

HEMLOCK CANOPY ARTHROPODS: BIODIVERSITY ON A THREATENED HOST

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ABSTRACT

The hemlock woolly adelgid (*Adelges tsugae*, Annand), a pest of hemlocks introduced from Japan in the first half of the last century, threatens the sustainability of both eastern and Carolina hemlock (*Tsuga canadensis* and *T. caroliniana*, respectively) in eastern North America. Hemlock represents a key ecological component in eastern forests and threats to these trees represent threats to birds, mammals, and fish, and impact forest vegetation composition and species richness. Hemlocks also support a diverse community of spiders, beetles, flies, and other predatory arthropod species which, although numerous, fail to exert control over hemlock woolly adelgid populations. Although past studies have sought to identify native predators that may impact the adelgid, little work has been done to document the entire arthropod community found on hemlocks, or to identify those factors which alter or dictate the composition and structure of hemlock arthropod communities. Here the initial findings of a series of studies designed to describe the A, B, and Γ diversity (using beat sheets and “branch bagging” to construct species accumulation curves, see Colwell et al. 2004) on hemlock, and evaluate the impacts of both the adelgid, and management efforts designed to control the adelgid, on the biodiversity and structure of this community are described. Briefly, these data show that:

- The α diversity estimate is high, with approximately 10 species of arthropods per branch.
- β diversity is also high, with an initial β estimate of nine (new) species/branch. There is very little $\delta\beta$ as represented by the change in slope, indicating that the accumulation curves are far from asymptotic.

- γ is likely high, however, because of the low $\delta\beta$, estimation of this value based on extrapolation methods yields inconsistent values, for example, the bootstrap estimate is 413 species, while the ICE estimate is 847.
- Diversity is high at multiple taxonomic levels, the 16 most abundant morphospecies include nine orders.
- Bagging 67 branches from 22 trees has produced more than 1,300 individual arthropods from approximately 300 morphospecies. Additional collections should move the accumulation figures closer to their asymptotes.
- The distribution of species abundances follows a typical pattern of exponential decrease, with a small number of highly abundant species, and a large number of rare species. Nearly half of the species appear as singletons.

These data clearly show that eastern hemlocks support a high diversity of arthropods. As this ecological resource is removed from forested systems through adelgid induced tree mortality it is likely to take with it a significant portion of the forest biodiversity. Although γ diversity estimates were highly variable (413-847 species), additional collections currently being processed should move the collection curve towards the asymptote, refining both estimates of diversity, and community structure in this threatened system.

Literature Cited

Colwell, R.K.; Chang, X.M.; Chang, J. 2004

Interpolating, extrapolating, and comparing incidence-based species accumulation curves.
Ecology. 85: 2717-2727.