Microarthropod Abundance and Community Structure Across a Boreal Forest Riparian Chronosequence in Interior Alaska

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Introduction: Microarthropods, particularly mites and collembola, are thought to have important influences on nutrient cycling and carbon storage in boreal forest ecosystems. We sampled microarthropods in three replicates of the Alder, Balsam Poplar and White Spruce stages of a riparian forest chronosequence. Using ordination and linear regression, we are trying to relate microarthropod communities to soil indicators of nutrient availability and carbon storage.

Justification: Changes in microarthropod communities and their abundance may affect and reflect alterations in the standing crop and turnover rates of bacteria and fungi. Bacterial and fungal communities interacting with litter quality have direct affects on nutrient cycling in forest soils. Changes in nutrient availability and carbon storage are both drivers and consequences of floodplain successional dynamics in Interior Alaska. Global climate change is likely to influence and may be influenced by the role, abundance, and diversity of microarthropods in boreal forest stands as changing disturbance regimes alter successional pathways. Our study provides novel baseline data of microarthropod abundance and diversity across a forest chronosequence within the Bonanza Creek Experimental Forest. Our baseline data will make it possible to observe range shifts and loss of microarthropod species, and to study the effects of invasive species in soil communities in response to environmental change. Invasive worms, in particular, are likely to dramatically alter interior Alaska boreal forests.

Model: Moore and other’s (2005) diagram shows a shift from bacteria dominant communities in early deciduous succession to later fungi dominant communities in later coniferous successional stages. This forest transition results in increasing carbon storage in soils and decreasing nutrient availability. Research from boreal forests outside Alaska suggests that this results from and in changes in the microarthropod community.


Results: Preliminary results indicate that microarthropod abundance increases with successional time and is likely related to increasing carbon content in forest soils. Taxonomically, I have a lot of work to do but samples analyzed to date suggest that microarthropod communities in the three forest types are very different. Specifically it appears that species diversity is much higher in Balsam Poplar and White Spruce forest stands compared with early successional stands. Early-successional alder stands have low numbers of oribatid mites and collembola. The limited mite community that exists is dominated by mesostigmatid and prostigmatid mites. Many of these mites appear to be predators. In the later successional Balsam Poplar and White Spruce stages, we observe increasing numbers and diversity of oribatid mites and collembolans. We also see increasing numbers of small insects and centipedes. Forest stand type, organic layer carbon content, and possibly organic nitrogen seem to be important factors in our preliminary ordination and linear regression models.

Linear model = oribatid ~ forest + Corig + Norg
Residual standard error: 182.5 on 4 degrees of freedom
Multiple R-squared: 0.9547, Adjusted R-squared: 0.9095
F-statistic: 21.1 on 4 and 4 DF, p-value: 0.005958

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