		27,893	41,794	29,904	99,592
Birch aphid			67	230	297
Birch defoliation[6]	392	125,200	156,397	72,604	354,593
Black-headed budworm	44	41,865	807	79,173	121,889
Cedar decline[7]	12,692	99	72	491	13,353
Conifer defoliation	1,866	19	2,115	750	4,750
Cottonwood defoliation[4]		7,315	7,098	5,169	19,582
Cottonwood leaf beetle	10		92	15	117
Dwarf birch defoliation[6]				601	601
Hardwood defoliation	183	75	686	1,867	2,811
Hemlock sawfly	10,146	295	827	2,062	13,329
Large aspen tortrix		682	1,547	1,054	3,283
Porcupine damage	339		49	99	488
Dothistoma Needle blight	97	128	1,868	2,739	4,831
Spruce beetle	2,137	23	19,752	5,119	27,031
Spruce broom rust		0	662	242	904
Spruce budworm		5,122	787	525	6,434
Spruce engraver and spruce beetle[8]		13		299	312
Spruce engraver beetle		2,527	2,640	2,574	7,741
Spruce needle aphid				158	158
Spruce needle cast	35			12	47
Willow defoliation[4]	364	4,392	6,113	11,482	22,351
Willow leafblotch miner		1,839	1,950	2,091	5,880

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 lands, 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 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 can include windthrow, snow loading, freezing injury, flooding, snow slides, and landslides.

4 Significant contributors include alder sawflies, internal leaf miners, and leaf rollers for the respective host.

5 Alder dieback is the new description used to label alder stem mortality mapped during the survey. 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 Defoliation of birch trees and dwarf birch has been reported separately. “Dwarf birch defoliation” primarily represents defoliation of dwarf birch, but also includes defoliation of Labrador tea, small willows, *Spiraea* and other woody shrubs, and is attributable to several external leaf-feeding insects. In contrast, birch tree defoliation is caused by a combination of internal and external leaf-feeding insects.

7 Acres represent only areas with actively dying yellow-cedars. More than 400,000 acres of cedar decline have been mapped over the years in Southeast Alaska.

8 Acres on which northern spruce engraver and spruce bark beetle activity occurred in the same stands.

Aerial Insect and Disease Detection Survey 2013

Significant Pest/Disease Activity

- Alder Defoliation/Dieback — 159,572 Acres
- Aspen Defoliation — 102,875 Acres
- Spruce Bark/Engraver Beetle — 35,084 Acres
- Birch Defoliation/Leaf Roller/Aphids — 337,683 Acres
- Black Headed Budworm — 121,889 Acres
- Willow Defoliation/Miners — 28,231 Acres
- Cedar Decline — 13,353 Acres

Land Cover

- Conifer Forest
- Mixed/Broadleaf Forest
- Shrub
- Non-Forest
- Water

Note: Many of the most destructive diseases are not represented on the map due to these agents not being detectable from aerial surveys.

Activity polygon area may be larger than actual area because activity polygons are enhanced with a large border to aid visualization.

0 100 200 Miles

0 150 300 Kilometers

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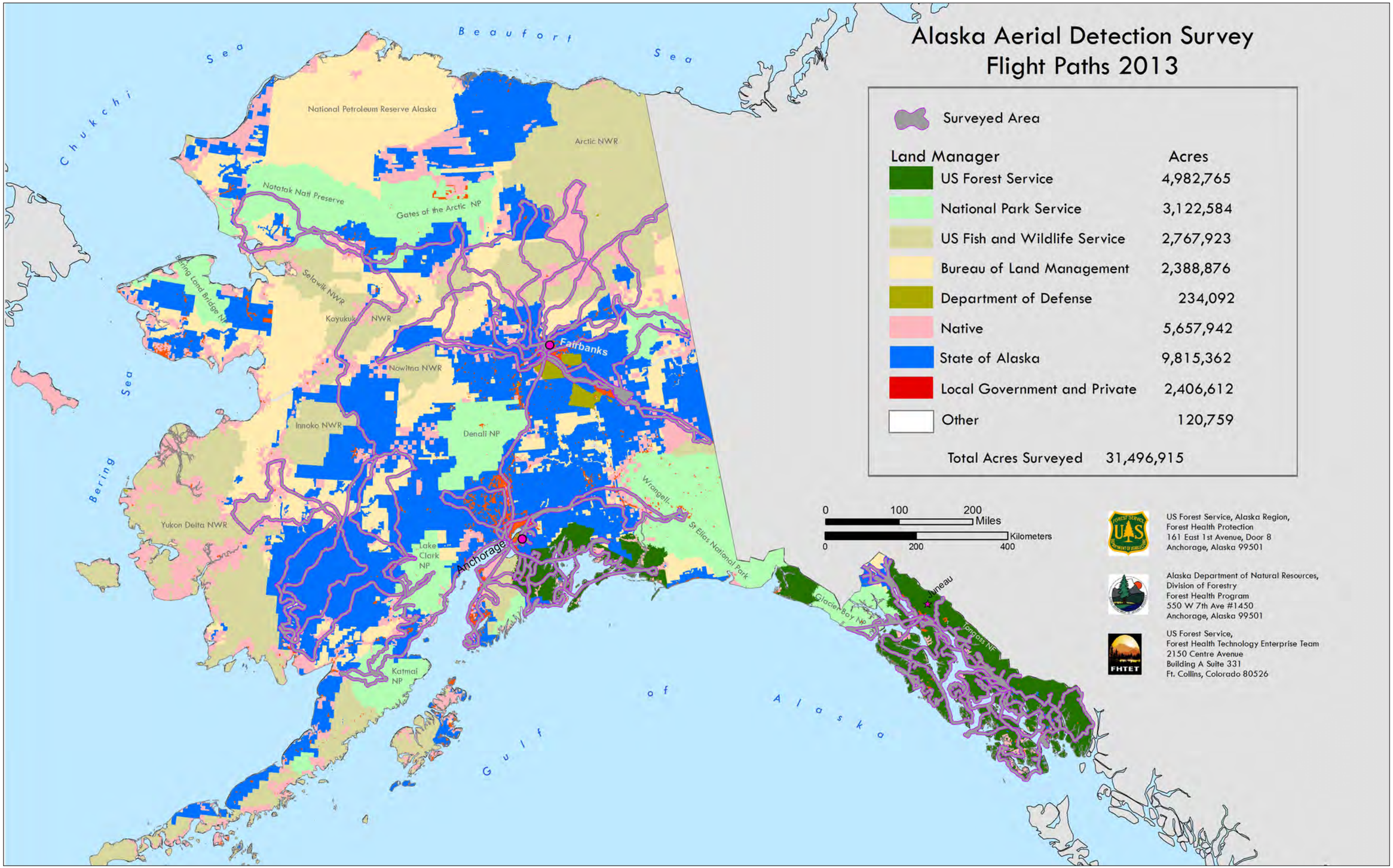
Land Cover: U.S.G.S. EROS
Alaska Field Ofice

Map 1. Aerial Detection Survey- 2013 significant pest activity.



Map 2. Survey flight paths from 2013 aerial survey and general ownership.

Table 2

Affected area (in thousands of acres) for each host group and damage type from 2009 to 2013 and a 10-year cumulative sum.

Host Group / Damage Type[1]	2009	2010	2011	2012	2013	10-year Cumulative[2]
Abiotic Damage	1.8	12	16.3	15.8	8.8	**62**
Alder Defoliation	3.4	7	123	58.5	133.1	**373.3**
Alder Dieback	1.3	44.2	142	16.4	26.4	**244.9**
Aspen Defoliation	310.8	464	145.6	82.7	102.4	**2789.9**
Birch Defoliation	14.3	33.3	76.7	177.8	349	**1219.7**
Cottonwood Defoliation	11.2	14.1	23.4	27.1	19.5	**149.7**
Hemlock Defoliation	3.6	9.1	11.1	5.5	13.3	**38.2**
Hemlock Mortality	2.1	0.4	6.2	0	0	**10.6**
Larch Defoliation[3]	0.1	0	0.1	0	0	**17.7**
Larch Mortality	0.1	0	0	0	0	**34.6**
Shore Pine Damage	0	0	0	2.9	4.8	**6.7**
Spruce Damage	0.8	40.9	5.5	14.2	7.5	**302.1**
Spruce Mortality	138.9	101.8	55.5	19.8	35.1	**794.3**
Spruce/Hemlock Defoliation	1.1	0.3	0	0	121.2	**126.1**
Spruce/Larch Defoliation	13.2	0	0	0	0	**16.5**
Subalpine Fir Mortality	0	0	0	0	0	**0.8**
Willow Defoliation[3]	139.7	562.7	63.9	47.7	28.2	**1136.9**
Total damage acres - thousands	**656.9**	**1336.8**	**707.0**	**491.1**	**849.3**	**7324**
Total acres surveyed - thousands	33,571	36,878	31,392	28,498	31,497	
Percent of acres surveyed showing damage	2%	3.6%	2.2%	1.7%	2.7%	

1 Values summarize similar types of damage, mostly from insect agents, by host group. Disease agents contribute to the totals for spruce defoliation, hemlock mortality and alder dieback. 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 2003 through 2013 and does not count the same acres twice.

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