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Evaluating a post-wildfire mitigation treatment using a flume

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Wildfires can dramatically increase overland flow rates and thereby increase hillslope and channel erosion rates and downstream sediment deposition. Land managers often attempt to mitigate these effects by applying channel treatments, but the effectiveness of post-wildfire channel treatments is uncertain. Further, the effects of these treatments on headwater streams are not well-documented. We modeled an ephemeral post-wildfire channel using a laboratory flume to determine if straw bale check dams reduce the sediment delivery rate or affect channel incision rates. The model was based on field measurements of post-wildfire peak flow rates and sediment concentrations from an instrumented watershed in Colorado. Sediment for the experiment was collected from a nearby post-wildfire debris flood. The resulting flume model had a slope of 8.5%, a width of 0.4 m, and a length of 11.4 m. Five runoff events with flow rates between 0.0108 and 0.0120 m^3 s^{-1}, sediment addition rates between 0.5 and 2.4 kg s^{-1}, and flow durations between 15 and 20 min were conducted in the untreated flume model. The channel was rebuilt with the addition of straw bale check dams before the same five events were repeated. Bed load sediment delivery rates were measured continuously during each runoff event. Channel topography was measured before and after each event using a laser elevation profiler. Initial results indicate that sediment production rates for the 5 untreated events produced 1039 kg of sediment while the treated channel produced 972 kg of sediment. Four of the 5 untreated events produced scour, and the cumulative result was a loss of 0.47 m^3 of sediment from the untreated channel. In contrast, the straw bale check dams stored a total of 0.45 m^3 of sediment. These results will help land managers assess the potential benefits of using straw bale check dams as a post-wildfire channel treatment, and the developed method will help researchers evaluate effects of high sediment concentration flows on stream channels.