Plant species composition reveals temporal and spatial dynamics of snow slides in the San Juan Mountains, Colorado

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Abstract. High magnitude 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 well-known clues of past avalanche activity. We show how landscape patterns of plant diversity can quantify and map the frequency and magnitude of past snow slide events.

Intact forest vegetation has been shown to have a mitigating effect on avalanche hazards in other mountain snow systems. Dense trees can shelter slopes from the effects of wind by slowing the redistribution of snow and formation of dangerous slabs, as well as potentially acting 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 of conservation concern. Alpine vegetation 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 mountains of southwestern Colorado, with avalanche slide paths running full track at 30 and 100 year return frequency magnitude. Near Silverton, Colorado, in the heart of the San Juan Mountains, many snow slides transcended local roads. Many slides cut fresh trimlines, expanding avalanche 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 runout zones. We present results from plant diversity measurements along the elevation gradient of an avalanche path near Silverton in the summer of 2005. The Natural Resource Ecology Laboratory www.nrel.colostate.edu, the Mountain Studies Institute www.mountainstudies.org, and the Center for Snow and Avalanche Studies www.snowstudies.org, offer an interdisciplinary framework to learn from this significant storm event.