Vegetation Composition & Structure

Responses to disturbance, species diversity documented by monitoring efforts

To date, work on the vegetation composition and structure in SWAN parks has focused on describing spatial patterns in vegetation across latitudinal and elevation gradients (e.g., Fig. 1; Carlson et al. 2013), refining sampling methods, and estimating sampling error. Repeated sampling has provided estimates of interannual variability in species cover but has also indicated short-term responses of vegetation to disturbance (Fig. 2). In forest stands affected by the spruce beetle, increases in snag densities and coarse woody debris have been observed since 2009. Most sites support high densities of saplings, but a few show higher densities of larger, older trees, suggesting a limit to recruitment. Data from forest monitoring plots in Kenai Fjords (KEFJ) supplement existing U.S. Forest Service Forest Inventory and Analysis (FIA) plots and will be used to monitor tree establishment and death, as well as changes in forest structure.

Importance

Vegetation is integral to ecosystem function, energy transfer, and element cycling. It drives ecosystem productivity in the SWAN, provides habitat and forage for wildlife, and food and materials for subsistence. Lastly, it is sensitive to environmental change.

Left: SWAN and KEFJ staff get acrobatic in KEFJ to measure the diameter at breast height (DBH) of a Sitka spruce. The coast of Kenai Fjords has some of the largest trees in the Network.

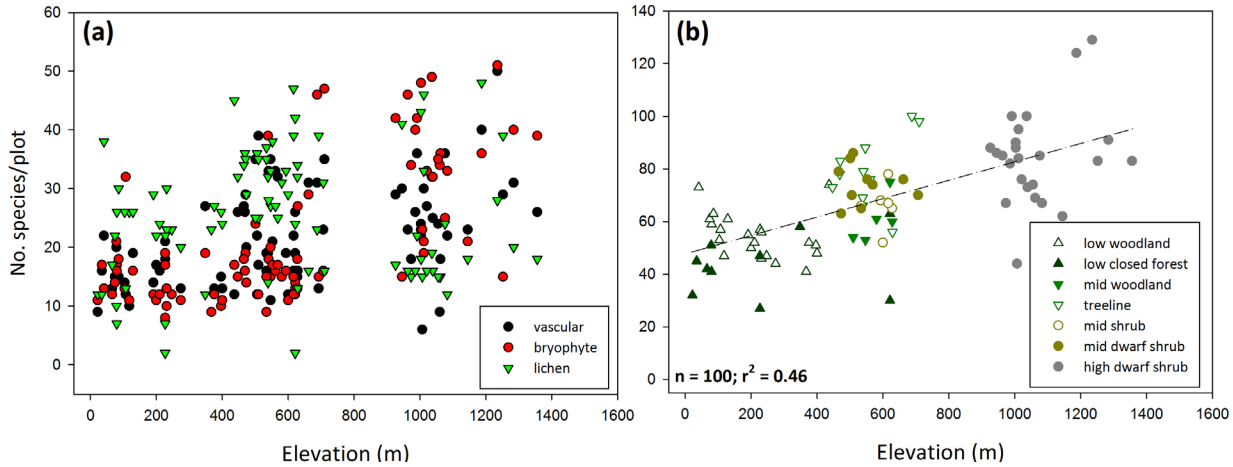

Figure 1. Species richness as a function of elevation and vegetation type in LACL and KATM. Vegetation classes that occur between 700-900 m are a current data gap. (a) Number of species per functional group (vascular, bryophyte, lichen) per plot as estimated from nested frequency plots sampled in 2009-2011. (b) Total number of species (vascular + nonvascular) per plot, grouped by vegetation type. Low woodland and closed forest were sampled at elevations between 0-450 m. Treeline spruce, shrub, and dwarf shrub tundra were sampled between 450-900 m. High elevation dwarf shrub plots were sampled >900 m.

Monitoring Approach

Vegetation composition and structure are being monitored at multiple temporal and spatial scales using a variety of sampling approaches. At the landscape scale, remotely-sensed data are being used to detect broad-scale changes in vegetation and landscape features. Image time series (e.g., historic air photos; IKONOS) developed by cooperators at St. Mary's University of Minnesota are being used to identify changes in major vegetation types associated with disturbance and succession.

At the community scale, plot measurements are being used to characterize stand structure, species composition, and selected environmental variables (e.g., soil temperature). Epiphytic lichens have been sampled at a subset of forested sites using FIA protocols. Epiphytic lichen inventories of the KEFJ plots yielded a number of common forest species (e.g., *Alectoria sarmentosa*, *Cetraria chlorophylla*, *Lobaria oregana*), as well as several atmospherically-sensitive indicators. FIA lichen inventories in Lake Clark (LACL) and Katmai (KATM) have likewise yielded over 400 collections that will be used to qualitatively assess air quality in the parks.

Tree cores collected at approximately one-third of sites are being used to describe forest age structure. Stem disks from dwarf birch collected at a lesser number of sites are being used to estimate shrub age and dates of shrub expansion. These various data sets will be used to develop an integrated analysis of change on the landscape. For example, loss of tundra habitat and/or lichen cover due to shrub encroachment may be documented through a combination of plot measurements, shrub age data, and field and aerial photos. To date, approximately 125 monitoring plots have been established across LACL, KATM, and KEFJ.

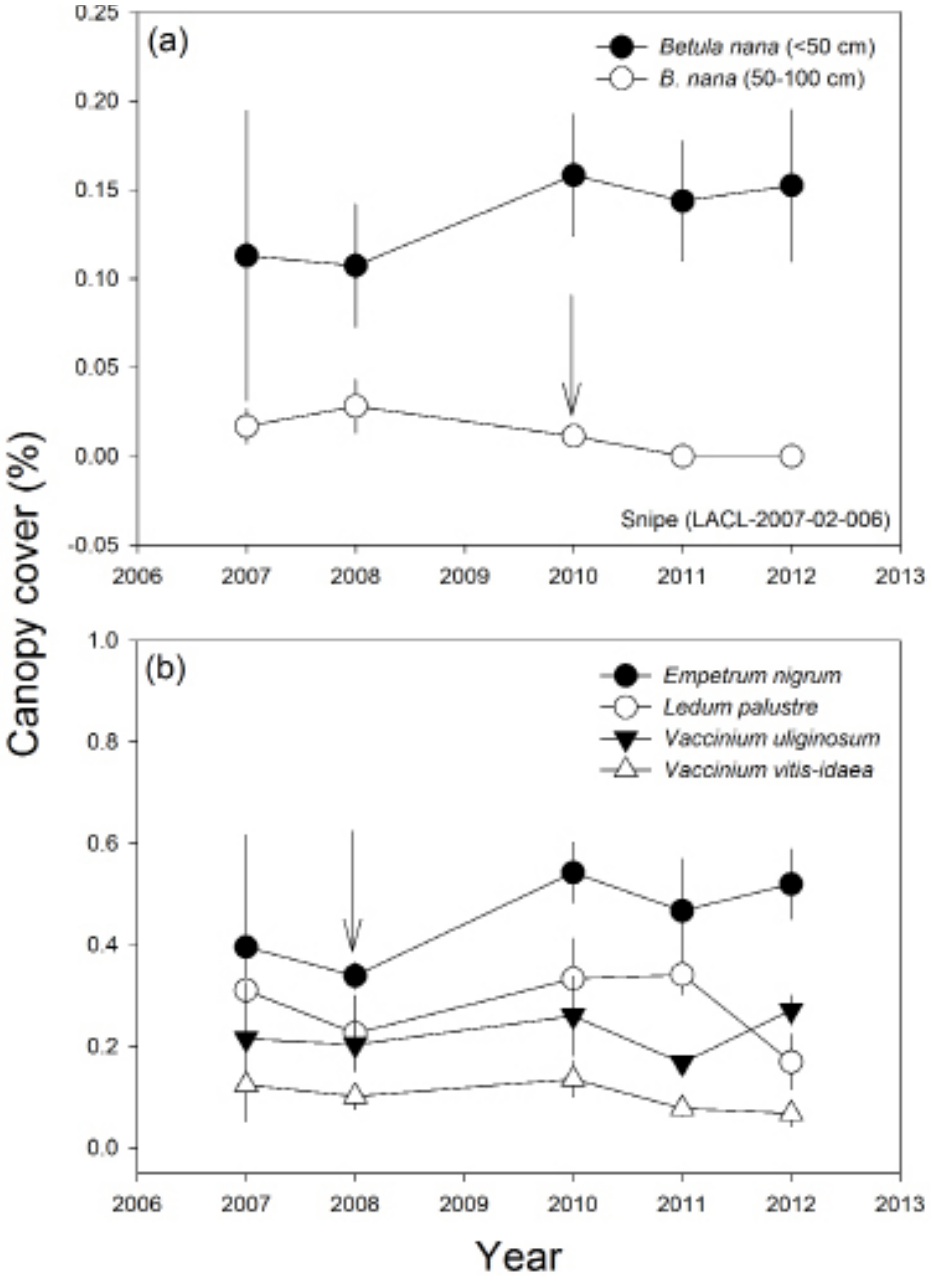

Figure 2 (Left). Inter-annual variation in species cover at a treeline site in LACL. (a) Reduction in dwarf birch *(Betula nana)* **cover in the 50-100 cm height class due to caterpillar defoliation. Arrow indicates the first year of a multi-year autumnal moth outbreak. Sprouting above the root crown has maintained cover in the <50 cm height class. (b) Recovery of crowberry** *(Empetrum nigrum)* **following frost damage in the winter of 2007-2008. Arrow indicates the year in which widespread dieback occurred in crowberry, Labrador tea** *(Ledum palustre)* **and lowbush cranberry** *(Vaccinium vitis-idaea)***.**

A KEFJ biologist measures the diameter of a Sitka spruce in order to estimate standing biomass.

Lichen Inventory

A lichen inventory, initiated in KATM in 2013 with cooperators from Oregon State University, will deliver a set of lichen collections and updated species lists for two parks in the Network. Field work in LACL is scheduled for 2014 with a final report and annotates lists due in 2016.

References

Carlson, M. L., R. Lipkin, C. Roland, and A. E. Miller. 2013. New and important vascular plant collections from south-central and southwestern Alaska. Rhodora 115:61-95.

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