

Science

BRIEFING

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SEDIMENT DELIVERY IN A CHANGING CLIMATE

BACKGROUND

The delivery and transport of sediment through mountain rivers affects aquatic habitat and water resource infrastructure. While climate change is widely expected to produce significant changes in hydrology and stream temperature, the effects of climate change on sediment yield have received less attention. In the northern Rocky Mountains, climate change is expected to increase sediment yield primarily through changes in temperature and hydrology that promote vegetation disturbances (i.e., wildfire, insect or pathogen outbreak, drought-related die off).

RESEARCH

Research Activity: RMRS researchers synthesized existing data from central Idaho to explore (1) how sediment yields are likely to respond to climate change in semi-arid basins influenced by wildfire, (2) the potential consequences for aquatic habitat and water resource infrastructure, and (3) prospects for mitigating sediment yields in forest basins.



Road erosion and runoff produces fine sediment, contributing to increased sediment yields.



Sediment produced in mountain basins may be delivered via infrequent massive pulses, such as this post-fire debris flow. These episodic erosional events are impractical for managers to mitigate.

Management Implications: Recent climate-driven increases in the severity and extent of wildfire suggest that basin-scale sediment yields within the next few years to decades could be greater than the long-term average rate of 146 T km⁻² year⁻¹ observed for central Idaho. These elevated sediment yields will likely impact downstream reservoirs, which were designed under conditions of historically lower sediment yield. Road restoration may be the most viable management opportunity for offsetting climate-related increases in sediment yield. However, short-term sediment yields from experimental basins with roads are three orders of magnitude smaller than those from individual fire-related events (on the order of 101 T km⁻² year⁻¹ compared to 104 T km⁻² year⁻¹, respectively, for similar contributing areas), suggesting that road restoration would provide a relatively minor reduction in sediment loads at the basin-scale. Nevertheless, the ecologically damaging effects of fine sediment (material < 6 mm) chronically produced from roads will require continued management efforts.

KEY FINDINGS

- Sediment delivery in the Idaho batholith is dominated by episodic pluses associated with post-fire thunder storms.
- Projected climatic trends, increased frequency of wildfires, and changing hydrology are likely to increase sediment yields.
- Sediment delivery from fire-induced debris flows is greater in magnitude, but lower in frequency compared to the chronic supply from roads.
- Road restoration is expected to provide relatively minor reductions in sediment yield, but may locally benefit aquatic ecosystems by reducing detrimental fine sediment input
- Episodic debris flows are impractical to manage and the dynamic response to such events may help to maintain more diverse and resilient ecosystems.

MORE INFORMATION

- www.fs.usda.gov/treesearch/pubs/40244

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