RESEARCH ABSTRACT

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Study Title: Sedimentation and geomorphic changes following the 1980-1983 eruptions of Mount St. Helens

Key Words: geology, streams, geomorphology, watersheds, rivers, erosion, Sedimentation, archives

Abstract: Reduced infiltration and burial of surface roughness elements, together with the loss of root strength and reduced evapotranspiration associated with blast-toppled vegetation have dramatically accelerated erosion of blast-affected hill slopes. Other investigators have found that rill erosion rates were initially higher than the yearly average, but then declined sharply so that rill erosion rates during the second year were only 5 percent of the average first year rate. Initial rates of sheet erosion were substantially higher than the average rate for the year, but the rate of decline was not as pronounced as in the case of rill erosion (Swanson, et al., 1983b).

The initial high sheetwash and rill erosion rates profoundly influenced hillslope morphology, and delivered about 6.2×10^4 m^3 of sediment to tributaries of the North Fork Toutle River between June 1980 and May 1981 (Lehre, et al., 1983). The resulting sediment yield has created persistent sedimentation and flooding hazards of unprecedented magnitude for downstream urban areas.

Later comparisons between hillslope erosion rates for the second year following the eruption and the total sediment yield of Mount St. Helens-affected streams during the 1982 water year suggest that most sediment is being eroded from in-channel and near-channel sources, primarily stream bank erosion and streamside debris slides and avalanches. The frequency of occurrence of muddy floods, debris flows, and debris torrents has decreased. However, active gully systems with streamside debris slides and avalanches continue to produce highly sediment laden flows, including occasional debris flows, during intense rains. Post-eruption flooding along some lahar-affected channels has caused more erosion and deposition than the initial lahars.

Analysis of the dominant processes and forms inherent to channel adjustment and evolution has found that total mechanical energy is minimized through time. Channel widening has been the dominant geomorphic process.

Type of Measurement(s): Bed-material particle size and cross-section surveys.

Frequency of Measurement(s): Annually, June 1980 to present.

Data Storage: PC and Data General computer files at USGS, Vancouver, Washington.

Long-term plans: Data available for collaborative efforts: Future plans are to continue monitoring the North Fork Toutle and Toutle River main stem.