Impact of black carbon on aqueous microbial metabolisms

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Wildfires release significant amounts of black carbon (BC) into the environment. While research shows that these particles accelerate heating in the atmosphere, new evidence suggests they also impact surface water heating, water quality and the behavior of microbes living in those environments. This research focuses on whether black carbon introduced by wildfires changes the way aquatic microbes metabolize various compound classes, specifically comparing burned and unburned watersheds. To investigate this, we used water samples from three streams in the 2024 Davis Fire footprint located south of Reno, Nevada in a sagebrush ecosystem. EcoPlates ™ were used to measure the microbial metabolism of six compound classes (polymers, carbohydrates, carboxylic acids, amino acids, amines, and phenols) over five days with and without the addition of black carbon. A major goal of this project is to see if adding a black carbon standard to these samples consistently affects microbial metabolism across different watersheds that experienced different degrees of burn severity. Preliminary results show a 45 – 81% reduction in overall microbial metabolism across all samples after BC addition. Metabolism of phenolic compounds was nearly 100% inhibited across all samples after BC addition, while inhibition was more stream-dependent and ranged from 16 – 91% for other compound classes. These results will help determine if such BC impacts on microbial metabolism are a universal trend and will provide evidence to inform mechanisms to explain the reduced metabolic activity. Understanding these shifts is important because when microbial metabolism is disrupted, it can change how nutrients cycle through the water, affecting water quality and the ecosystem at large.

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- 2024 Davis Fire south of Reno, NV
  - Samples from three streams - high desert sagebrush ecosystems
  - Varying degrees of watershed burn severity
- Used Ecoplates™ to assess the impact black carbon has on microbial metabolism of six compound classes over 5-day period
  - Polymers, carbohydrates, carboxylic acids, amino acids, amines, phenols
- Preliminary results show significant inhibition of compound metabolism;
  - 45-81% overall inhibition
  - 16-100% - compound class
- Microbes are engines of nutrient cycling – disruptions can lead to significant shifts in water quality and the health of the entire ecosystem.