Insect Emergence from a Minimally Disturbed Headwater Stream in the Southern Appalachian Mountains

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Introduction

Many aquatic insects have fascinating life history strategies where they spend most of their lives maturing in an aquatic environment before emerging from the water as an adult. Many predators such as birds, bats, and lizards have been observed to shift foraging behavior during times of high insect emergence to subsidize their diets (fig.1). This is the primary way that energy and nutrients leave the stream and return to the terrestrial system.

Metal contamination has been observed to have a negative effect on the total number of aquatic insects present in a stream. The makes the stream less productive in terms of feeding the surrounding forest and often results in a less productive riparian food web. Some of these organisms are also known to bioaccumulate metals when they mature in a water source that has been contaminated at a sub-lethal level. These contaminants can then be carried into the terrestrial system by emerging insects.

We collected emerging insects from a minimally disturbed stream located within a nature preserve and from a stream with a history of logging and mining. The organisms collected were used to compare species richness and abundance of emerging insects between the two study sites.

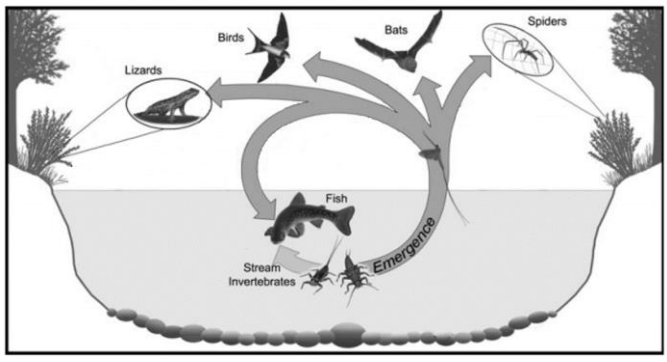

Figure 1. Baxter et al. 2005

Site Selection

Two sites were selected on the Cumberland Plateau of the Appalachian Mountains, both sites are first-order headwater streams located in Letcher county Kentucky. The streams have an eastern aspect, emptying into Line Fork Creek, and are only ~2214 feet from each other.

Big Everidge Hollow (BE), the reference site, is located in an old growth forest within the Lilley Cornett Woods nature preserve. The old growth forest and stream passing through it has been minimally disturbed by humans for 150+ years and is an excellent reference site for much of the southern Appalachian Mountains.

Poll Branch Hollow, the treatment site, was logged ~75 years ago and contour mined ~45 years ago. Metal data was collected 20 years ago and 10 years ago, both times Poll Branch had higher conductivity, sulfate, aluminum, iron, manganese, and selenium than Big Everidge.

Methods

Floating emergence traps (fig 2) were constructed from PVC, mesh netting, pool floats and funnel traps. The traps were pyramid shaped with the funnel at the apex in order to direct flying insects up into collection cups.

All traps were placed within a 100-meter reach near the confluence of these headwater streams with Line Fork Creek. All traps were placed over pools and secured using fishing line.

Five traps were placed at each site and emptied every 2 days for a 10-day period. Organisms collected were stored in alcohol for storage, identified to order, and grouped into morphospecies.

Figure 2.

Results

A 31% decrease in abundance of emerging insects was observed at the Poll Branch site. A 30% decrease in species richness was also observed at the Poll Branch site. Twenty species collected were unique to the Big Everidge site, while only 4 of the species collected were unique to the Poll Branch site.

One species of chironomid midge comprised 30% of the samples from both streams; however, this species was still 30% less abundant at the Poll Branch site.

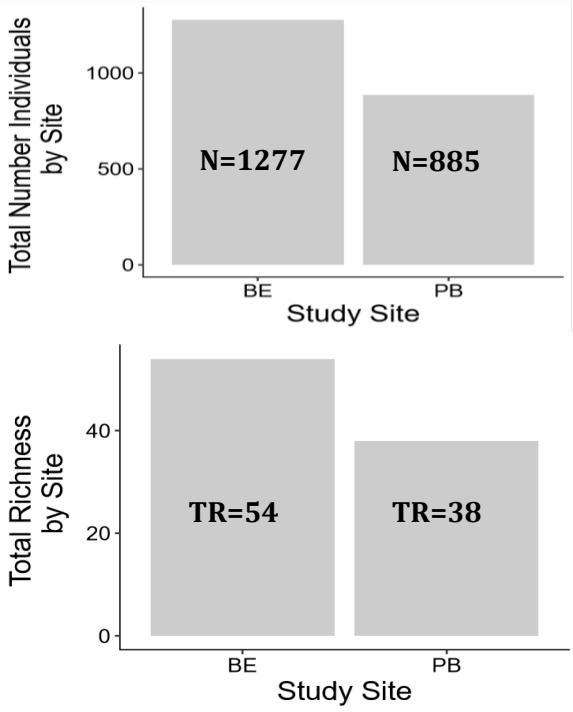

Figure 3. Comparison of total insect emergence and species richness from each site.

Conclusions

Twenty years prior to this study Gregory Pond conducted sampling of aquatic immature insects in the same streams. This study confirms his findings and supports the hypothesis that a stream with a history of mining would be less effective at supporting the insect communities that are vital to stream health. It has also provided a more in depth understanding of how the long-term effects of invasive mining practices may influence emerging insect communities and the ability of the stream to feed the surrounding forest.

This is the first study of its type performed in the Appalachian Mountains and the Big Everidge site may serve as a future reference site for similar studies. The groundwork was laid for a larger future study looking at the sub-lethal effects of contamination in streams that have been affected by mining.

References

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