

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 dangers of traveling in snow-covered avalanche terrain. Approaches from landscape ecology offer practical methods to characterize avalanche paths based on patterns of plant species composition and evidence of past disturbance. Linear swaths of open vegetation within otherwise forested mountain slopes are evidence of past avalanche activity, and 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 tree line in steep alpine terrain. Once a slide is initiated, the mass of moving snow can mobilize trees, rocks, ice, and structures such as buildings that may be in its path.

A series of snow storms in January of 2005 set records for snow avalanches in the San Juan Mountains of southwestern Colorado, with many avalanche paths running full track at 30 and 100 year return frequency magnitude. Near Silverton, Colorado, many snow slides cut fresh trimlines in the forested margins of existing paths, 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 were used to reveal patterns of past snow avalanche disturbance. Dendro-ecological signals include the relative width of annual growth rings, traumatic resin ducts, reaction wood in response to tilting, and impact scars from the moving snow and associated powder air blast. Preliminary plant species diversity measurements along the elevation gradient of an avalanche path near Silverton indicate high local diversity, low overlap in species composition and structure among neighboring sites, and new opportunities for seedling establishment.