Legacy Effects of Abandoned Insect Ecosystem Engineering Structures on Montana Stream Hydraulics

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Habitat modifications from ecosystem engineering can have profound legacy effects on ecological processes and communities. Our research identifies a hydraulic effect stemming from net-spinning caddisfly (*Hydropsychidae*) retreat structures that are ubiquitous in Montana stream ecosystems and describes the longevity of this effect over ecologically relevant timescales. We used a laboratory experiment to investigate how caddisfly net and retreat structures built in Montana streams influence fluid dynamics at local spatial scales over a two month time period after simulating abandonment by removing the caddisly larvae, leaving the retreat structure intact. We made velocity measurements with accoustic doppler velocimetery around caddisfly silk structures to test how hydropsychid caddisflies influence flow velocity and if any changes to flow velocity are maintained after the structure is abandoned by its caddisfly. We found that caddisfly silk nets reduce flow downstream of the structure by 85% and upstream of the structure by 17%. We also found that caddisfly silk structures without their caddisfly present can persist for over 60 days, suggesting ecologically significant legacy effects of these biotic structures on near bed hydraulics. The legacy of these local changes to hydrology may provide important refugia for less flow-tolerant benthic macroinvertebrate taxa and especially to those with rapid life histories and high turnover rates. Future work could address variation in the magnitude and duration in biotic engineering effects among different silk-producing species, densities of the structures through space or time, and decay rates of the silk structures at different flows that span those observed in Montana streams.