Post-416 Fire Aquatic Impacts and Recovery

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Mountain Studies Institute
SAN JUAN MOUNTAINS COLORADO

COLORADO SCHOOL OF MINES

Rocky Mountain Research Station

Mountain Studies Institute (MSI, project lead) is a non-advocacy, not-for-profit mountain research and education institution based in southwest Colorado. Scientists from MSI, Colorado School of Mines (CSM) and U.S. Forest Service Rocky Mountain Research Station (RMRS) assist local communities and water users with monitoring efforts following the 416 Fire near Hermosa, Colorado. This collaborative research approach enhances opportunities for partners to leverage funding, utilize sampling and instrument equipment, conduct lab analysis, and share expertise.

July 2019: one year after the 416 Fire

July 2020: two years after the 416 Fire

Background

The flames, smoke, and subsequent debris flows from the 416 Fire (2018) caused both immediate and persistent impacts to livelihoods, landowners, and local economies. A team of scientists from MSI, CSM, and RMRS has monitored burned and unburned locations since June 2018 to investigate post-fire impacts. We monitor locations within, upstream, and downstream of the burn area for comparison of impacted vs. unaffected sites and across burn severity gradients.

Methods

We deployed instruments and sampled surface water and benthic macroinvertebrates (BMIs, aquatic insects) to evaluate physical, biological and chemical changes across a spatial (different locations) and temporal scale (immediate vs. long-term). Results from the water samples illustrate water quality conditions at a specific point in time, while evaluating the habitat and population of aquatic life serve as a longer-term biological indicator of water quality and habitat conditions. Evaluating post-fire impacts across multiple lines of evidence helps the research team and communities understand if post-fire conditions are unprecedented, pose risks to different water users or aquatic life, as well as assess the duration of impacts and track watershed recovery.

What Did We Find?

Post-fire runoff events mobilized sediment and ash from the burn area and substantially impacted aquatic life, water quality, and aquatic habitat. However, conditions have improved incrementally each year since the fire, indicating a recovery trajectory back toward pre-fire conditions.

Chemical Changes: Water Quality

In the first two years following the 416 Fire, surface water metals and nutrients were substantially elevated above pre-fire conditions. Downstream of the fire, aluminum, iron, and lead occurred at levels high enough to be of concern for aquatic life. In 2020, two years after the fire, many water quality parameters remain elevated above pre-fire levels, but have decreased incrementally over time, indicating a recovery trajectory toward pre-fire conditions. The overall risk to aquatic life from metals has decreased each year following the fire, as indicated by the incremental reduction in the Cumulative Criteria Unit (CCU; sum of the ratio of measured exposure to Colorado Department of Public Health and Environment (CDPHE) water quality standards for metals) depicted on Page 2. However, in 2020, aluminum and iron were still regularly exceeding chronic water quality standards protective of aquatic life at Hermosa Creek, Animas River at Trimble Lane, and Animas River at Rotary Park.

Biological Changes: Benthic Macroinvertebrates

Prior to the fire, Hermosa Creek supported a diverse benthic community dominated by mayflies, stoneflies, and caddisflies, which are groups of aquatic insects known to be excellent indicators of high-quality aquatic habitat conditions and good water quality. Following the fire, there was a distinct shift in benthic community composition in Hermosa Creek and Animas River sites immediately downstream of the burn area. In the fall of 2018, immediately after the fire, the benthic community was markedly less diverse and became dominated by sediment-tolerant midges. By 2020, community composition had incrementally shifted back toward pre-fire observations with increased diversity, reduced abundance of midges, and increased relative abundance of caddisflies and mayflies. However, in 2019 and 2020, the benthic community has been dominated by Baetis mayflies and Simulidae blackflies, which due to their high fecundity and ability to complete multiple life cycles per year, are able to readily colonize and become dominant shortly after disturbance events. The dominance of these early colonizers in 2019 and 2020 suggest that benthic communities are in an early successional stage and may continue to transition back toward pre-fire condition in the future.

In addition to a post-fire shift in benthic community composition, we also detected an accumulation of metals in benthic tissue at sites downstream of the burn area. In 2020, two years after the fire, we found that aluminum and iron in benthic tissue downstream of the burn area continued to be elevated above pre-fire levels, but that other metals including cadmium and lead were recovering to pre-fire levels.

Physical Changes: Aquatic Habitat

High quality stream bottom habitat is necessary to support fish spawning and diverse aquatic insect communities. Reaches within the burn area and in immediate downstream proximity to the burn area, exhibited substantial changes in stream bottom habitat following the fire, transitioning to a higher abundance of sand and fines that filled interstitial spaces between substrate particles, eliminating potential habitat for many benthic macroinvertebrate taxa.

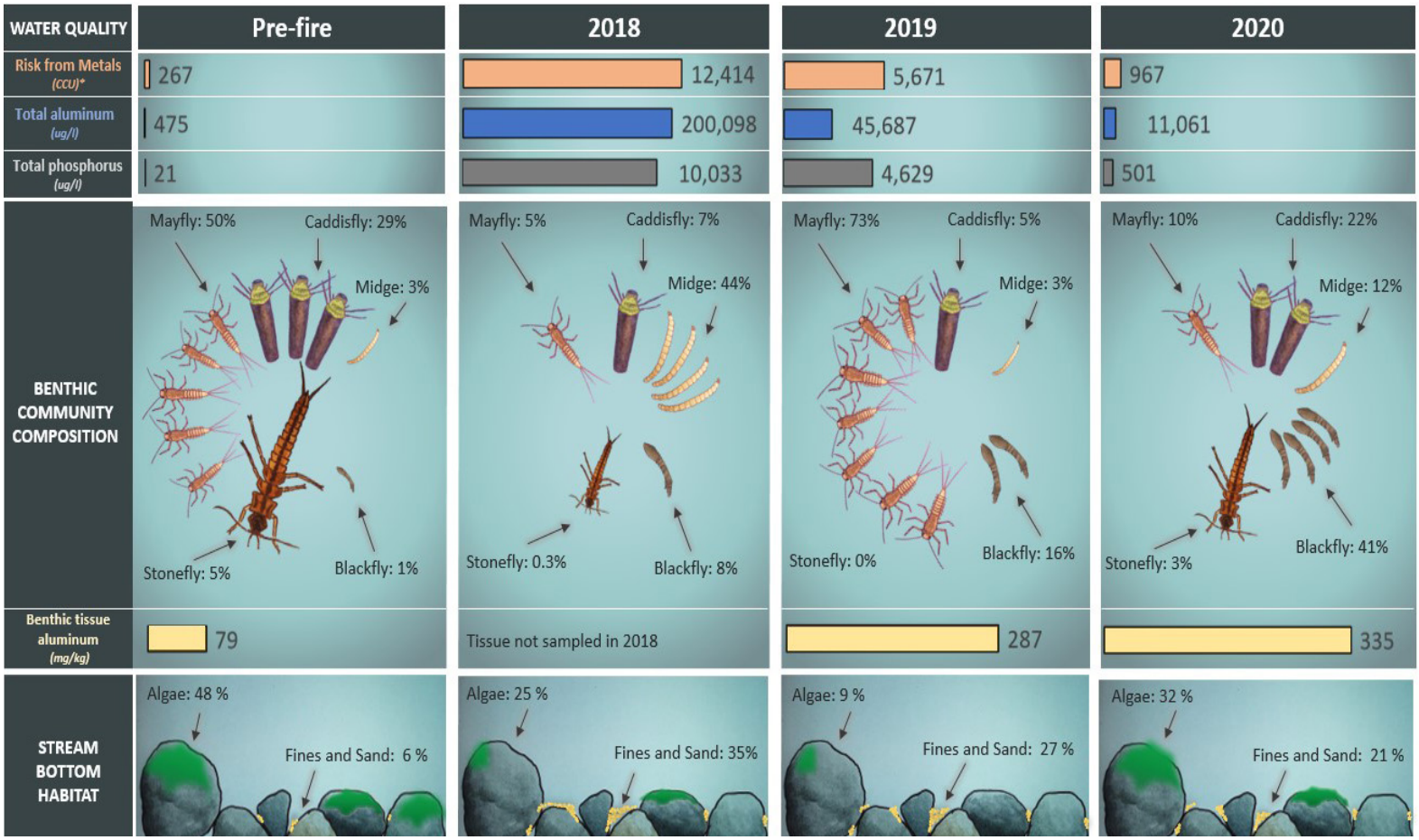

Figure 1. Illustrated average conditions observed at Hermosa Creek and Animas River sites downstream of the burn area from Hermosa through Durango. ***Note: CCU (Cumulative Criteria Unit) represents overall risk to aquatic life from metals and is the sum of the ratio of measured exposure to CDPHE water quality standards for metals.*** **[Art courtesy of Artemis Eyster]**

What's Next?

In 2020, two years following the fire, conditions have improved incrementally, indicating a recovery trajectory toward pre-fire conditions. However, a full recovery has yet to occur, and continued monitoring is necessary to further track recovery and better understand the potential long-term impacts to aquatic ecosystems.

For more information visit www.mountainstudies.org/animasriver