Green Roof Effect on Arthropod Biodiversity

By Caitlin Race

A green roof is a roof that is partially or completely covered with vegetation and planting medium, set over a waterproofing membrane. Green roof technology has become increasingly popular due to several benefits including, insulation, runoff protection, and aesthetic value. This project was designed to see if a green roof would benefit the environment by encouraging greater biodiversity as well. The question this project seeks to answer is whether a green roof has greater biodiversity than a traditional roof by using the new green roof that has been installed on campus by the Boiler Green Initiative, but due to the difficulty of acquiring roof access the hypothesis had to be modified. Since the current green roof has both planted and paved sections, this project compared the biodiversity of the planted area to the paved area, predicting that the planted areas would have a greater biodiversity.

The green roof was sampled randomly with a D-vac sampler. Two one square foot sections were sampled to create one composite sample for each of the two environments for every sampling date. Samples were frozen for a period of one day before the arthropods were sorted out and then preserved in 70% ethanol. Microscopic specimens were cleared and dyed before being mounted on slides with PVA mounting medium. Specimens were identified using a variety of dichotomous keys, supplemented with expert help.

On the planted area of the green roof, a total of 16 arthropod families and 78 individuals were collected, with a Shannon diversity index of 2.08. In the paved area of the roof, only 4 arthropod families and 8 individuals were collected, with a Shannon diversity of 1.21. A new collembolan record for the state of Indiana, genus Homidia, was found on the green roof as well. Since the data was non-normal and multiple paired zeros occurred on sampling dates when nothing was collected for either the paved or the planted section, a Mann-Whitney rank test was used to calculate a test statistic for the data. Then, a program called R was used to randomize the data 999 times in order to build a null distribution to compare our test statistic to. When a one-tailed comparison of the data and the null distribution was made, a p-value of less than 0.001 was generated.

The p-value shows a very significant difference between the planted and paved sections of the green roof, and that the planted section had a greater biodiversity than the paved sections, as the Shannon diversity index confirms. Diversity on the green roof and the planted sections specifically, is likely greater than a paved section because there is more diverse habitat for arthropods to inhabit. It is also likely that some arthropods present on the roof were brought in with the plants and planting medium rather than immigrating, but since they have already survived one winter they are established and unlikely to vanish and cause the measured biodiversity to shrink. From the results of this experiment, I would say there is a strong possibility that the relationship between the planted and paved areas of the Purdue green roof could be extrapolated to say that green roofs in general would have a higher biodiversity than a traditional type of roofing environment.