

## Road sediment production and delivery: Effects of road decommissioning

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**Abstract.** Road decommissioning is being increasingly used to reduce road sediment delivery to streams, but few studies have rigorously evaluated its effectiveness. The objectives of this study were to: 1) measure sediment production before and after road decommissioning; and 2) conduct road surveys to quantify road-stream connectivity before and after decommissioning on the Arapaho-Roosevelt National Forest, Colorado. The study area is west of Red Feather Lakes and ranges in elevation from 2600 to 2850 m. Annual precipitation is approximately 410 mm yr<sup>-1</sup> with 36 % falling as snow, while in July and August most of the precipitation falls during short-duration summer thunderstorms. In summer 2013 there was 116 mm of rainfall between 11 June and 7 September, but only five storms had maximum 30-minute intensity ( $I_{30}$ ) greater than 10 mm hr<sup>-1</sup>; the maximum  $I_{30}$  was 24 mm hr<sup>-1</sup>. Sediment fences were installed on 18 road segments to be decommissioned and nine other segments as controls. Total road sediment production varied from 0.0 kg m<sup>-2</sup> to 3.0 kg m<sup>-2</sup> with no significant difference between the segments to be decommissioned and the controls. Segment slope, active area and percent bare soil were poorly correlated with sediment production. Segments on abandoned roads with no traffic had very low sediment production (0.2 kg m<sup>-2</sup>), while segments with low and high traffic had 1.7 kg m<sup>-2</sup> and 1.2 kg m<sup>-2</sup>, respectively. The qualitative traffic variable seemed to be the primary control on road sediment production. Fourteen kilometers of roads to be decommissioned were surveyed, and just 13% of the total length was connected to the stream network. An unusual 206 mm storm from 10-16 September occurred after the roads were ripped but before mulching. The maximum  $I_{30}$  was 16 mm hr<sup>-1</sup> and mean sediment production from 4 decommissioned segments functioning during the storm was 43% of the previous total, but 150% for the controls. Ripping seemed to greatly reduce road sediment production. These results indicate that road sediment production is highly variable and not readily predictable. Monitoring will continue for two more years and rainfall simulations with traffic measurements will be developed to improve our ability to predict road sediment production and to evaluate the effectiveness of road decommissioning.

Key Words: forest roads, road surface erosion, road decommissioning, sediment production.