Less Mowing, More Growing: Mowing Your Lawn Affects Insect Biodiversity

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ABSTRACT

Insects are vital components to healthy ecosystems. Serving as both food sources and pollinators, the maintenance of their population in the face of disappearing habitats is of large concern. A recent study revealed the detrimental effects of non-native plants on Lepidopteran species (butterflies/moths; Burghardt et al. 2010). Their work showed a difference in diversity that a native habitat could foster compared to a non-native one.

This project investigated the effects of various meadow management strategies on primarily Dipteran (flies) and Coleopteran (beetles) species diversity. We investigated three habitats: a fallow meadow, a cultivated meadow consisting of only native wildflowers, and a mowed lawn (control). Our findings show that the cultivated native wildflower meadow supported the widest variety of Dipteran and Coleopteran taxa, with 18 families of Dipteran and six families of Coleopteran represented. Both meadows supported a wide variety of Hymenoptera taxa, including honey and bumble bees. The mowed lawn supported the least amount of biodiversity, supporting no bee species and dominated by Hemipterans (leafhoppers).

This research shows that mowed lawns are not as effective as cultivated or native meadows at fostering insect diversity. Despite being a longstanding cultural practice, we suggest replacing mowing with planting native wildflowers. Native wildflowers will provide the most effective habitat for supporting the insect diversity.

INTRODUCTION

The practice of maintaining a mowed lawn, once a symbol of wealth and common ground, is still an important aspect of the American home (Pollan 1989). Today, lawns are generally mowed out of habit rather than necessity. Unfortunately, lawn mowing can be detrimental to the health and diversity of insect species.

In 2010, a study by Burghardt and collaborators investigated the effects of native and non-native plants on species diversity and taxa richness of Lepidopteran (butterflies/moths) species, due to their important role in bird food chains. Their research suggested that the gradual replacement of native North American plants with non-native European and Asian species significantly reduced the carrying capacity of the habitat. Further, they showed that non-native plant species generally host three times less diverse communities, as compared to native plants.

The work by Burghardt and collaborators provided the basis for this project. The objectives of this project were to evaluate which habitats (i.e. fallow meadow, cultivated meadow [Fig. 1], and mowed lawn) sustained the highest levels of biodiversity, as well as assess the specific insect composition within each habitat. Our hypothesis was that the cultivated meadow would sustain the highest levels of biodiversity because it provides varied habitat and native plant species.

Fig 1. Collecting insects in the cultivated meadow (Litchfield High School, Litchfield, CT) with a modified butterfly net. These procedures were repeated every Sunday during August 2016.

REFERENCES

Burghardt, K., Tallamy, D., Philips C., and Shropshire K. 2010. Nonnative Plants Reduce Abundance, Richness, and Host Specialization in Lepidopteran Communities. Ecosphere 1:1-22.
Pollan, M. 1989. "Why Mow? The Case Against Lawns." The New York Times Magazine.
Tucker, J. 2014. "Why Bees Are Important to Our Planet." *One Green Planet*. N.p.,

MATERIAL AND METHODS

Collection Instruments

- Modified butterfly net with the end cut off and a string tied around the bottom for easy removal (Fig. 2)
- Jars, labeled with location and date
- Measuring tape
- Ethyl Acetate
- Cotton balls

Fig 2. The modified butterfly net used for collecting the insects.

Study Area and Organism

- The project investigated three 50 ft x 4 ft areas: cultivated, native wildflower meadow (Litchfield High School, Litchfield, CT); adjacent mowed lawn (Litchfield High school, Litchfield, CT); fallow meadow (Litchfield, CT) (Fig. 1)
- This area included plants, such as Speckled Alder (*Alnus icana*), Boneset (*Eupatorium perfoliatum*), Joe Pye Weed (*Eutrochium fistulosum*), Cardinal Flower (*Lobelia cardinalis*), and Seaside Goldenrod (*Solidago sempervirens*)
- The primary organisms studied included the insect orders of Coleoptera (beetles), Diptera (flies), Hymenoptera (bees, wasps, ants), and Hemiptera (leafhoppers)

Data Collection Protocol

- Three jars were labeled with the specific site and the date
- Weather conditions, date, and time were recorded
- Ethyl acetate-soak cotton balls were placed in each jar and capped
- Every Sunday during August 2016, a modified butterfly net was swiped through each location three consecutive times, at varying heights of 5 ft, 3 ft, and ground level in the two meadows and at a consistent ground level height in the mowed lawn (Fig. 1)
- The end of the net was inserted into the jar, the collected insects were shaken into the jar, and then capped

Taxa Analysis

- Collected individuals were categorized to order by comparing their characteristics to unique characteristics of each insect order. They were then grouped into families by visual appearance (Fig. 3).
- Wing size analysis was used to examine the frequency distribution of the size of Dipterans in each meadow. To analyze wing size, insects were sorted by order and habitat, and then observed under a dissecting microscope to measure the wing in millimeters.
- The Simpson's index was used to examine taxa diversity among the three habitats. The formula is:

$$\sum \frac{n_i(n_i - 1)}{N(N-1)}$$

Fig 3. Examining and categorizing insects under dissecting microscopes.

RESULTS

Order	Cultivated Meadow		Fallow Meadow		Mowed Meadow	
	# of Families	# of Individuals	# of Families	# of Individuals	# of Families	# of Individuals
Diptera	18	22	12	13	8	11
Coleoptera	6	41	5	26	3	5
Hymenoptera	8	14	3	13	2	3
Hemiptera	1	2	1	2	4	78
Arachnids	0	0	1	1	1	2
Snails	0	0	1	3	0	0
Thynsanoptera	0	0	0	0	0	0
Dipteran Diversity	0.0108225		0.0384615		0.1272727	
Coleopteran Diversity	0.1487805		0.6492308		0.6666667	

Table 1. Insects and diversity found in each study site in Litchfield, CT. Simpson's index values nearing 0 indicate infinite diversity and values near 1 indicate no diversity.

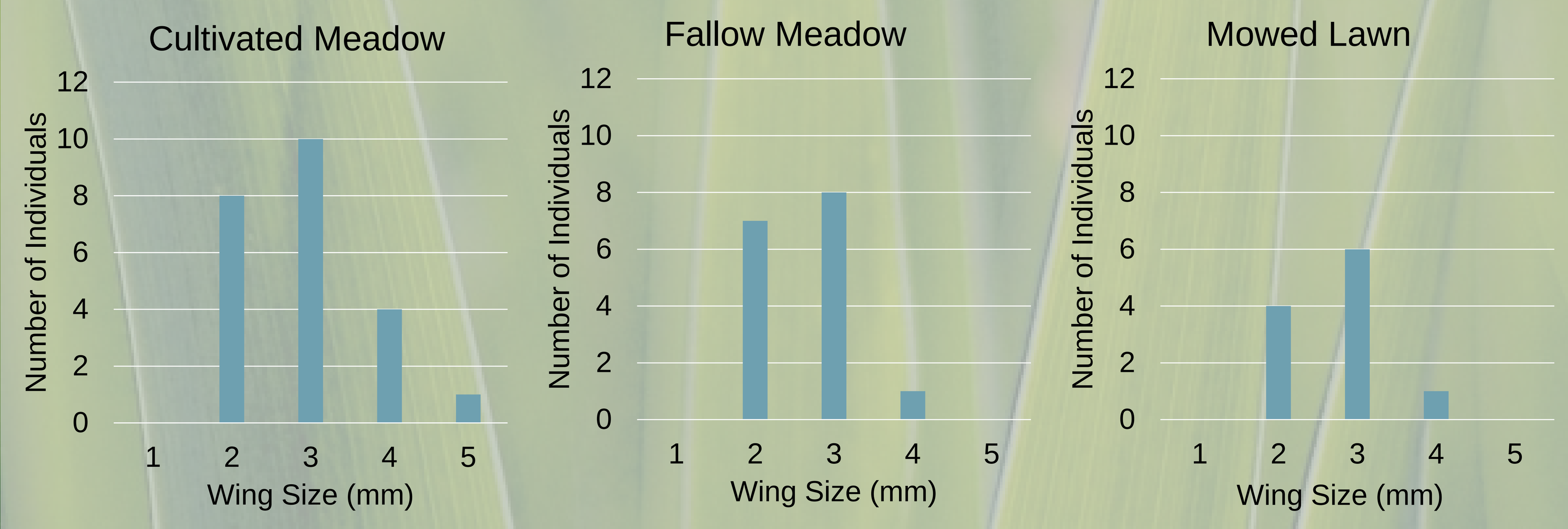

Fig 4. Wing sizes of Dipterans found in each study site in Litchfield, CT.

CONCLUSIONS

Our findings show an important difference in insect diversity among the sites. Fewer individuals, families, and orders (except in the case of Hemiptera) were collected from the mowed lawn (Table 1). The Simpson's Biodiversity Index provided evidence that the Coleoptera and Diptera orders were less diverse in the mowed habitat as well (Table 1). The cultivated meadow exhibited the highest number of families and individuals of the Diptera, Coleoptera, and Hymenoptera orders, along with high diversity of Dipterans and Coleopterans (Table 1).

Hymenoptera are a highly functional, pollinating group, without which no other insects would survive (Tucker 2014). As such, pollinator presence is a key indicator of ecosystem health and sustainability. One potentially confounding factor to this project was the presence of a honeybee hive about 400 feet from the fallow meadow site. Despite this, only honeybees and black bees were collected from the fallow meadow site. In contrast, five honey bee species, two bumble bee species, and seven other small bee species were detected in the cultivated meadow. While the fallow meadow supported more Hymenoptera individuals, the cultivated meadow supported a wider diversity of Hymenopteran species (Table 1). The cultivated meadow also supported the widest range of wing sizes in the Diptera (Fig. 4).

Given our findings, a small area of cultivated, native wildflower meadows can support many times more diversity than a mowed lawn, and equal or greater diversity as a natural, fallow meadow. Capable of providing habitat for insects as well as beautiful flowers, cultivated wildflower meadows have the potential to become an aesthetically-pleasing, life-supporting, component to any backyard.

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