CHANGES IN SOIL MOISTURE AND PORE PRESSURE AFTER HARVESTING A FORESTED HILLSLOPE IN NORTHERN CALIFORNIA

Elizabeth T. Keppeler¹, Robert R. Ziemer¹, and Peter H. Cafferata²

ABSTRACT: In 1987, a 0.83-ha zero-order swale was instrumented with 58 pierometers and 25 tensiometers along several hillslope transects. Through 1993, soil moisture conditions were measured by pressure transducers connected to a digital data logger recording at 15-minute intervals. In August 1989, the 100-year-old second-growth forest in the swale was felled. Logs were removed by cable yarding and heavy logging equipment was excluded from the hillslopes. Increases in peak piezometric levels and soil moisture were observed following logging. In the shallower, unsaturated portion of the soil profile, the increase was short-lived due to the rapid resprouting of redwood stumps. At the soil-bedrock interface, increased pore pressures persisted during winter periods throughout the 4-yr post-harvest period. In addition to changes in evapotranspiration, pore pressure increases may be explained by reduced canopy interception, compaction, or the collapse of soil pipes. At the base of the swale, pipeflow accounted for virtually all of the stormflow. After logging, soil pipes continued to efficiently route surplus stormflows through an existing piping network and no slope instabilities were observed.

KEY TERMS: hillslope hydrology, piezometer, soil moisture, timber harvest, soil piping.

INTRODUCTION

The impacts of timber harvesting on hydrologic processes are of great concern to land managers and the public in the Pacific Northwest. Many scientists have evaluated the effects of logging on streamflow and sedimentation but much less work has been done on subsurface flow processes. Slope stability problems arise on steep slopes where subsurface drainage is inefficient. The resultant mass erosion events are the major source of sedimentation in this region. It is now known that logging roads can alter subsurface flow conditions and aggravate slope stability hazards (Megahan, 1972). It is not clear if timber felling and skyline yarding alone can significantly affect the physical properties that govern hillslope drainage processes. This study addresses this issue by comparing pre- and post-harvest pore pressure levels and soil moisture conditions on a steep hillslope within a zero-order basin in coastal northwestern California.

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