LITERATURE CITED

Buckhouse, J. C. and G. Gifford. 1976. Water quality implications of cattle grazing on a semiarid watershed in southeastern Utah. Journal of Range Management 29(2):109-113.

Clemm, David. 1977. Survival of bovine enteric bacteria in forest streams and animal wastes. Masters thesis. Central Washington University. 20 p.

Kunkle, S. H. 1970. Sources and transport of bacterial indicators in rural streams. Symposium on interdisciplinary aspects of watershed management. Montana State University, Proceedings, American Society of Civil Engineers. p. 105-133.

INFILTRATION, RUNOFF, AND SEDIMENT YIELD IN RELATION TO MOUNT ST. HELENS ASH DEPOSITION

J. C. Buckhouse

On May 18, 1980, Mount St. Helens shattered a 120 year-dormant interval with an explosive eruption that devastated most of the immediate area in a 160 degree sector north of the mountain, killing people, triggering numerous mudslides and destructive floods, and blanketing much of eastern Washington, northern Idaho, and western Montana with volcanic ash.

A joint investigation involving U.S.D.A.-SEA and Oregon State University was undertaken through the leadership of Forrest Sneva. A number of aspects of ash-related situations were examined. Physical and chemical components of the ash, dietary effects of ash ingested by rumenants, seedling emergence and plant production aspects, and watershed characteristics (sediment production and water infiltration) were evaluated.

The hydrologic portion of this effort was conducted during the late summer months. The ash had been distributed on the crested wheatgrass seeding in three replications of five treatments. The treatments were Moses Lake Ash at 89,000 pounds/acre, Moses Lake Ash at 178,000 pounds/acre, Yakima Ash at 89,000 pounds/acre, Yakima Ash at 178,000 pounds/acre, and an ash-free control.

A Rocky Mountain infiltrometer provided a simulated rainstorm. The equipment consists of a 500-gallon water storage tank, a pump and motor apparatus, which pumps water into a sprinkler and then to a series of three infiltration/runoff plots. The plots are constructed so precipitation and runoff waters can be captured and measured.

Precipitation was applied at a rate of about 4 inches for one-half hour. This intensity of storm was chosen because it simulates the sort of high intensity, low frequency convectional storms to which this area is subjected on a 50- to 75-year return frequency.

RESULTS

Dramatic differences in both infiltration and sediment were evident. Fallout location of the ash was more dramatic than was rate of application.

Yakima ash plots showed consistently higher infiltration rates than the Moses Lake plots (Figure 1). Infiltration on the two Yakima ash treatments were similar to each other, but different from the control and Moses Lake treatments. The Moses Lake infiltration trial showed Moses Lake ash to inhibit infiltration, even though both depths of Moses Lake ash were similar to each other and to the control.

Sediment production rates followed an inverse pattern compared to that of the infiltration process. This is to be expected because as infiltration rates increase, the volume of water entering the soil increases and, therefore, the amount of water running off site as overland flow decreases. With lowered infiltration rates, the reverse is true. Higher overland flows mean higher energy potentials and potentially greater erosion.

The potential sediment rates associated with the Moses Lake ash was an average of 3250 pounds/acre as compared to 676 pounds/acre on the control plots and an average of 128 pounds/acre on the Yakima sites (Figure 2). Although sediment production from the two Moses Lake treatments was similar, they were different from the control and Yakima treatments. The control and Yakima trials were similar to each other, even though the arithmetic mean shows the Yakima plots to be less erosive than the controls.

CONCLUSIONS

Differences in Mount St. Helens ash, dependent upon where it precipitated out, were more important than rates of 89,000 versus 178,000 pounds/acre deposition. The coarser Yakima ash actually served as a hydrologic enhancement over the ash-free soils of the Squaw Butte Experiment Station. The soils covered with Yakima ash had higher infiltration rates and lower potential sediment deposition values than did the ash-free control plots. Conversely, Moses Lake ash, which was finer in texture, lowered the infiltration rates and increased the potential sediment production values noted on the control plots.

Apparently the coarse textured Yakima ash provided a "mulch" which encouraged water movement into the soil and reduced particle detachment, entrainment, and potential sedimentation. The fine-textured Moses Lake ash conversely "clogged" the macro pore space within the soil profile, discouraged infiltration, encouraged surface runoff, and since the ash material was light and unconsolidated, provided a ready medium for erosion, entrainment, and potential sedimentation.

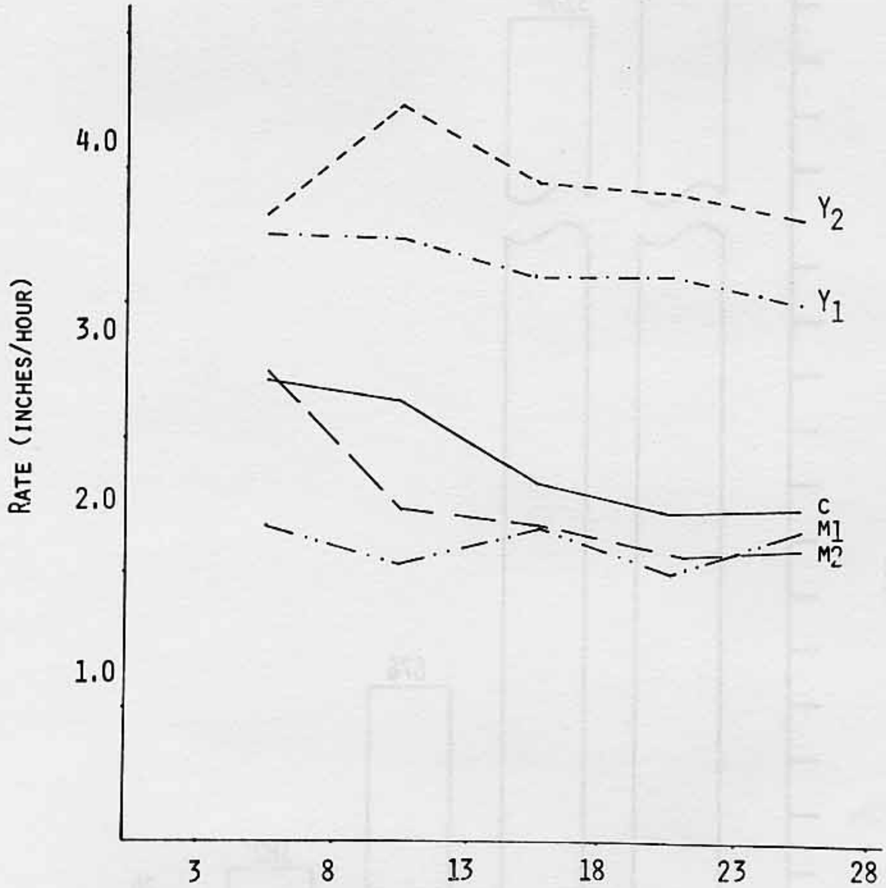

Figure 1. Infiltration rates associated with ash treatments.

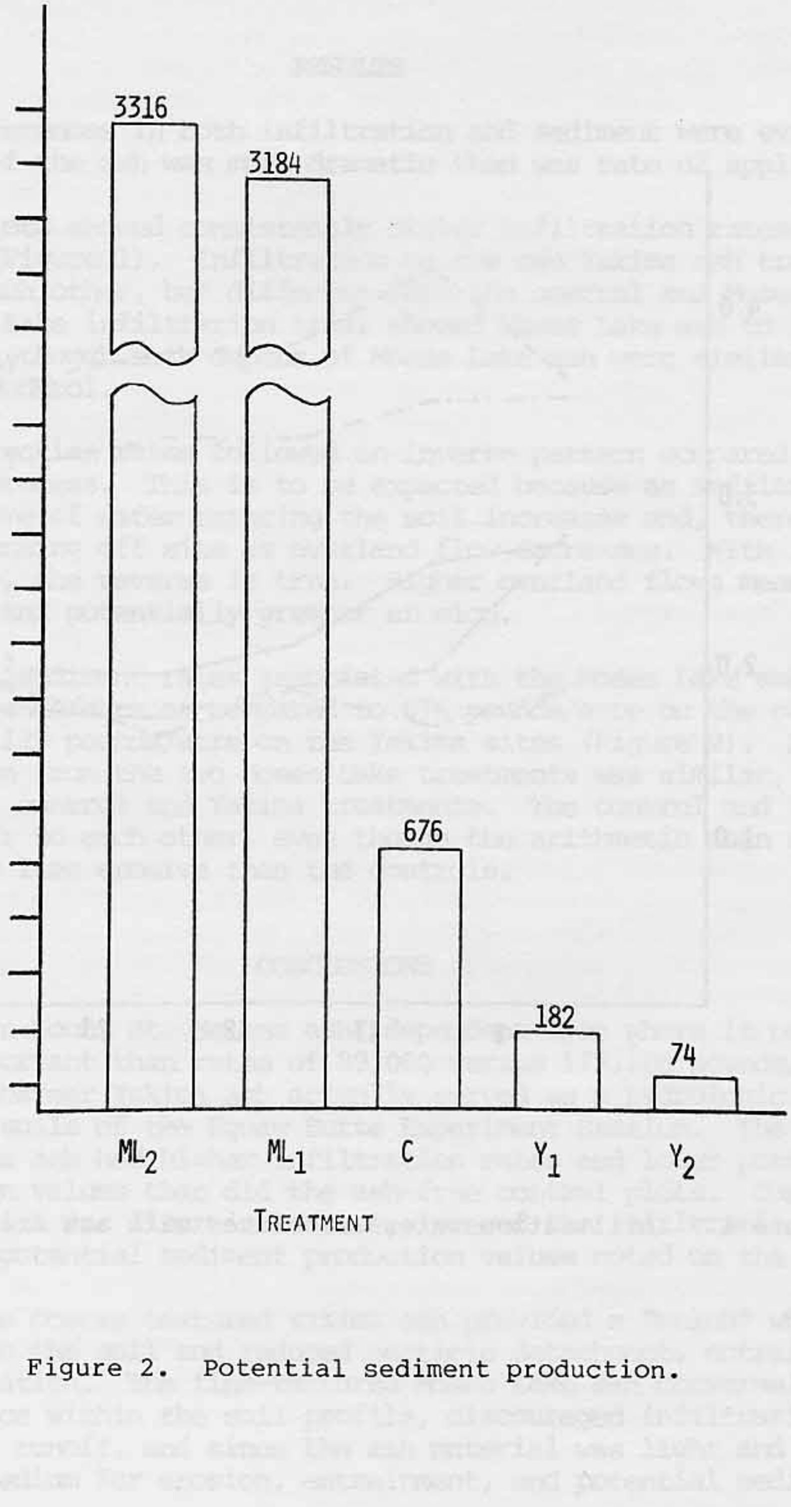

Figure 2. Potential sediment production.