# FERTILIZER AND DROUGHT REDUCTION EFFECTS ON SOIL AND LITTER MACRO-INVERTERBRATE COMMUNITY DYNAMICS

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## Background

- Macro-invertebrates in forest soils are a diverse group of organisms that are key drivers of processes such as decomposition, nutrient cycling, and soil aeration.
- Intensive silvicultural practices such as fertilization may impact soil macro-invertebrate communities, thus potentially altering the rate of litter decomposition and nutrient cycling.
- Reduction in throughfall may impact macro-arthropod community dynamics and affect litter decomposition rates

## Objective and Methods

**Objective:** To survey and compare the diversity and abundance of soil and organic horizon macro-arthropods in response to drought simulation and fertilization in a mid-aged, 11-year-old, loblolly pine (*Pinus taeda*) stand.

**Experimental Design:** Treatment plot: 108'×108' (0.27 ac); Measurement plot: 68'×68' (0.11 ac) (*Fig. 1*); Stand prior to treatment: Age 9, loblolly pine, 330 stems/ac; Fertilization Rate: 200, 25, and 50 lbs per acre of Nitrogen, Phosphorous, and Potassium, respectively.

**Soil and Litter Collection:** Soil was sampled with a soil auger to a depth of 10 cm, 3 samples per plot. Soil was sieved through a 2mm mesh screen and handpicked for macro-arthropods. Organic horizon macro-arthropods were captured in modified Tullgren funnels for five days (*Fig. 2*). Microscopes were utilized to help identify macro-arthropods (*Fig. 3*). The Shannon-Weiner diversity index was used to analyze the data.

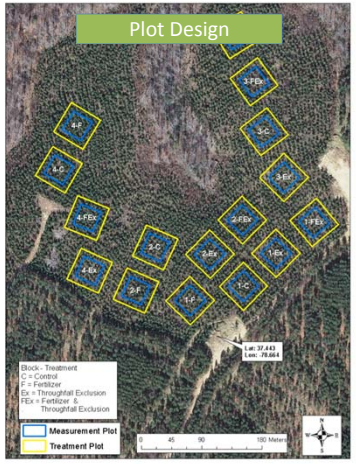


Figure 1: Plot layout in the Appomatox-Buckingham State Forest in Central Virginia.

## Results

- Fertilization, fertilization and throughfall, and throughfall treatments increased Shannon diversity in the organic horizon. (Fig. 3)
- Fertilization, fertilization and thoughfall, and throughfall treatments decreased Shannon diversity in the soil. (Fig. 2)
- The control plot resulted in the highest Shannon diversity in the soil and the lowest Shannon diversity in the O horizon.

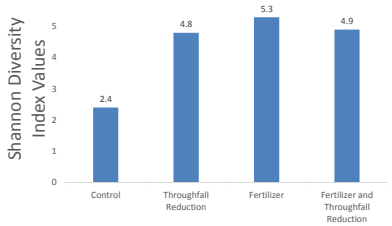


*Figure 4: Shannon diversity of macro-arthropod decomposer communities in the organic horizon in response to a variety of treatment types on the Virginia Piedmont.*

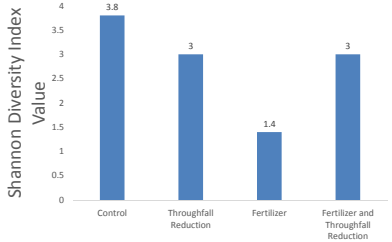


*Figure 5: Shannon diversity of macro-arthropod decomposer communities in the A horizon in response to a variety of treatment types on the Virginia Piedmont.*

Figure 2 (Far left): Modified Tullgren funnels used for litter macro-arthropod extraction.

Figure 3 (Right): Microscope macro-arthropod identification.

## Discussion

- O horizon and soil macro-arthropod communities respond differently to fertilization and throughfall treatments.
- O horizon macro-arthropods respond the most to fertilization and second-most to the combination of fertilizer and drought. The response may be as a result of increased nutrients and nutrient availability in dead, fallen needles.
- Soil Shannon diversity responds negatively to increased fertilization and throughfall reduction, suggesting that the soil creates a habitat only suitable to a specific set of organisms.
- Although O horizon and soil Shannon diversity indices differ, comparisons between them should be disregarded due to different methods of macro-arthropod extraction.

## Summary

- The O horizon and soil vary in treatment responses to macro-arthropod decomposer communities.
- Further work is needed to establish clear relationship between decomposer communities in the O horizon and soil environments and decomposition rates in response to treatments in a mid-aged loblolly pine stand.

## Acknowledgments

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