Habitat Influences Arthropod Biodiversity

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Abstract

Biodiversity is an important indicator of environmental health. Insects are very interconnected ecologically, very adaptable, and highly diverse, making them excellent indicators for environmental health. Human interference tends to disrupt ecosystems to make them less diverse (Benton et al. 2003). A greater variety of plants should be expected to support a greater variety of insects, aiding environmental health (e.g., Diniz et al. 2010). We tested the effect of degree of habitat disturbance/plant diversity on insect diversity in 6 habitats over three dates, expecting to see greater insect diversity where there is greater plant diversity. We calculated insect biodiversity using Simpson's Index of Diversity, and found greater insect abundance and diversity in more diverse habitats. Insect diversity is important for habitat health, so as insect diversity declines, other animals in those ecosystems suffer as well, as the food web is disrupted (Kemp and Ellis 2017).

Purpose

The purpose of this research was to evaluate arthropod species diversity and richness across various habitats over time in relation to habitat diversity.

Questions, Hypotheses, and Predictions

Question: What effect does varying habitat type have on arthropod species biodiversity?

Hypotheses:
The most structurally complex and resource-rich habitats will have the greatest diversity of arthropods, regardless of time sampled.

Prediction: The two creek habitats sampled will be the most biodiverse, and the Johnson Cancer Center location and the oat plants would be least biodiverse due to limited plant diversity.

Study System

Six habitats were identified for sampling (Fig. 1).

Methods and Experimental Design

Each habitat was sampled over three different days, and weather conditions were recorded. Sampling consisted of 20 sweeps of the vegetation with a sweep net (Fig. 1B, 40 cm diameter) on each of three dates. Samples were collected into Ziploc bags, returned to the laboratory, and all collected arthropods were classified into morphospecies (Obrist and Duelli 2010), and counted. We used a Simpson's Biodiversity Index (Ecological Sampling, Magurran and McGill 2011) to characterize the biodiversity for each location and date.

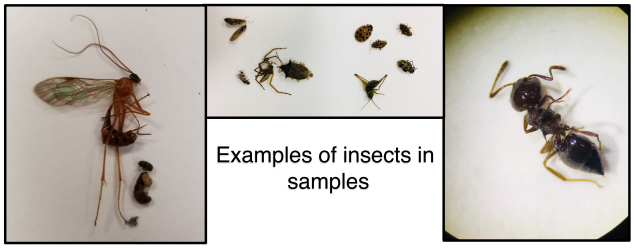
Fig 1. Sampling habitats: A) Johnson Cancer Center; B) Jardine Garden; C) Campus Creek; D) Oat plants; E) Evergeen Plants; F) Big Creek

Results

Table 1. Simpson's Diversity Index values (underlined) and weather conditions for each sampled habitat by date. The parenthetical numbers beneath each index value are the (left) number of morphospecies collected (richness), and (right) the total number of all individuals collected (abundance). Greatest diversity was observed in the two creek locations, supporting our hypothesis.

Date/Weather	Locations sampled		
	Oat plants	Evergreen Plant	Big Creek
13 October 50F, damp, overcast	1.00 (2 spp, 2)	1.00 (2 spp, 2)	0.76 (5 spp, 10)
17 October 62F, overcast, breezy	1.00 (1 sp, 1)	1.00 (4 spp, 4)	0.50 (2 spp, 4)
27 October 74F, sunny	0.87 (7 spp, 11)	1.00 (3 spp, 3)	0.45 (8 spp, 50)

Date/Weather	Locations sampled		
	Jardine Garden	Johnson Cancer Center	Creek
7 October 59F, damp	0.80 (3 spp, 5)	1.00 (2 spp, 2)	0.97 (8 spp, 9)
14 October 33F, windy, snowy	1.00 (4 spp, 4)	1.00 (2 spp, 2)	0.86 (6 spp, 18)
21 October 71F, partly cloudy	1.00 (4 spp, 4)	1.00 (5 spp, 5)	0.90 (25 spp, 42)



Conclusions

Food web stability – as indicated by biodiversity – is critical for the long-term health and sustainability of livestock and wildlife populations. Our work reinforces the importance of greater habitat diversity for insect diversity and food web stability.

Future Directions

We would use other sampling methods (such as pitfall traps) to better sample the habitats (and being less intrusive), and sample at different times of the day and night, and over extended periods of time to more accurately assess the true biodiversity of the habitats. We would expect to see the same pattern of insect diversity relative to habitats, but would better understand the entire food web. It also would be valuable to look at more and different habitats across multiple locations, and to study habitats near livestock and wildlife areas to determine the effects of biodiversity on animal health, and to better manage insect pests.

References

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