RESEARCH ABSTRACT

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Study Title: Effects of hillslope erosion on revegetation and sediment influx to the Toutle River

Key Words: geology streams rivers geomorphology erosion tephra revegetation sedimentation watershed blowdown zone archives

Abstract: The 1980 eruption of Mount St. Helens covered soils with a tephra blanket and killed the forest tree cover in a 550 km^2 area. After the eruption, rates of erosion and plant cover were measured on tephra-covered hill slopes north of the volcano, some of which had been subject to one of three land-management practices. Rill erosion was initially greater than sheetwash, but its importance decreased comparatively quickly. On hill slopes left undisturbed since the eruption, rill erosion and sheetwash underwent a rapid and early decline due to the development of a stable rill network and the exposure and creation of more permeable and less erodible substrates. This decline was independent of plant recovery. Logging of trees downed by the eruption and scarification of the surface in preparation for reforestation slowed erosion, although the effect was small because erosion rates had already slowed substantially by the time these two practices were implemented. An experimental grass seeding program gave rise to a plant cover only after erosion had slowed, and then only in a limited range of environments.

The factors controlling erosion, revegetation, and their timing relative to one another at Mount St. Helens are similar to those following explosive volcanic eruptions elsewhere. This suggests that grass seeding is not likely to be effective at slowing erosion following most eruptions, that early mechanical disturbance could be an effective erosion-control measure, and that the persistence of erosion following a future eruption may best be predicted by measurements made soon after the eruption and at several subsequent occasions in order to project the rate of change with time. Annual erosion at our study sites decreased from 26 mm between May 1980 and May 1981 to 1.8 mm between May 1982 and May 1983. Projecting this rate of decline into the future indicated that only about one-sixth of the tephra on hill slopes will be removed by water erosion before soil creep and other forms of mass wasting again dominate hillslope evolution.

Thirty-one percent of all sediment eroded from hill slopes in our study area was trapped in lakes impounded by the debris avalanche that filled the North Fork Toutle River valley on 18 May 1980. The remaining sediment entered streams of the Toutle River system. Additional sediment reached these streams from

rockslide debris and mudflow material. Net sediment yield to the Main Toutle was 30-37 x 10^6 m^3.

Type of Measurement(s): Erosion stakes; rill and channel cross sections; suspended sediment measurements; sedimentology of fluvial, debris flow, and blast deposits.

Frequency of Measurement(s): Erosion stake measurements were made in 1980-1983. All other measurements were made in 1980-1981.

Data Storage: Data are in field notebooks in Dunne's possession.

Long-term plans: Data available for collaborative efforts: Erosion and sedimentology studies have been suspended. Dunne has no long term plans for continuing this project. He is available for future collaborative efforts.