

Effects of Road Treatments on Sediment Production and Delivery in the Sierra Nevada

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Abstract. Increased sediment loads are a major concern for water quality and aquatic ecosystems, and unpaved roads are often the major sediment source in forested watersheds. Grading and waterbar installation is necessary when unpaved road segments become impassable, and previous studies suggest that grading may increase the supply of fine sediment and thereby increase sediment production. Grading is often associated with waterbar installation, which should reduce road sediment delivery and possibly road sediment production by reducing the drainage area of the road segment. The objectives of this study are to quantify the initial and longer-term effects of these two treatments on: 1) road segment characteristics; 2) road sediment production; and 3) road sediment delivery. The effect of grading and water bar installation on road segment characteristics was assessed by detailed surveys of 10 km of native surface roads prior to and immediately after these treatments in José Basin, located on the Sierra Nevada National Forest in California. The 1.9 km of roads treated in summer 2007 were resurveyed in summer 2008 to assess longer-term changes. Road sediment production is being measured using sediment fences. The sediment plumes draining from each road segment were measured to assess road-stream connectivity. Grading and the installation of waterbars reduced the mean road segment length by 29%. After one wet season there was a 74% increase in the mean segment length and a 153% increase in the standard deviation. The increased mean and variability were due to the failure of five newly-installed waterbars. The development of rills on each of the newly-graded segments may have increased sediment production, as the mean sediment production rate for the 14 ungraded native surface road segments was $1.4 \text{ kg m}^{-2} \text{ yr}^{-1}$ (s.d. = $2.2 \text{ kg m}^{-2} \text{ yr}^{-1}$), while the mean sediment production rate for the three steeper, graded segments was nearly eight times higher. The mean sediment plume length increased 57% in the first year after grading, but there was no significant change in road-stream connectivity. Sediment production and survey data to be collected in summer 2009 will help clarify the short and long-term effects of grading and waterbar installation on road sediment production and delivery.

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