

Road Sediment Production and Delivery in the southern Sierra Nevada, California

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Abstract. Unpaved roads are a major source of sediment in many forested watersheds, but there are few data on the production and delivery of road related sediment. The primary goals of this study are to: (1) quantify the sediment production from unpaved road surfaces; (2) determine the key controls on sediment production rates; and (3) quantify the connectivity between the road network and the stream channels.

The study is located in the Kings River Experimental Watersheds (KREW) in the southern Sierra Nevada Mountains in central California. Elevations range from 1485 m to 2420 m. Sediment production was measured with sediment fences from 36 road segments and 9 undisturbed hillslope swales over the 2003-2004 wet season. The road segments are stratified into native surface roads, ditches adjacent to paved roads, graveled roads, and mixed-surface roads. Nine additional sediment fences, located at least 20 m below a road drainage outlet, measure how much sediment is being delivered downslope. Detailed road surveys assess the connectivity between the road system and the stream network.

Data from a nearby weather station indicate that precipitation for the 2003-2004 wet season was 700 mm, or 70% of the long-term mean. Native surface roads had the highest mean sediment production rate at 0.44 kg m^{-2} . The mixed-surface roads produced 0.10 kg m^{-2} , while the gravel roads generated only 0.06 kg m^{-2} . No sediment was produced from the ditches adjacent to the paved roads or the undisturbed hillslopes. Road surface area squared times slope ($A^2 \cdot S$) explained 92% of the variability in sediment production from the native surface roads.

Eleven kilometers of roads were surveyed in segments based on drainage divide. Fifty-four percent of the roads had no sediment plume or a plume that extended less than 20 m. Thirty-three percent of roads had plumes longer than 20 m, but only 13% of roads had sediment plumes that reached to within 10 m of a stream channel. These results show that unpaved roads can be an important sediment source, but much of this sediment is unlikely to reach the stream network.