

# DATA *Nugget*

## Do insects prefer local or foreign foods?

Featured scientist: Elizabeth Schultheis from Michigan State University

### Research Background:

Insects that feed on plants, called **herbivores**, can have big effects on how plants grow. Herbivory can change the size and shape of plants, the number of flowers and seeds, and even which plant species can survive in a habitat. A plant with leaves eaten by insect herbivores will likely do worse than a plant that is not eaten.

Plants that naturally grow in an area without human interference are called **native** plants. When a plant is moved by humans to a new area and lives and grows outside of its natural range, it is called an **exotic** plant. Sometimes exotic plants become **invasive**, meaning they grow large and fast, take over habitats, and push out native species. What determines if an exotic species will become invasive? Scientists are very interested in this question. Understanding what makes a species become invasive could help control invasions already underway and prevent new ones in the future.

Because herbivory affects how big and fast a plant can grow, local herbivores may determine if an exotic plant thrives in its new habitat and becomes invasive. Elizabeth, a plant biologist, is fascinated by invasive species and wanted to know why they are able to grow bigger and faster than native and other exotic species. One possibility, she thought, is that invasive species are not recognized by the local insect herbivores as good food sources and thus get less damage from the insects. Escaping herbivory could allow invasive species to grow more and may explain how they become invasive.



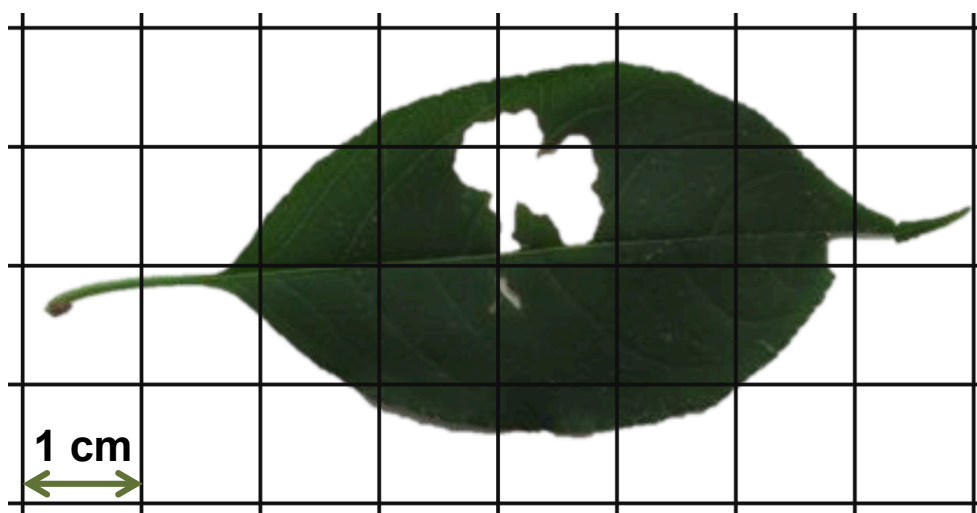
**Figure 1:** Undergraduate researchers Dan and Gabe checking on the 610 plants in the experiment. The experiment ran for three years, from 2011 to 2013.



**Figure 2:** Every year, Elizabeth measured the proportion of leaf area removed by herbivores on each of the experimental plants.

To test this hypothesis, Elizabeth planted 25 native, 25 exotic, and 11 invasive species in a field in Michigan. This field was already full of many plants and had many insect herbivores. The experimental plants grew from 2011 to 2013. Each year, Elizabeth measured herbivory on 10 individuals of each of the 61 species, for a total of 610 plants. To measure herbivory, she looked at the leaves on each plant and determined how much of each leaf was eaten by herbivores. She then compared the area that was eaten to the total area of the leaf and calculated the proportion leaf area eaten by herbivores. Elizabeth predicted that invasive species would have a lower proportion of leaf area eaten compared to native and noninvasive exotic plants.

Let's look at one leaf to see how Elizabeth collected herbivory data. Here is an example of a leaf from an invasive plant:



Observe the shape of the leaf. Does it appear some of the leaf area is missing and has been eaten by herbivores? Estimate how many grid cells the leaf covers and how many grid cells are missing from the leaf. Each grid cell represents 1 square centimeter (cm).

Area of leaf eaten by herbivores = \_\_\_\_\_

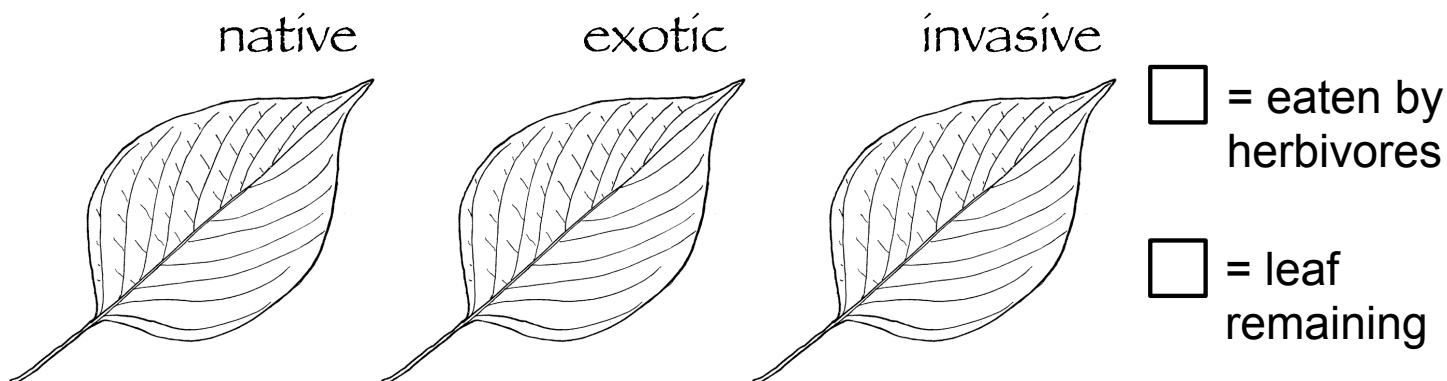
Total area of leaf = \_\_\_\_\_

Proportion leaf area eaten by herbivores = area of leaf eaten / total area of leaf = \_\_\_\_\_

**Scientific Question:** How does insect herbivore damage compare for native, exotic, and invasive plant species?

**What is the hypothesis?** Find the hypothesis in the Research Background and underline it. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.

**Draw Your Predictions:** On the three leaves below, draw your predictions for the amount of herbivory on the three plant types. Use one color to fill in areas that the herbivores have eaten. Use another color to fill in the rest of the leaf. Remember to fill in the legend to show which colors you used.



**Scientific Data:**

Use the data below to answer the scientific question:

Average Proportion Leaf Area Eaten by Herbivores

Plant Type	Year of Data Collection		
	2011	2012	2013
<b>native</b>	0.046	0.037	0.046
<b>exotic</b>	0.075	0.063	0.057
<b>invasive</b>	0.168	0.087	0.078

What data will you graph to answer the question?

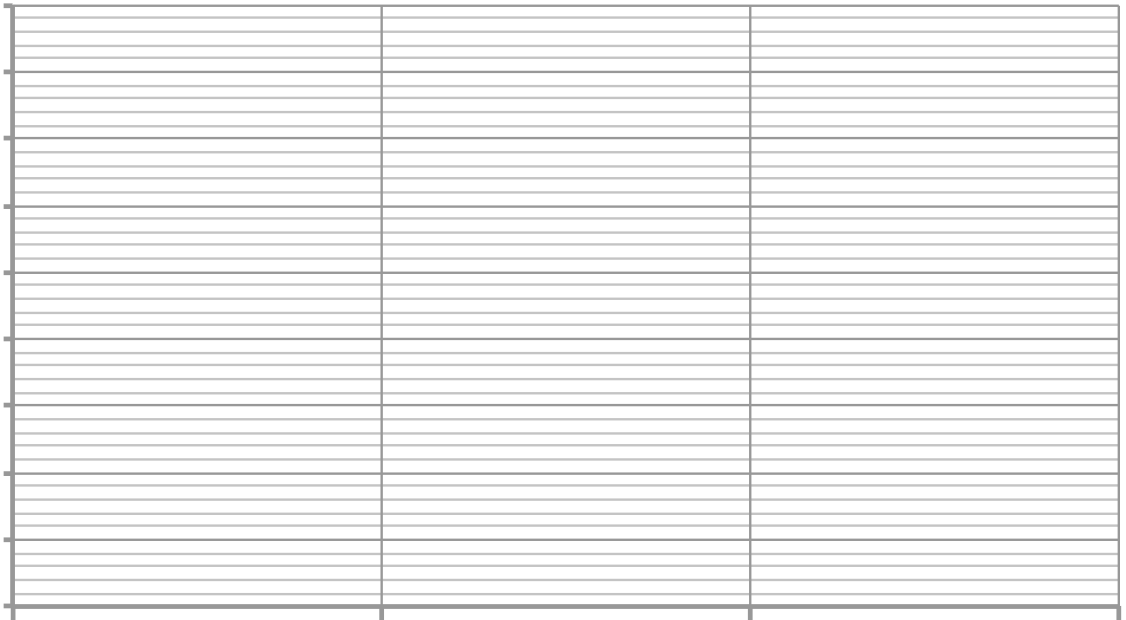
Independent variables: \_\_\_\_\_

\_\_\_\_\_

Dependent variable: \_\_\_\_\_

Name \_\_\_\_\_

Draw your graph below: Identify any changes, trends, or differences you see in your graph. Draw arrows pointing out what you see, and write one sentence describing what you see next to each arrow.



Interpret the data:

Make a claim that answers the scientific question.

What evidence was used to write your claim? Reference specific parts of the table or graph.

Name\_\_\_\_\_

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about the effects of herbivory on plant performance.

Did the data support Elizabeth's hypothesis? Use evidence to explain why or why not. If you feel the data were inconclusive, explain why.

*Your next steps as a scientist:* Science is an ongoing process. What new question(s) should be investigated to build on Elizabeth's research? What future data should be collected to answer your question(s)?