The Influence of Wildfire Disturbance on River Corridor Hydrobiogeochemical Function

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Project Abstract: *This element of the RCSFA aims to reveal the mechanisms by which wildfires influence biogeochemical cycling in river corridors from reaction to basin scale. Our objective is to improve model predictive capacity in watersheds impacted by fire disturbances, important for ascertaining the influence of fire on ecosystem structure and function*. Wildfires generate a spectrum of physical and chemical alterations to terrestrial vegetation (i.e., char and ash), which alter runoff materials entering inland waters; these altered materials and pathways can change aquatic ecosystem functions. Recent thermodynamic modeling work supports emerging theories that pyrogenic organic matter (PyOM) – a portion of these materials – is more bioavailable than traditionally accepted, supporting growing evidence that it may be an underappreciated driver of river corridor biogeochemistry. Most research on changes in char chemistry focuses on the continuum of combustion temperatures created in the laboratory and does not target shifts in burn severities seen in the landscape. Therefore, we designed and implemented an open-air burn table experiment to investigate how chemistry of vegetation-derived chars and their leachates changes with burn severity metrics. Initial experiment results showed organic phosphorus (P) was increasingly converted to calcium-associated inorganic P forms in chars with higher burn severity, while total percent carbon (C) and nitrogen (N) increased from parent feedstock to low severity burns, then subsequently decreased with increasing burn severity. We found higher severity burns had lower concentrations of dissolved C and N than lower severity burns, and shrubland feedstocks were more soluble than conifer feedstocks. These contrasting changes to organic matter (OM) and inorganic nutrient composition indicate that wildfires in different ecosystems may uniquely impact downstream riverine biogeochemical processes across common wildfire fuel types. Differences in OM chemistry at the landscape scale are also being examined through high resolution storm sampling across 5 western Oregon watersheds in the Holiday Farm Fire burn perimeter. We find that post-fire storms elevated the transport of surface materials to streams within the burn perimeter in which the quality of material delivered was controlled primarily by burn severity within the catchment. Additionally monthly changes in OM chemistry are being investigated in a semi-arid sub-watershed of the Yakima River Basin. We are modeling and monitoring in- and out-of-fire impacted stream reaches in the context of shifting C:N:P dynamics to assess the influence of fires on the relationships between C, N, and P cycling.