Morgan Voss - 2018 Project Update

Avalanche disturbances are vital events in the natural dynamics of mountain ecosystems, yet have received relatively little research attention, especially in Glacier National Park. Over 50% of high elevation basins in the park are covered by avalanche paths and observation of the unique landscapes highlights the prevalence of avalanche paths within the park. More recently, land managers have begun to incorporate the importance of avalanche paths as grizzly bear habitat and their complex nature in fire patterns and ecology. In addition to grizzly bear habitat, the role of snow avalanches and their influence on hillslopes in alpine and subalpine forests has many implications for carbon sequestration, nutrient flows, woody debris, and fuel in terms of ecologic fire patterns. With past and present changes in climate, these influences are likely to impact land cover and forest stand dominance in alpine and subalpine landscapes. Future changes in climate will also affect the locations and frequency which avalanche paths impact mature forest stands, a significant factor for land managers to consider concerning transportation infrastructure and land cover dynamics. Understanding the characteristics of these avalanche events (such as size and spatial distribution) is crucial for assessing disturbance regimes and their link to social-ecological systems. The locations and frequencies of events in snow avalanche paths in GNP is not entirely known, therefore, quantifying the impacts on vegetation and mapping the location of avalanche paths is crucial for demonstrating their effectiveness as disturbance agents in GNP.

Avalanches leave visible biogeographic paths on the alpine landscape, clearly noticeable on the ground and in various resolutions of imagery. The distinct patch dynamics of avalanche paths are well suited for remote sensing and machine learning algorithms. In this study, mosaics of National Agricultural Imagery Program (NAIP) high resolution imagery acquired in 2013 were used to quantify the avalanche paths within the park using segmentation algorithms. Avalanche paths were found where expected from previous inventories and comprise a substantial percentage of high elevation basins and approximately 5% of the park's entire land cover, as would be expected from the dominant form of mass wasting within the park. Analyzing ecologic and geomorphic characteristics of these paths across the entirety of GNP provides insight on mass wasting and associated geomorphic change within the park as well as providing land managers with new information about vegetation disturbance regimes. A summer field campaign will provide ground truth to validate the algorithm's results in two prominent and frequent avalanche areas.