



Conference Abstract

Impacts of mountain forest dieback on aquatic insect communities: A DNA metabarcoding analysis of samples from the Bavarian Forest

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Abstract

Mountain forests are increasingly affected by changes in rainfall and pest outbreaks, and the way forests are managed can have direct consequences for the streams flowing through forests. Aquatic macroinvertebrate communities are great bioindicators and changes to their ecosystem likely translates to changes in their overall composition and abundance. The Bavarian Forest National Park (SE Germany) is dominated by the Norway spruce (*Picea abies*) which, weakened by storms and other stressors, is susceptible to infestation by the European spruce bark beetle (*Ips typographus*).

The result is large scale forest dieback in some areas, and forest management practices that lead to a predominance of three different forest types (hereafter habitats):

1. Intact forest that is healthy and not impacted by *Ips typographus*;
2. Disturbed forest that was impacted by *Ips typographus*, left to regenerate naturally, and from which deadwood was not removed; and
3. Salvaged forest that was heavily impacted by *Ips typographus* with the same consequences, but from which deadwood was removed, creating a treeless forest meadow.

To analyze the impacts these different forest management strategies have on the aquatic insect communities, 30 samples from 11 different streams were taken using kick-sampling. Operational taxonomic units (OTUs) were identified by bulk metabarcoding of dried, ground samples. A mock community was used to verify the setup and a DNA spike-in with three foreign OTUs was added to each sample to measure the biases introduced by PCR amplification and sequencing. Biases varied across samples, but spike-in OTUs produced a pattern indicating predictable biases which could lead to quantifiable metabarcoding results in the future. In total, 260 macroinvertebrate OTUs were identified.

In comparison, a morphological study by Bojková et al. (2018) in the same region with twice the number of sampling sites collected 194 taxa in the same month as our samples. This underlines the potential for metabarcoding in evaluating species richness. Species richness was high across all habitats. A significant difference between the forest conditions was detected: The number of detected Diptera OTUs was lowest in disturbed habitats (55) and highest in salvaged areas (73). A permutational multivariate analysis of variance (PERMANOVA) indicated that habitat (i.e., intact, disturbed, salvaged) had an effect on the observed OTU distribution (9.2%), but that the stream catchment had a much larger effect (39.3%) regardless of the habitat.

Our findings indicate that forest management can affect stream macroinvertebrate communities, and that this was most pronounced for the Diptera, a group for which DNA metabarcoding is particularly well suited because of their small size and high diversity.

Keywords

Metabarcoding, OTU Distribution, DNA Spike-in, Bavarian Forest, Forest Dieback, Forest Management, Macroinvertebrates, Insects

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