Stream Mayflies, Stoneflies, and Caddisflies: Do They Care About Controlled Burning in the Forest?

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Despite the widespread use of fire as a management tool in forested landscapes, we know surprisingly little about its effects on streams and their biota. Forest management of this type may affect light, temperature, nutrient, sediment, and hydrologic regimes within stream channels, which in turn may affect the abundance and diversity of aquatic microbes, plants, and animals. In cooperation with the USDA Forest Service / National Forests in Alabama, in 1994 my graduate students and I began a long-term experimental study of the effects of forest thinning and prescribed burning on stream water quality within the Talladega National Forest (Shoal Creek District), Alabama. Streams in six small watersheds have been monitored seasonally; three of the streams are being exposed to understory thinning and infrequent, low-intensity burning (i.e., once every 2 years), and the three remaining streams drain watersheds that have been left intact as reference sites. Study watersheds lie in close proximity to each other and have similar drainage areas, geomorphology, parent geology, and soils. Streams are small (1st-order channels, < 2 m wide), heavily shaded (> 85% riparian cover), and are well oxygenated (> 7 ppm). Particular emphasis has been placed on the response of benthic invertebrates (mostly aquatic insects) to management, although we also have studied physical-chemical water quality attributes and stream periphyton (attached algae).

Our analyses to date revealed no major differences in water chemistry between managed and reference streams, with both groups of streams showing uniform pH (slightly acidic), and low alkalinity, conductivity, total suspended solids, and dissolved nutrients. Periphyton abundance was higher in spring and summer (vs. winter), and also was generally higher in managed streams. All streams showed high benthic macroinvertebrate species richness (> 125 species per stream). Preliminary analysis from spring and summer 1995 samples suggests that habitat-specific richness was higher in reference than in managed streams, especially in spring. However, the two groups of streams showed similar total invertebrate total density, species diversity, EPT richness (i.e., number of mayfly, stonefly, & caddisfly species), and species dominance. Although these data are preliminary, they are compelling in that they suggest thinning and burning and associated environmental changes (e.g., increases in light levels reaching streams, short-term but biologically significant nutrient releases, etc.) may have positive effects on the abundance and species composition of stream periphyton, but only minor effects on stream invertebrate diversity.

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