Monitoring the Margin: Yellow-cedar Decline Marches Northward along the Outer Coast of Southeast Alaska

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Yellow-cedar decline is a climate-induced extensive tree mortality of the valuable yellow-cedar. The pattern of the roughly ½ million acres of yellow-cedar decline aligns with regional snow models, with dead yellow-cedar limited to low snow zones (i.e., less than 250mm, modeled as annual precipitation as snow).

We noticed large patches of recent mortality around Slocum Arm on the outer coast of Chichagof Island during our annual forest health detection survey. These are unusual, because most stands of yellow-cedar decline have numerous old, spike-toped snags representing mortality that dates back to about 1900. This outer coast area also marks the northern extent of yellow-cedar decline. In 2010, we flew over the area, and from the air, assigned patches of dead trees to particular snag classes to estimate the timing of mortality. The maps and associated photographs shown here were produced from this one-day mission (Figure 33).

There is an apparent spreading pattern of yellow-cedar decline on the outer coast of Chichagof Island. Stands in the southern portion of Slocum Arm appear to be composed of mainly older snag classes 3, 4, and 5. To the north are stands with more recent class 2. Still further north are dying trees and snags in classes 1 and 2. Healthy cedar forests extend from here all the way north to Glacier Bay. In previous research (Hennon et al. 1990, Can J. Bot), we established time-since-death for these snag classes to aid in reconstructions of morality. Observations from the air need to be supported by ground data for confirmation. The apparent spreading of yellow-cedar decline on the outer coast of Chichagof Island offers unique opportunities for monitoring and research on climate change and associated responses. The following is a list of projects that could be established along this gradient.

- **Field plot monitoring** – Permanent plots could be installed in stands representing old-dead, recent-dead, and healthy yellow-cedar forests. Plot data would be a means of reconstructing temporal patterns of mortality and vegetation responses, as well as monitoring into the future.
  - Snag dating: data on the abundance of each snag class indicate the onset and progression of tree mortality in each area.
  - Plant succession: data on the occurrence and growth of other tree species can aid in interpretations of plant succession as a response to cedar death.
  - Tree vigor: measurements of tree rings and sapwood area can be used to assess vigor for live trees for cedar and other species.

- **Historical aerial photographs** – aerial photographs may be available from the 1920s, 1940s, 1960s, and more recent sets to verify the timing of yellow-cedar decline along different portions of the outer coast.

- **Microclimate monitoring** – we have experience deploying small air and soil temperature loggers that record hourly temperature for a year or more. Data can determine when shallow soils dip into the lethal temperature range (-5°C) and also show patterns of snow deposition and melt.

- **Snow modeling** –Snow models used with global circulation projections can predict new areas where yellow-cedar decline would be expected to occur (i.e., northern extension) as the climate continues to warm, including possible spread to cedar forests in Glacier Bay National Park. •

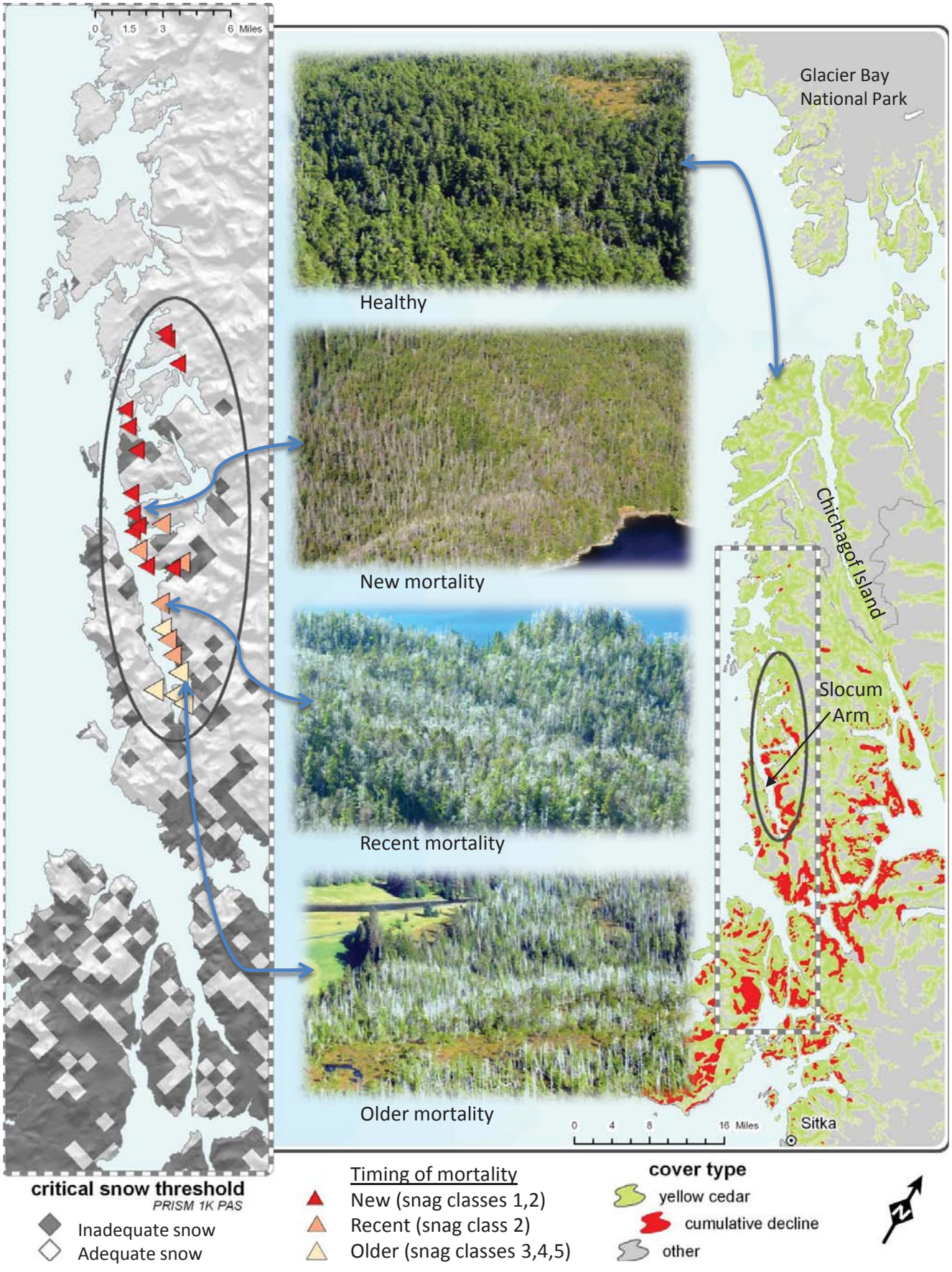

Figure 33. Expanding yellow-cedar mortality.