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Changes in Storm Peak Flows After Clearcut Logging

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Streamflow in a rain-dominated, 473-ha watershed bearing second-growth redwood forest was monitored at 13 locations before and after 50% of the watershed was logged, primarily by clearcutting. Three gauged subwatersheds were maintained as unlogged controls throughout the 11-year study period. The analysis included 526 observations of peak flow from 59 storm events. The logarithm of unit area peak flow was statistically modeled as a function of control watershed peak flow, proportion of watershed cut, antecedent wetness, and time since logging. The logarithm of unit area peak flow was found to vary linearly with the proportion cut. The slope of the relation was greatest in relatively dry conditions, but was always positive. Peak flow increases are attributed to loss of evapotranspiration and interception in the treated watersheds. Mean peak flow increases under the wettest conditions and largest storms of the study were less than 20% in watersheds that were partially (30-50%) clearcut. Peak flow increases over 100% were generally limited to smaller storms (less than $0.0025 m^3 s^{-1} ha^{-1}$) in watersheds that were at least 95% cut. At the current rate of recovery, peak flows will return to pretreatment levels about 13 years after cutting. The watershed proportions occupied by roads landings, skid trails, and firelines (up to 8.5% of gauged watersheds) were not found to be useful explanatory variables. Cumulative impacts were investigated by testing terms in the model for watershed area and its interaction with logged area. Neither term was significant, indicating that (1) unit area peak flows were independent of watershed size, and (2) increases in unit area peak flow after logging were independent of watershed size.