

AN ABSTRACT OF THE DISSERTATION OF

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Channels that were scoured to bedrock by debris flows provided unique opportunities to calculate the rate of sediment and wood accumulation, to make inferences about processes associated with input and transport of sediment, and to gain insight into the temporal succession of channel morphology following disturbance. In an intensive investigation of 13 channels the time since the previous debris flow was estimated using dendrochronology. The volume of wood in the channel was positively and linearly correlated with the time since the previous debris flow. The pattern of sediment accumulation was non-linear and appeared to increase as the storage capacity of the channel increased through time. Wood stored the majority of the sediment in these steep headwater streams, and landslides and wind throw were the dominant mechanisms for delivering wood to the channel. With an adequate supply of wood, small streams have the potential to store large volumes of sediment in the interval between debris flows and can function as one of the dominant storage reservoirs for sediment in mountainous terrain.

In an investigation of 125 headwater streams, the spatial and temporal patterns of debris flow occurrence and deposition were investigated. The temporal distribution of debris flow occurrence varied with network structure and drainage area of the tributary basin. Network structure may affect the frequency of debris flows delivered to the mainstem river valley because it reflects the number of potential landslide source areas and the routing ability of the channel. Tributary basins with larger drainage areas and

more convergent topography had a greater proportion of channels in the younger, post-debris flow age-classes compared to smaller basins with less convergent topography. The flux rate of material delivered to the confluence with the larger river also influenced the development of debris flow fans. Fans at the mouth of tributary basins with smaller drainage areas had a higher likelihood of being eroded in the interval between debris flows, while larger, more persistent fans were present at the mouth of bigger basins. Valley floor width of the mainstem river typically constrained fan development and was also an important predictor of fan size.