Name_____

DATA Nugget

Does a partner in crime make it easier to invade?

Featured scientists: Yi Liu and Tomomi Suwa from Michigan State University

Research Background:

A **mutualism** is a relationship between individuals of two different species in which both partners benefit. One example exists between a type of plant, **legumes**, and a type of bacteria, **rhizobia**. Rhizobia live inside bumps on the roots of legumes, called **nodules**. There, they convert nitrogen from the air into a form that can be used by plants; in return, plants provide the rhizobia with food and protection in the root nodule.

Mutualisms can affect what happens when a plant is moved to a location where that species hasn't been before. **Invasive plants** have been transported by humans from one location to another and grow and spread quickly in their new location. For invasive legumes with rhizobia mutualists, there is a chance that the rhizobia will not be moved with it and the plant will have to form new relationships in the new location. These new partners might work well together or might not. Scientists predict that in their new ranges, invasive legumes will grow poorly at first, and then better and better over time. Over generations, invasive plants and their new rhizobia partners may coevolve to become more efficient mutualism partners.

Yi and Tomomi are scientists who tested this hypothesis using one invasive plant species, hairy vetch. They took soil samples from three different spots based on the invasion history: vetch had never been there (no invasion, 0 years), vetch arrived recently (new invasion, less than 3 years), and vetch invaded a long time ago (old invasion, more than 10 years). These soils had rhizobia in them, each with different histories with hairy vetch. Yi and Tomomi took these soils

The invasive legume, hairy vetch (*Vicia villosa*), growing in the field.

into the greenhouse, divided them into pots, and grew several hairy vetch plants in each soil type. When the plants had grown for some time in the soils, Yi and Tomomi dug them up and measured two things. First, they counted number of nodules on the roots of each plant, which is a way to see how well the mutualism between rhizobia and plants is going. Second, they dried and weighed the plants to measure biomass, which shows how much the plants were growing.

Scientific Questions: (1) Is hairy vetch forming new relationships with rhizobia mutualists in its invasive range? (2) In what ways does this relationship change over time?

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.

Scientific Data:

Use the data below to answer the scientific questions:

	History of invasion		
	no invasion	new invasion	old invasion
Average number of nodules per plant	15.9	89.3	70.0
Average plant biomass (g)	72.6	188.9	139.4

What data will you graph to answer the questions?

Independent variable(s): _____

_____

Dependent variable(s): _____

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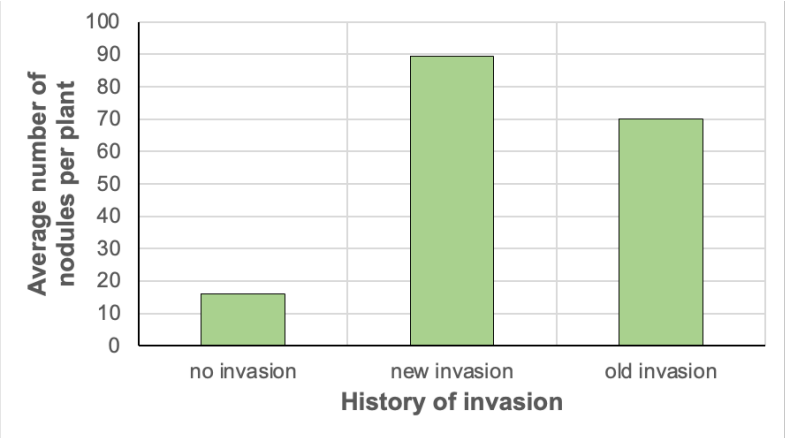
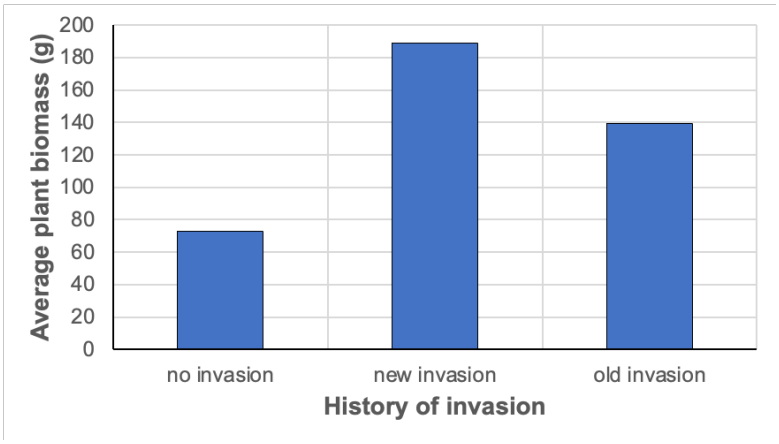
Name_____

Below are graphs of the data: Identify any changes, trends, or differences you see in your graph(s). 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 each of the scientific questions: (1) Is hairy vetch forming new relationships with rhizobia mutualists in its invasive range? (2) In what ways does this relationship change over time?

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What evidence was used to write your claims? Reference specific parts of the table or graph(s).

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about how mutualisms may impact an invasive plant's ability to invade a new area.

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Did the data support Yi and Tomomi's hypothesis? Use evidence to explain why or why not. If you feel the data are inconclusive, explain why.

Your next steps as a scientist: Science is an ongoing process. What new question(s) should be investigated to build on Yi and Tomomi's research? How do your questions build on the research that has already been done?