Principles of Biology, Fall 2022
Sec 12M Empacts
Dr. Casey Brewster, Instructor

Biodiversity of pollinators on Lady Boneset

The Hollows EMPACTS Project

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PROJECT OVERVIEW

Why is this project important?
-It is important for our group to successfully conduct an experiment and accurately be able to record all data and transcribe that into either proving or disproving our hypothesis.

Why is it relevant?
-It discovers the cause and effect among variables. Researchers can further analyze relationships through testing. It helps researchers understand a specific environment fully. The studies can be replicated so that the researchers can repeat their experiments to test other variables or confirm the results again.

What are pollinators and their relationship to flowering plants?
-In mutualistic relationships between flowers and their pollinators, flowers benefit by having their pollen efficiently distributed to other flowers of the same species, allowing them to reproduce. Pollinators benefit by feeding on the nutritious pollen and nectar that flowers provide.

What is diversity? Who cares?
-Plant diversity refers to the existence of wide variety of plant species in their natural environments.Over many years, some flowers and pollinators have influenced each other's evolution. Today, when flower-pollinator pairs have traits that work very well together, it's a sign this kind of evolution may have happened. The ones who care the most are going to be our pollinators
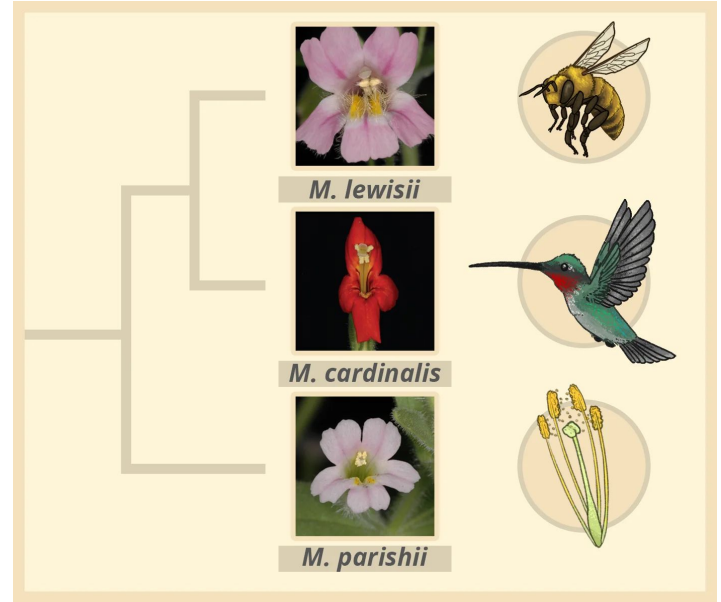
BIODIVERSITY

What is Biodiversity?

- Biodiversity is the variety of life in the world or in a particular habitat or ecosystem.
- Three main categories of biodiversity are species diversity, genetic diversity, and ecological diversity. Species diversity is the number of varied species that are found in a certain ecosystem. Genetic diversity is the traits that are carried throughout a species and Ecological diversity is the largest scale of biodiversity which leads to greater stability for species and ecosystems.

Why is this diversity important?

- What makes biodiversity important is the support and flow that it creates to have a functioning ecosystem. Biodiversity supplies clean air and water, pollination of plants, and many other natural functions that are essential for a healthy ecosystem.

What plant species did we choose to conduct a research experiment on?

To summarize we will be estimating biodiversity by collecting information on different pollinators that come by the Lady Boneset (Eupatorium Serotinum) at the NWACC nature preserve and we'll be conducting the observational procedure to determine the type of biodiversity this plant brings to this environment and why it is important.

Methods

The group will be supervising the species of plant and collecting data from the different pollinators that visit the plant.

We will be using the Seek application on our cell phones to track and detect the diversity of species that are found in this experiment. The seek application is a way to identify insects by taking a picture of it on your cell phone. The application will also help us identify the plant species that we will be collecting our data from.

We expect to use our data to determine the diversity of the pollinators that visit the plant.

Field data/Work Cite

We estimated biodiversity by collecting information on different pollinators that come by the Lady Boneset (Eupatorium Serotinum) in the area where our group conducted the procedure (refer to map). The Lady Boneset is more common in midsummer and fall it makes more sense to find pollinators in this area.
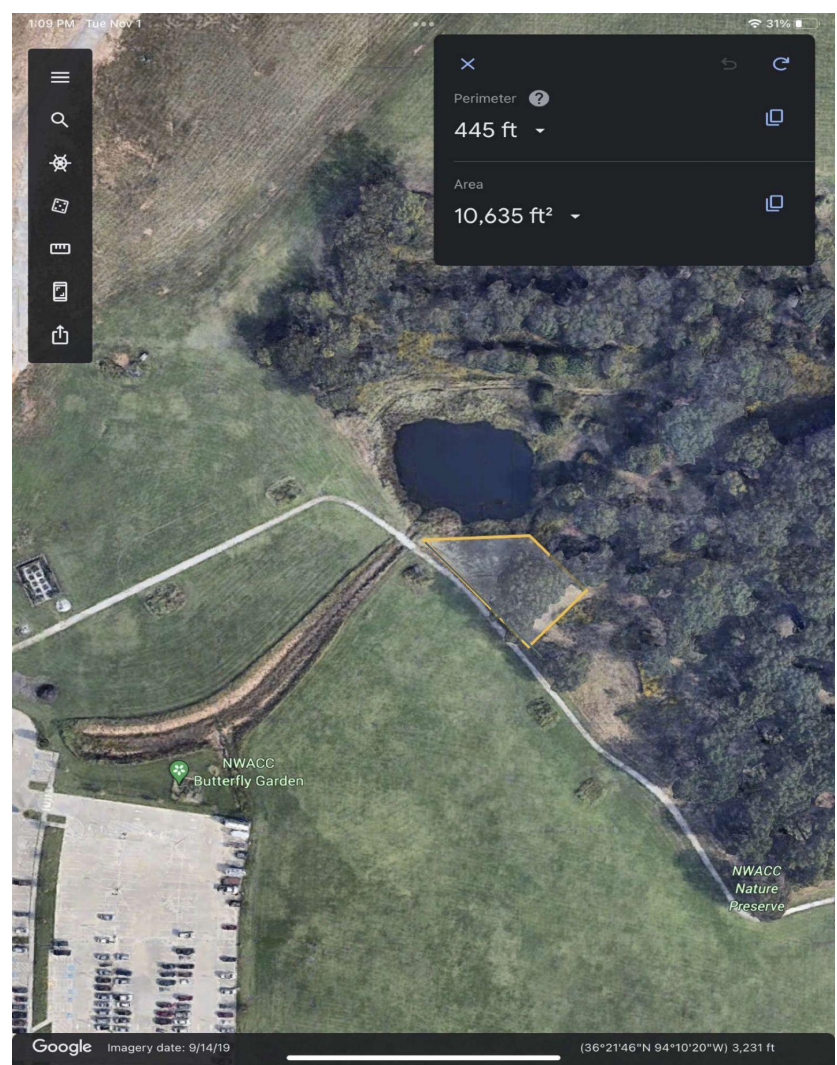
Field Data Collection

Equation For Diversity

The Shannon-Weiner Species Diversity Index is calculated by taking the number of each species, the proportion each species is of the total number of individuals, and sums the proportion times the natural log of the proportion for each species.

The Shannon diversity index (H) is another index that is commonly used to characterize species diversity in a community. Like Simpson's index, Shannon's index accounts for both abundance and evenness of the species present. A large number of species can increase diversity.

Shannon diversity index

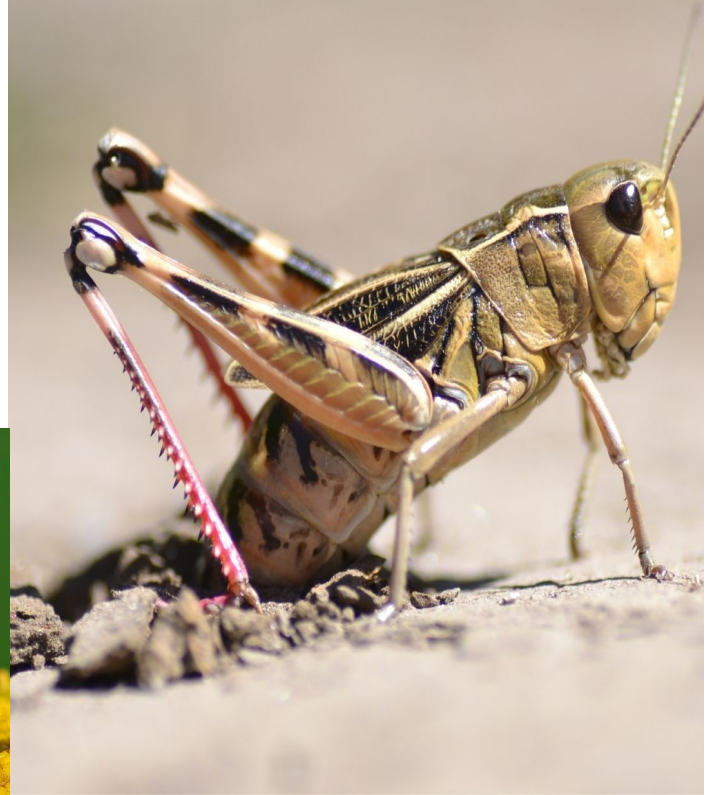- Shannon index is an information statistics. The assumption is that all species are presented in a sample and that they are randomly sampled.

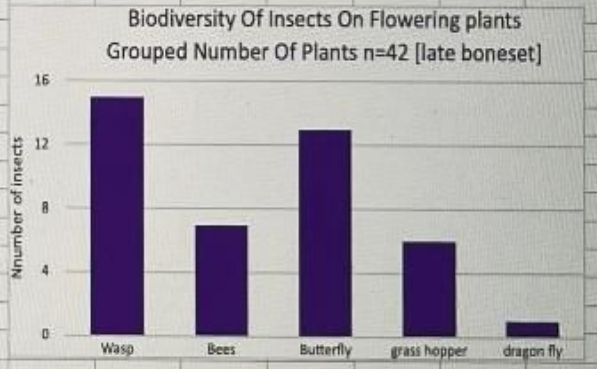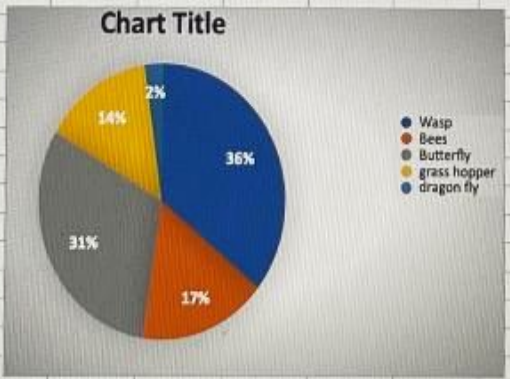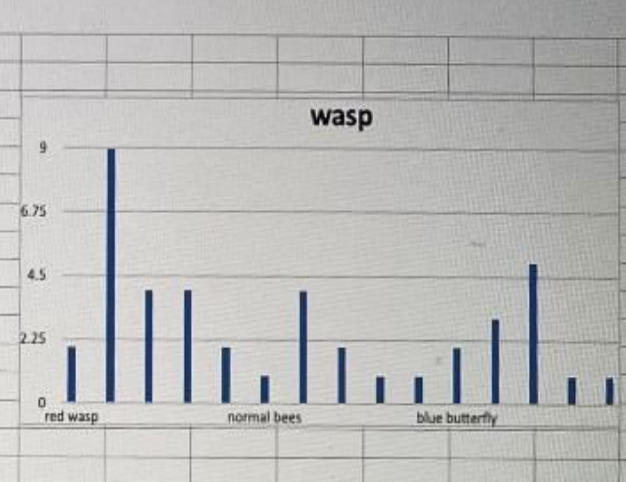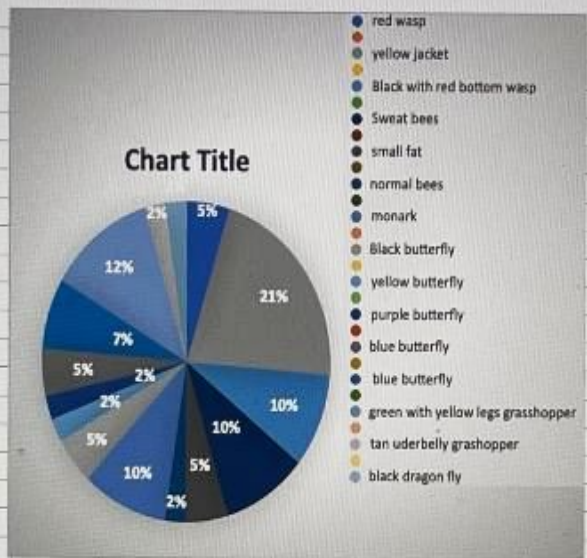$$\text{Shannon Index (H)} = - \sum_{i=1}^{s} p_i \ln p_i$$

- p is the proportion (n/N)
- n is one particular species found in a population N
- ln is a natural logarithm
- Σ is the sum
- s is the number of species

Different types of pollinators

#	Distance (m) or Observation #	Species ID# (A-Z)	Species Common Name	Total	Species ID# (A-Z)	A Total # of observations (# Obs) each species	P Proportion of each species (P) = A/ (ΣA)	H (−LN (P)*P)	J
1	1	A	red wasp	2	A	2	0.0476190476190	0.145	
2	2	B	yellow jacket	9	B	9	0.2142857142857	0.330	
3	3	C	Black with red bottom wasp	4	C	4	0.0952380952380	0.224	
4	4	D	Sweat bees	4	D	4	0.0952380952380	0.224	
5	5	E	small fat	2	E	2	0.0476190476190	0.145	
6	11	F	normal bees	1	F	1	0.0238095238095	0.089	
7	13	G	monark	4	G	4	0.0952380952380	0.224	
8	15		Black butterfly	2	H	2	0.0476190476190	0.145	
9	17		yellow butterfly	1	I	1	0.0238095238095	0.089	
10	19		purple butterfly	1	J	1	0.0238095238095	0.089	
11	21		blue butterfly	2	K	2	0.0476190476190	0.145	
12	23		blue butterfly	3	L	3	0.0714285714285	0.189	
13	25		green with yellow legs grasshopper	5	M	5	0.1190476190476	0.253	
14	27		tan uderbelly grashopper	1	N	1	0.0238095238095	0.089	
15	29		black dragon fly	1	O	1	0.0238095238095	0.089	
16	31				P				
17	33			42	Q	42			
18	35				R				
19	37				S				
20	39				T				
21	41				U				
22	43				V				
23	45				W				
24	47				X				
25	49				Y				
26	51				Z				
					ΣR	(ΣA)	(ΣP) this should = 1	(ΣH)	(ΣH) / ln(S)
					15	42	0.9999999999999	2.469	0.912

animal		common name		scientic name
red wasp	2	Red Paper Wasp		Polistes spp.
yellow jacket	9	Eastern Yellowjacket		Vespula maculifrons
Black with red bot	4	Ichneumon Wasp		Trogus pennator
Sweat bees	4	Sweat Bee		Lasioglossum spp.
small fat	2	Northern Golden Bum		Bombus fervidus
normal bees	1	Common Eastern Bur		Bombus impatiens
monark	4			
Black butterfly	2	Gray-edged Hypena		Hypena madefactalis
yellow butterfly	1			
purple butterfly	1			
blue butterfly	2			
blue butterfly	3			
green with yellow	5			
tan uderbelly gras	1			
black dragon fly	1	Marl Pennant Skimm		(Macrodiplax balteata)
Wasp	15			
Bees	7			
Butterfly	13			
grass hopper	6			
dragon fly	1			

Chart Title

Legend:
- red wasp
- yellow jacket
- Black with red bottom wasp
- Sweat bees
- small fat
- normal bees
- monark
- Black butterfly
- yellow butterfly
- purple butterfly
- blue butterfly
- blue butterfly
- green with yellow legs grasshopper
- tan uderbelly grashopper
- black dragon fly

Pie values: 5%, 2%, 21%, 12%, 7%, 5%, 2%, 2%, 5%, 10%, 2%, 5%, 10%, 10%

wasp

Chart Title

Legend:
- Wasp
- Bees
- Butterfly
- grass hopper
- dragon fly

Pie values: 36%, 17%, 31%, 14%, 2%

Biodiversity Of Insects On Flowering plants
Grouped Number Of Plants n=42 [late boneset]

Nnumber of insects (y-axis): Wasp, Bees, Butterfly, grass hopper, dragon fly

Field Data Results

- But because the Lady Boneset is more common in midsummer and fall it makes more sense to find pollinators in this area. We found that out of all of the pollinators, dragonflies turned out to be the least common with only 1 out of 42 being observed throughout the data collecting process. We had expected to see more honey bees or bumble bees because they are very common pollinators in Northwest Arkansas and this makes our results interesting because we only saw a total of 6 out of 42 bees of different types.
- And we also expected to see more dragonflies because our location was near a body of water. Dragonflies lay their eggs and hunt near bodies of water. We also expected to see mosquitos because of this same reason, but we observed none.
- We saw the most wasps out of any species of pollinators with an observance of 15 out of 42.

What does this information tell us?

- Given our information from the equation, we can tell that our biodiversity gives a healthy ecosystem. We have no invasive species that come into contact with the Lady Boneset. Despite the fact that we saw mostly wasps, it was not enough to make them an invasive species.

Team Members

Brooke Bennett- photographer and creative director

Jonathan Michaels- data collector and diversity charts/graphs

Lauren Gatlin- data analysis and assistant creative director

Victoria Jimenez- data analysis and top editor

Tianna Gooley- data analysis and work cite developer

Mattie Finley- data analysis and assistant editor

Acknowledgements

Dr. Casey Brewster, Instructor

C.D. Phillips, EMPACTS Facilitator

Conclusion