Post-Landslide Recovery Patterns in a Coast Redwood Forest

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Large landslides can exert a lasting influence on hillslope and channel form, and channel-adjacent slide deposits may contribute to high in-stream sediment loads long after a slide occurs. Persistent influences such as these need to be understood in order to facilitate watershed management planning to mitigate the generation of cumulative impacts. Long-term records of suspended sediment loads at the Caspar Creek Experimental Watersheds in coastal Mendocino County allow evaluation of the temporal distribution of sediment inputs during and after major landslide-generating storms, in some cases allowing sediment inputs from individual slides to be tracked through time.

During the slide-generating storm of 1995 and those immediately following it, suspended sediment loads associated with the 3600-m$^3$ Z slide accounted for about a third of the total long-term suspended sediment output contributed by the slide. The Z slide generated a debris flow, accounting in part for the downstream extent of slide-related deposits. Sediment loads associated with the slide approached expected pre-slide loads within 10 years of the slide’s occurrence. Analyses for several other Caspar Creek slides occurring between 1995 and 2006 show similar patterns, but also reflect differences in slide volumes, transport mechanisms, storm histories, and land-use activities. Recovery trends may be interrupted by the recurrence of larger peak flows.

After the initial flush of suspended sediment derived directly from the landslide’s mobilization, deviations from expected pre-slide sediment loads originate from erosion of temporarily stored landslide deposits, abrasion and breakdown of coarse landslide debris in transport as bedload, and secondary erosion triggered by the slide (e.g., sheet and rill erosion on the slide surface) or its deposits (e.g., undercutting of colluvial banks and destabilization of in-channel woody-debris). Recovery of slide-related sediment loads occurs as the slide scar and deposits are revegetated and as coarse sediment remobilized from initially unstable deposits is trapped downstream at more stable locations, often associated with woody debris. Such storage elements will provide sources of sediment in the future as the woody debris deteriorates, thus contributing to future “background” sediment loads.

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