Arthropod Community Inventory

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Introduction

The examination of lower trophic levels within an ecosystem is vital to understanding the system’s food web structures and dynamics, as lower trophic levels inevitably affect the functions of higher trophic levels (Chen and Wise, 1999). Without reliable information about each trophic level, reliable conclusions regarding the ecosystem’s functions cannot be made (Hairston et al., 1960). The arthropod community plays a key role in the functioning of a hardwood forest ecosystem as it feeds on the microbials that help to break down leaf litter, thus contributing greatly to the decomposition within the forest floor (Admiraal et al. 2012, Tilman 1999, Whitford and Parker 1989). Processes that take place in the forest floor are intricately connected with the energy flow and nutrient cycling within the forest ecosystem (Chen and Wise 1999). Testing if bottom-up processes through resource limitation have an effect on lower trophic level productivity can in turn prove useful in determining an ecosystem’s productivity and health. Because ground dwelling fauna are often nutrient limited, it is possible to hypothesize that invertebrate populations will increase with an increase of available N and P. Taking an inventory of the population and richness of arthropod communities by Order throughout old, middle, and young growth forest can help indicate whether N and P fertilization treatments have an effect on these lower trophic levels.

Additionally, this research involves venturing into a 7th grade classroom with our arthropod samples, both introducing the students to our research and providing an opportunity to take part in a Citizen Science type of experiential learning. According to John Dewey, learning is cultivated through intrigue and curiosity, which can be cultivated through the act of first-hand experience and action within a subject (Dewey, 1910). Studies on Citizen Science projects have shown that a learning environment that fosters higher levels of student involvement with their surrounding environments greatly improves both a student’s attitude towards learning, as well as their performance within the classroom (Jenkins, 2011). By bringing the arthropod samples from our stand into the classroom for the students themselves to sort, we are providing real life context and purpose for the student’s learning. To get a younger generation interested in the sciences, it is imperative that they are exposed to its practical uses, rather than viewing it as an estranged subject of study within a textbook (Dewey, 1910). This incorporation of students within the Bartlett community helps bridge the gap between the world of hard science and the community that surrounds it.

Methods

We collected data by extracting sixteen 15.5cm in diameter circular sections of litter in the buffer zones of each subplot in each of the four plots in all nine stands at the Bartlett Experimental forest, as well as those in the two Hubbard Brook and two Jeffers Brook stands. In order to ensure randomness of the litter selection, we used a meter stick to measure out the distance from the subplot markers that we would collect. Wherever the tip of the meter stick landed was where we collected, this way there was no bias in the litter selection. We then used a sharpened 15.5cm metal cylinder to cut the leaf litter in the chosen location. The cylinder was punched into the ground and twisted in order to both fully cut through the leaves and attempt to trap any arthropods from escaping. Surface litter and the OE layer were then swiftly scooped up within this cylinder and placed into sealed plastic bags. The sixteen samples from each plot were complied into the same bag and labeled. Only twelve samples were collected in the Hubbard Brook and Jeffers Brook mid plots due to their smaller area. Bags were stored in a cooler with ice packs until brought back to the lab later that day and placed in the Tullgren funnels.

 (Not sure yet if we’re including this: In order to compensate for the possibility of fast moving fauna escaping the initial litter collection, 10 pitfall traps will be placed within each buffer zone as well. These will be constructed of the top half of a cut (twelve fluid ounce?) plastic bottle turned upside down in order to simulate a funnel. Caps will be fashioned for these traps so that they may remain in the ground for later use and research. For our use, the fauna within the pitfall traps will have a 48-hour collection period, and we will employ the same storage methods for these invertebrates as with the litter.)

The twenty-five litter samples from each plot were compiled, weighed, and and placed into Tullgren funnels for 72 hours until dried. Extra drying time was necessary for stands C6 and C7. Two to three funnels were used per plot. Funnels were equipped with overhead lights containing 40watt incandescent bulbs. Cups containing 70% isopropanol were placed under the funnels to trap and kill the arthropods. Following the extraction of the arthropods, all litter will be collected from the funnels, dried at 60 degrees C, then weighed individually. Collected specimen will be removed from the alcohol and identified under a dissecting microscope. Specimen from stand 7 will be stored until brought to A. Crosby Kennet Middle School for sorting by 7th grade students.

 Students in the classroom are already familiar with the MELNHE project. Based on their familiarity, they have written a variety of questions that can be answered with this arthropod data set. A basic description and explanation of a forest floor food web within a hardwood forest will also be relayed to the students so that they may better understand the concepts of our project. We will use middle school student appropriate keys to help the students sort the samples by Family and Order.

 Within the classroom samples will be distributed one per student worktable with strict rules not to mix up or confuse samples. Extracted and properly identified bugs will be placed in clearly labeled jars, then brought back to the Bartlett lab for further identification.

Objectives

1. Assess the effects of nutrient additions on the richness and relative abundance of arthropods found in surface leaf litter at each stand when categorized by Order
2. Connect the surrounding community and a younger generation with relevant scientific research

Hypothesis

In regards to the fauna samples, I expect to see larger populations in the treated plots verses the control plots, with populations highest in the N+P plots. With the students I am expecting to observe a higher rate of interest pertaining to the Bartlett experimental forest, as well as a deeper knowledge of the differences between and importance of arthropods in a hardwood forest.

Literature Cited

Chen, B., Wise, D., 1999. Bottom-Up Limitation of Predaceous Arthropods in Detritus-Based Terrestrial Food Web. Ecology, 761-772.

Dewey, J., 1910. How We Think. “Chapter Four: School Conditions and the Training of Thought” D.C. HEATH & CO.

Dewey, J., 1910. How We Think. “Chapter One: What is Thought?” D.C. HEATH & CO.

Hairston, N., Smith, F., Lawrence, S., 1960. Community Structure, Population Control, and Competition. The American Naturalist, 421-425.

Jenkins, L., L., 2011. Using Citizen Science Beyond Teaching Science Content: A Strategy for Making Science Relevant to Students' Lives. Cultural Studies of Science Education, 501-508.

Admiraal, W., Breure, A., Gessner, M., Hunting, E., Kampfreeth, A., Kraak, M.,Mulder, C., 2012. DECOTAB: a multipurpose Standard Substrate to Assess Effects of Litter Quality on Microbial Decomposition and Invertebrate Consumption. Freshwater Science, 1156-1162.

Tilman, D., 1999. The Ecological Consequences of Changes in Biodiversity: A Search For General Principles. Ecology, 1455-1474.

Whitford, W.,G., Parker, L., W., 1989. Contributions of soil fauna to decomposition and mineralisation processes in semiarid and arid ecosystems. Arid Soil Res Rehab, 199–215.