



Alagnak

Aniakchak

Katmai

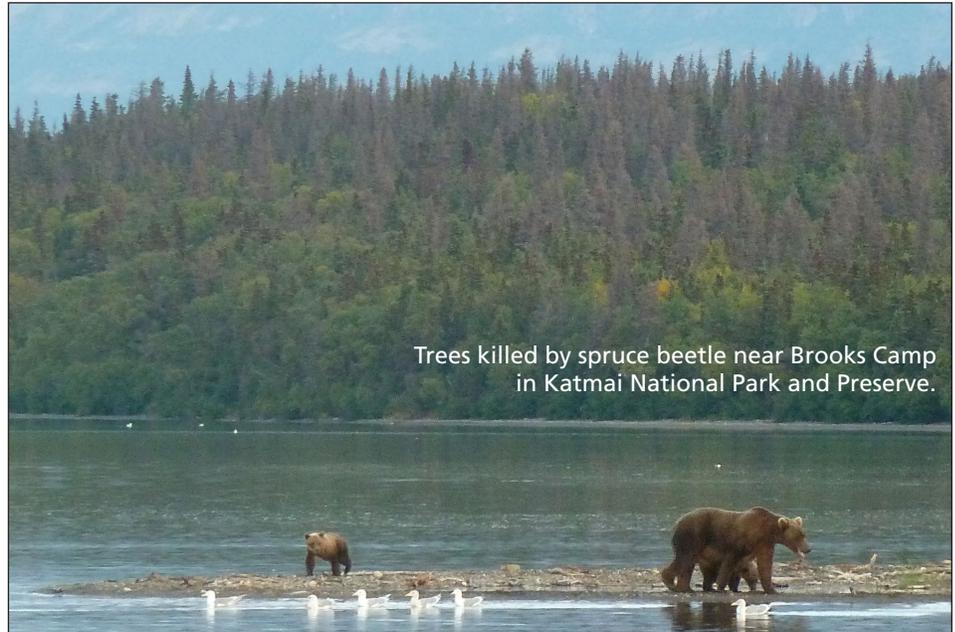
Kenai Fjords

Lake Clark

# Forest Insects

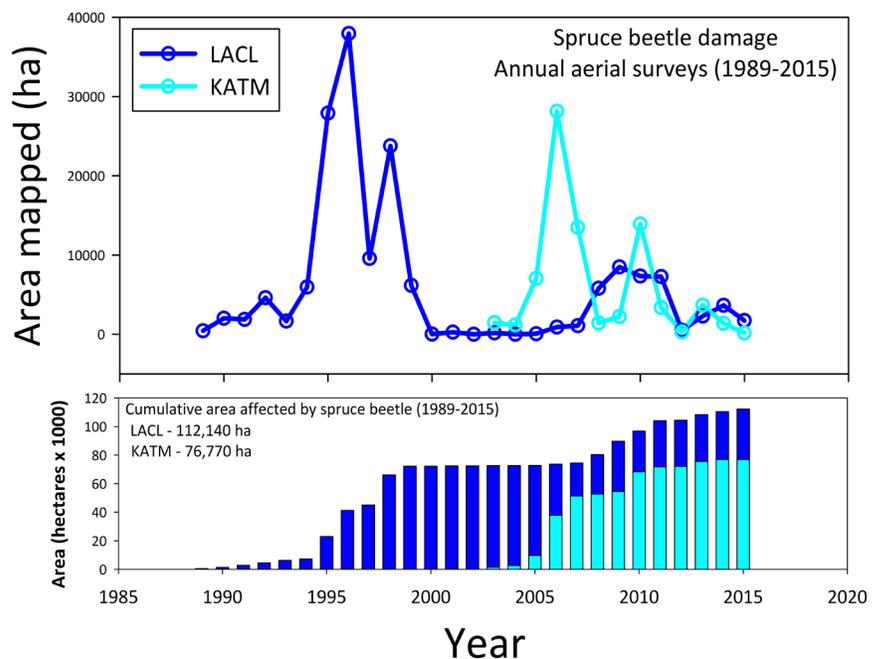
Over the last twenty-five years, roughly 3.7 million acres (1.5 million hectares) of forest in south-central Alaska has been killed by the spruce beetle (*Dendroctonus rufipennis*; Figure 1), a native bark beetle that has shown increased activity with warmer temperatures (Sherriff et al. 2011). During the last five years, native defoliators (e.g., geometrid moths, noctuid moths) have affected alder, willow, and dwarf birch in Lake Clark National Park and Preserve (NPP), and huckleberries and salmonberries in Kenai Fjords National Park (NP). Birch leaf roller (*Epinotia solandriana*) has been on the rise in Lake Clark and Katmai since 2012 (U.S. Forest Service 2016). In 2015, the spruce aphid (*Elatobium abietinum*), introduced from Europe, was confirmed on the western Kenai Peninsula. It has not yet been found on the eastern Kenai Peninsula or in Kenai Fjords NP (U.S. Forest Service 2016).

A warmer climate is known to facilitate the growth of spruce beetle and spruce aphid populations. Warm winters result in lower over-winter mortality of both beetles and aphids. In addition, warm summers accelerate larval development in the spruce beetle, reducing generation time from a two-year life cycle to a single year, allowing the population to increase rapidly. Above-average spring and summer temperatures may also contribute to drought stress in white spruce, weakening the trees and leaving them vulnerable to spruce beetle attack (Csank et al. in press).



Trees killed by spruce beetle near Brooks Camp in Katmai National Park and Preserve.

NPS/A. Miller



**Figure 1.** Area (in hectares) of spruce beetle damage by park and year (top), and cumulative area affected in each park through time (bottom), from U.S. Forest Survey aerial survey data (1989-2014; <http://foresthealth.fs.usda.gov/portal/>). Areas mapped are dependent on flight line locations and may not include all areas affected in a given year, or areas affected in prior years.

## Spruce Beetle Damage in Katmai and Lake Clark

Annual aerial surveys conducted by the U.S. Forest Service and Alaska Department of Natural Resources track general trends in spruce beetle activity. Beetle activity in Lake Clark peaked in the mid-1990s (Figure 1), and has affected approximately 277,100 acres (112,140 ha) of forest to date (Figure 1). Aerial surveys began in Katmai in 2003, following the outbreak in the early to mid-1990s. Beetle activity peaked in 2006, following two warm summers. Recent beetle damage has been centered on Lake Brooks and the Valley of 10,000 Smokes Road, with cumulative damage of approximately 190,450 acres (77,100 ha; Figure 1). Forest plot measurements and tree-ring studies are adding to our understanding of the timing, frequency, and ecological effects of these outbreaks.



Spruce aphids are non-native, and while not yet found in SWAN parks, they are likely to spread from the current infestation on the eastern Kenai Peninsula.

## Widespread Alder Damage in Lake Clark

In 2015, roughly 24,410 acres (9,880 ha) of defoliation or dieback were observed across alder and willow stands in the central portions of Lake Clark NPP. U.S. Forest Service entomologists will return to some of these areas in June 2016, in order to collect samples on the ground and to ascertain the cause of damage. A previous defoliation event in interior Lake Clark (2010-2012) led to extensive damage to dwarf birch.

## Non-native Spruce Aphid Arrives on the Kenai Peninsula

The spruce aphid (*Elatobium abietinum*) was found in Homer and in Halibut Cove in 2015. The U.S. Forest Service crew flew a survey on the eastern side of the Kenai Peninsula, including the Kenai Fjords coastline, in late February of this year, and have not (yet) found it there. Additional surveys are planned for this summer.

Originally from Europe, the spruce aphid (*Elatobium abietinum*) was introduced to the Pacific Northwest in 1910. In Alaska, it is well known in southeast forests, where it has damaged coastal Sitka spruce stands since at least the early 1960s.

## References

- Csank, A.Z., A. E. Miller, R. L. Sherriff, E. E. Berg, and J. M. Welker. 2016. Tree-ring isotopes reveal drought sensitivity in trees killed by spruce beetle outbreaks in south-central Alaska. *Ecological Applications* (in press).
- Sherriff, R. L., E. E. Berg, and A. E. Miller. 2011. Climate variability and spruce beetle (*Dendroctonus rufipennis*) outbreaks in south-central and southwest Alaska. *Ecology* 92:1459-1470.
- U.S. Forest Service. 2016. Forest Health Conditions in Alaska, 2015. U.S. Forest Service, Alaska Region, Anchorage, AK. Publication R10-PR-38, 78 pp.



Defoliator damage on dwarf birch near Snipe Lake, Lake Clark NPP, June 2010. Between 2010 and 2012, widespread damage from native defoliators (autumnal and geometrid moths) was observed as far west as Wood-Tikchik State Park. Shrubs had recovered by 2015, but still show many dead branches.