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Using polycyclic aromatic hydrocarbons to determine post-wildfire contamination and sediment sources in a large watershed in central British Columbia, Canada

Kristen Kieta[1], Philip Owens[2], and Ellen Petticrew[3]

[1]University of Northern British Columbia, Environmental Science Program, Prince George, Canada (kieta@unbc.ca)
[2]University of Northern British Columbia, Co-chair of Landscape Ecology, Environmental Science Program, Prince George, Canada
[3]University of Northern British Columbia, Co-chair of Landscape Ecology, Geography Program, Prince George, Canada

The Nechako River Basin (NRB) in central British Columbia is a large (52,000 km^2), regulated basin that supports populations of sockeye and chinook salmon and the endangered Nechako white sturgeon. These important species are experiencing population declines and one potential cause of this decline is excess sediment, which can clog their spawning habitat and reduce juvenile success. This excess sediment is likely the product of a combination of factors, the most visible being the significant land cover changes that have occurred in the basin, which includes pressure from forestry and agriculture, the Mountain Pine Beetle epidemic, and large-scale wildfires in 2018. Focusing specifically on the impact of the 2018 wildfires on sediment transport from upland burned areas to adjacent waterways, this research aimed to determine the spatial and temporal contamination of tributaries and the mainstem of the Nechako River with polycyclic aromatic hydrocarbons (PAHs), which are produced during the combustion of organic matter and have been identified as toxic to aquatic organisms and to humans. Additionally, this study intended to determine if burned areas were a more significant contributor of sediment than unburned areas and better understand the utility of PAHs as a potential tracer. Source soil samples were collected in 2018 and 2020 from burned and unburned sites, and suspended sediment samples were collected throughout the ice-free period from 2018-2020 in three tributaries and three mainstem sites. All samples were analysed for PAHs, magnetic susceptibility, colour, and particle size. Results from the fall 2018 source samples show a significant difference in PAH concentrations between unburned and burned soils, and while concentrations of PAHs in source soils in 2020 were lower than in 2018, they were still elevated compared to unburned soils. Sediment samples showed that concentrations of total PAHs are higher in the mainstem sites than in the tributaries, with the greatest concentrations consistently found at the most downstream site on the mainstem of the Nechako River. Concentrations across sites were highest in samples taken during the spring snowmelt period in 2019, have decreased throughout the rest of the sampling period (2019-2020), and are well below sediment quality guidelines for total PAHs. In addition to determining the spatial and temporal extent of PAH contamination, this study also aims to use PAHs along with colour and measurements of magnetic susceptibility to trace sediments associated with the 2018

wildfires. The high cost of PAH analysis limits the number of samples that can be analysed and thus, these additional tracers will allow for the use of models such as MixSIAR that improve with a more robust number of samples. As large-scale megafires continue to burn across the globe, understanding their potential to contribute PAHs to local waterbodies and potentially be used as a tracer is as prescient as ever.