Air, Water and Aquatic Environments Science Program

Rocky Mountain Research Station

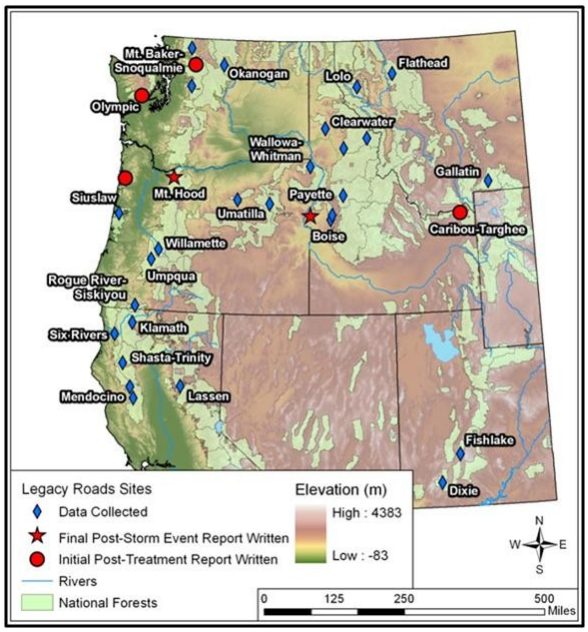
The Legacy Roads Monitoring Project

Research | Technology Transfer | Science Application

Key Findings

- Forest road decommissioning projects reduce hydrologic connectivity and sediment delivery to streams significantly.
- Recontouring of the road prism reduces risk of major storm damage by allowing runoff to drain locally without concentrating and causing gullies and mass wasting.
- Removal of stream crossing pipes and fills eliminates risk of catastrophic crossing failure, but there may still be local in-crossing mass wasting risks.
- Storm damage risk reduction projects can produce moderate reductions in hydrologic connectivity and sediment delivery to streams.
- Adding concentrated drainage above steep slopes can result in increases in gully initiation and shallow landsliding risks.
- Some treatments at stream crossings, such as upsizing culverts and adding dips downhill of the crossing, can reduce risks of crossing failure.

In 2008, Congress created the Legacy Roads and Trails program to fund USFS projects reducing the impacts of roads and trails on water and aquatic resources. The Rocky Mountain Research Station partnered with the Pacific Northwest, Intermountain, Northern and Pacific Southwest Regions of the USFS to assess the effectiveness of road storm damage risk reduction and decommissioning treatments in reducing the runoff and erosion impacts of forest roads on streams.



We assess the effectiveness of treatments for reducing: 1) road-stream hydrologic connectivity; 2) fine sediment production and delivery; 3) mass wasting; and 4) stream crossing failure risk. We carefully inventory roads before and after treatments, focusing on the condition of the road drainage system. We use the GRAIP model to predict improvements in outcomes based on implemented treatments. Ultimately we return to the roads to observe the response of treated vs. untreated roads to large storms. Data collection has been initiated at 46 sites, with post treatment reports written at four sites, and post-storm reports at two.

Decommissioning

Projects that included recontouring of the road prism reduced road-stream hydrologic connectivity between 70% and 97%. Fine sediment delivery to streams was predicted to decline between 81% and 98%. Post storm monitoring found evidence of runoff from the recontoured road surfaces, however they drained locally. This result suggests continuing hazard from non-recontoured roads.

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Decommissioning, cont'd

The removal of stream crossing pipes and the associated fill material eliminated the risk of stream-flow diversion and catastrophic fill failure at all but one survey site. Channel grade adjustments and mass wasting occurred at excavated stream crossing sites where the reconstructed channel width was insufficient, side slopes were too steep or the channel slope was not matched to the natural channel.

Storm Damage Risk Reduction (SDRR)

SDRR included low cost treatments that were applied extensively across the road system. Treatments at two sites increased the frequency of road drainage features, where the new waterbars and culverts allowed for better infiltration downslope and reduced road to stream connectivity between 21% and 38%. These treatments are predicted to reduce sediment delivery at these sites between 58% and 63%. At a third site the existing roads had limited sediment delivery potential and the risk was completely eliminated.

In very steep terrain, adding new road drainage features increased the risk of initiating gullies and landslides. Future projects in mass wasting prone landscapes should weigh the trade-offs between reducing fine sediment delivery to streams and increasing the risk of mass wasting during infrequent storm events. GRAIP allows interactive assessment of the risk of gully and landslide initiation from a given road drainage configuration. SDRR treatments did not fully abate risks at stream crossings. The risks of pipe plugging, flow diversion and fill failure at stream crossings were reduced at one site, eliminated at one site and left unresolved at a third.

Project Science Team

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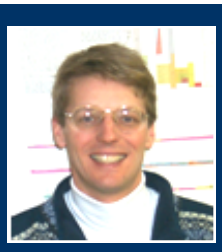

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Detailed monitoring reports are available at our website: http://www.fs.fed.us/GRAIP/index.shtml