Assessing Biological and Physical Controls on Persistent Nutrient Losses in Severely-Burned Watersheds

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Abstract. In many locations throughout the Western U.S., drought, climate change, and uncharacteristically dense forests are contributing to increased fire frequency and severity. Wildfires can influence watershed nutrient retention as they alter biological composition and physical structure in upland landscapes, riparian corridors, and stream channels. While numerous studies have documented substantial short-term increases in stream nutrient concentrations and export (particularly reactive nitrogen, N) following forest fires, the long-term implications for watershed nutrient cycling remain unclear. For example, recent work indicates that nitrate concentrations and export can remain elevated for a decade or more following wildfire, yet the controls on these processes are unknown. In this research, we use nutrient tracer injections and continuous water quality monitoring to compare biological and physical controls on persistent nutrient export across a burn-severity gradient. Results show that although there is substantial stream-groundwater exchange in burned streams, there is little biological nutrient uptake. We suggest that shifts in nutrient loading to the channel along with suppressed in-channel uptake can reduce the capacity of fire-affected streams to transform and retain nutrient inputs. These findings will be useful in assessing changes in downstream water quality and directing upland and riparian restoration.