Where is instream wood most geomorphically effective? Investigating trends in wood-induced sediment and POM storage at the headwaters of North Saint Vrain Creek, CO

Andrew Pfeiffer and Ellen Wohl
Department of Geosciences, Colorado State University

Abstract. Sediment and particulate organic matter (POM) retained by wood within the bankfull channel were evaluated for 58 stream reaches at the headwaters of North Saint Vrain Creek (NSV), CO. Wood-induced storage in headwater regions is hypothesized to be important in buffering downstream transport of material. However, the magnitude of storage has not been thoroughly investigated in relation to different types (wood volume, channel gradient, channel confinement, and riparian basal area, for example) and scales (jam, reach, and drainage basin) of controls. Multiple and single variable linear regressions informed results. On the jam scale, there was no observed relationship between storage and visually estimated jam porosity and permeability. Whereas the reach-scale volume of stored coarse sediment (gravel, cobble) responds strongly to reach scale wood volume, reach-scale fine sediment (sand and finer) volume responds most strongly to wood piece characteristics (average piece length/average channel width and longitudinal spacing) and localized coarse sediment storage. POM storage was most strongly related to factors outside of the channel (channel confinement and riparian forest basal area). These results were translated into a drainage basin-scale analysis in ArcGIS. Despite comprising 18% of the stream network, third order reaches store 75% of total estimated coarse sediment, 45% of total wood, and 46% of total fine sediment. Large and frequent logjams exert a high cumulative storage effect in a relatively small portion of the watershed. In contrast, 57% of estimated total POM storage occurs in first order streams (50% of network stream length). Low transport capacity in these small streams retains highly mobile POM and nearby riparian forest contributes lateral roots that obstruct POM transport. These results indicate differential effects of wood in different parts of a headwater stream network. From a management perspective, road building and campsite development should avoid impacts to first order streams, as they are important to overall drainage basin POM retention. Third order streams are hotspots of wood, coarse sediment, and fine sediment; promoting or allowing wood recruitment processes in these areas can facilitate high sediment retention and buffering of downstream transport.