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Post Wildfire Forest Management: Can We Reduce the Impact of Salvage Logging on Erosion and Stream Sedimentation?

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Wildfires around the world continue to increase in size, severity, and cost. Major concerns after wildfires include the increased runoff and erosion due to loss of the protective forest floor layer, loss of water storage, and creation of water repellent soil conditions. Salvage logging is often a post-fire forest management action to recoup the economic loss of the burned timber, yet concerns arise due to the impacts of this activity on erosion and downstream sedimentation. A decade of research dedicated to impacts of post wildfire salvage logging throughout the Western US has been conducted using rill experiments, paired swales, and remote sensing imagery. Using 2-m resolution WorldView imagery, we are now able to map logging equipment tracks spatially and ground-truth the imagery with field measurements. The Normal Difference Vegetation Index (NDVI) of the 2-m resolution WorldView imagery has allowed us to detect disturbed bare soil from the logging equipment tracks and can differentiate when wood slash was added to the track. Adding wood slash increased ground cover significantly which resulted in an order of magnitude decrease in hillslope erosion with the rill experiment and was confirmed with hillslope plots under natural rainfall as well. Riparian buffers are often managed for timber harvest disturbances to decrease the risk of hillslope erosion entering stream channels during runoff events. However, after wildfires, burned riparian buffers may become less efficient at infiltrating runoff and trapping and reducing soil loss. We investigated the efficiency of burnt over riparian buffers with a sediment-laden runoff experiment to determine how much infiltration occurs and how much sediment is removed by the buffer. Rill travel length significantly decreased through the buffer as vegetation regrowth provided increasing ground cover. In the high burn severity areas, sediment concentrations were 19 g/L immediately after the wildfire and reduced to 7–14 g/L after 10 months due to abundant vegetation recovery. The amount of sediment dropping out of the flow consistently increased over the study period and varied by burn severity. The sediment removal rate in the low burn severity area of 1.2 g/L/m approached the removal rate in the unburned buffer of 1.3 g/L/m after 2 years post-fire. Forest managers may need to increase the widths of burned stream buffers 2x to 8x during post-wildfire salvage logging operations to minimize sediment delivery to streams. Integrating erosion mitigation strategies into salvage logging operations should be commonplace when hillslope erosion and downstream sedimentation is a concern.