Ecosystem Engineering by Net-Spinning Caddisflies (*Hydropsychidae*) In Rocky Mountain Streams

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Ecosystem engineering is a ubiquitous process by which organisms modify physical habitat characteristics and influence patterns of biological organization. Often, modification of physical environments by ecosystem engineers can facilitate other organisms by creating habitats for species that would otherwise be absent. Despite the potentially wide reaching consequences of facilitation through ecosystem engineering, many facets remain poorly understood in stream ecosystems. Here we present a synthesis of ecosystem engineering by hydropsychid caddisflies and describe how they affect stream macroinvertebrate communities. Hydropsychid caddisflies are a globally distributed group of net-spinning insects that live in stream gravel beds and have high abundances across western Montana. Hydropsychid caddisflies act as ecosystem engineers because their silk structures alter sediment transport conditions and local flow patterns of streambeds. Using lab experiments and field surveys, we show that ecosystem engineering by caddisflies changes physical templates of streambeds and influences other members of the macroinvertebrate community. We found that caddisfly nets increase the shear stress required to initiate gravel movement for gravels up to 70 mm. Additionally, we found that caddisfly silk structures substantially alter local flow at the streambed surface by reducing velocity by 70%. Furthermore, we have found that the presence of net-spinning caddisflies markedly increases local abundances and biomass of other stream macroinvertebrates across environmental gradients. Taken together, these findings indicate that caddisflies impart substantial physical changes to streambed habitats that have ecologically significant consequences for stream macroinvertebrate communities. Our findings indicate that caddisflies influence ecological processes from physical habitats to biological community structure and could act as important controls of Rocky Mountain stream ecosystems.