



Insect Outbreaks

Resource Brief
October 2011

Importance

High latitude forests periodically experience widespread mortality and/or loss of canopy cover due to insects and disease. Variation in climate and/or changing land use practices (e.g., forest harvest) may affect the population dynamics of forest pests, as well as the resistance of host trees. These dieback events, in turn, may result in broad-scale changes in forest structure and composition, and in concomitant changes in understory species composition.

Status

Over the last two decades, roughly 1.5 million hectares (3.7 million acres) of forest in south-central and southwest Alaska has been killed by a spruce beetle (*Dendroctonus rufipennis*) outbreak, with nearly half of the damage occurring on the Alaska and Kenai Peninsulas. Smaller, more localized irruptions of native defoliators (e.g., noctuid moth, *Sumira verberata*) have affected alder, willow and dwarf birch.

To better understand forest disturbance dynamics, the SWAN has used tree-ring data to examine the frequency of historic spruce beetle damage in Lake Clark NPP (LACL) and Katmai NPP (KATM), and the relationship between climate and beetle outbreaks, regionally. In addition, plot measurements in beetle-affected stands and other areas impacted by insect damage (e.g., shrublands affected by defoliators) will be used to monitor vegetation response to the disturbance.

Discussion

In spruce-beetle affected forests, tree-ring data from the Alaska and Kenai Peninsulas show that widespread forest thinning has occurred at roughly 50 year intervals over the last 250 years (Fig. 1; Sherriff et al. 2011). As beetles kill the large, old trees in a stand, younger trees in the understory are released from competition and show an increase in growth ('growth release'), as indicated by an increase in the width of the annual rings (Fig. 2). Major growth releases appear in the tree-ring record in the 1810s, 1870s, 1910s, and 1970s-1980s and often follow warmer and/or drier than average years, often during a cool-phase of the Pacific Decadal Oscillation (PDO; Fig. 1). Monitoring plots established in beetle-kill in 2009-2010 will provide information regarding stand recovery, fuel loads, and shifts in understory species composition.



Recent spruce bark beetle-induced tree mortality as seen here in the Bay of Islands, (KATM) is widespread in the Naknek Lake basin.



Amy Miller and Rosemary Sherriff core spruce trees in Brooks Camp, KATM. Trees are cored at the base of the tree, which provides the most accurate estimate of age.

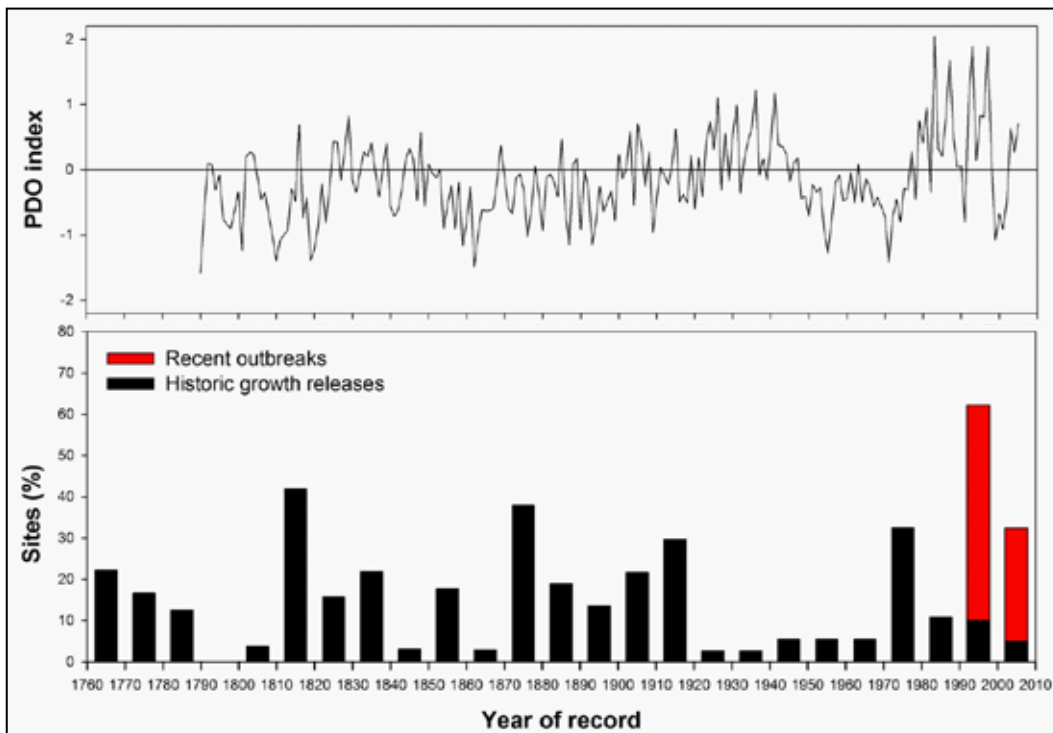


Figure 1. Percentage of forest sites initiating a growth release between 1760-2010 (lower figure) and PDO index derived from tree-ring records (upper figure). Values of the PDO index above zero indicate warm-phase PDO conditions; whereas values below zero indicate cool-phase PDO conditions. Spruce beetle outbreaks have tended to initiate following warm, dry years, often during a cool-phase PDO (Figure adapted from Sherriff et al. 2011).

Discussion (continued)

In non-forested areas, the more recent, localized defoliation events recorded in LACL and KATM are also being studied. The SWAN has been working with U.S. Forest Service and Alaska Natural Heritage Program cooperators to identify the organisms responsible and to document the nature and extent of the damage (Fig. 3; USFS/ADNR 2006; Boucher et al., in review). As with the larger-scale forest dieback, these small-scale disturbances, in combination with pathogens, frost damage, or other environmental effects, could lead to eventual changes in community composition and structure. Monitoring data from spruce woodland and shrub-dominated areas will provide insights regarding the frequency of defoliator outbreaks and their long-term effects on vegetation.



Figure 3. Alder decline attributed to the noctuid moth, *Sunira verberata*, on Dumpling Mountain in 2009, KATM.



Figure 2. Examples of growth release observed on tree-ring cores from the Tlikakila River, LACL.

References

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