

PLANT SPECIES COMPOSITION REVEALS TEMPORAL AND SPATIAL DYNAMICS OF SNOW SLIDES IN THE SAN JUAN MOUNTAINS, COLORADO

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ABSTRACT: Snow avalanche events are difficult to study due to the uncertainty of forecasting when and where they will occur, and the inherent dangers of traveling in snow-covered avalanche terrain. Approaches from landscape ecology offer practical methods to characterize avalanche paths based on vegetation diversity and evidence of disturbance. Linear patterns of open vegetation (typically meadow or low shrub) within otherwise forested mountain slopes are evidence of past avalanche activity. We show how landscape patterns of plant diversity can be used to further quantify and map the frequency and magnitude of past snow slide events.

Intact forest vegetation can offer some protection from avalanche hazards in mountain snow systems. Dense trees can shelter slopes from wind effects by slowing the redistribution of snow and formation of dangerous slabs, and potentially act as anchors, preventing the initiation of snow slides. However, many avalanche starting zones are high above treeline in steep alpine terrain. Once a slide is initiated, the mass of moving snow can take out trees, rocks, or anything in its path. Alpine snowbed vegetation, which can occur in high elevation starting zones, is predicted to be sensitive to changes in distribution of snow, environmental stress, and multiple disturbance agents.

A series of snow storms in January of 2005 set records for the San Juan Mountains of southwestern Colorado, with avalanche paths running full track at 30 and 100 year return frequency magnitude. Near Silverton, Colorado, many snow slides closed local roads. Many avalanches cut fresh trimlines, widening their tracks by uprooting, stripping, and breaking mature trees. The powerful avalanches entrained large amounts of snow and deposited massive piles of snow, rocks, and woody debris in their runout zones. Cross-section discs and cores of representative downed trees revealed signals of past snow avalanche disturbance, including characteristic patterns in annual growth rings, impact scars, and reaction wood. Preliminary results of plant diversity and disturbance measurements along the elevation gradient of an avalanche path near Silverton indicate high local plant species diversity, low overlap in species composition and structure among neighboring sites, and new opportunities for seedling establishment.

Keywords: plant species diversity, disturbance ecology, January 2005 storm, snow avalanche path, tree-ring record.

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