Name_____

DATA Nugget

Invasion meltdown

Featured scientists: Katie McKinley, Mark Hammond, & Jen Lau from Michigan State University

Research Background:

Humans are changing the earth in many ways. First, by burning fossil fuels and adding greenhouse gasses to the atmosphere we are causing **climate change**, or the warming of the planet. Scientists have documented rising temperatures across the globe and predict an increase of 3° C in Michigan within the next 100 years. Second, we are also changing the earth by moving species across the globe, introducing them into new habitats. Some of these introduced species spread quickly and become invasive. **Invasive species** harm native species and cost us money. There is also potential that these two changes could affect one another; warmer temperatures from climate change may make invasions by plants and animals even worse.

All living organisms have a range of temperatures they are able to survive in, and temperatures where they perform their best. For example, arctic penguins do best in the cold, while tropical parrots prefer warmer temperatures. The same is true for plants. Depending on the temperature preferences of a plant species, warming temperatures may either help or harm that species.

Katie, Mark, and Jen are scientists who are concerned that invasive species may do better in the warmer temperatures caused by climate change. There are several reasons they expect that invasive species may benefit from climate change. First,

A flower of the invasive plant, *Centaurea stoebe* (spotted knapweed).

A view of the plants growing in a heated ring. Notice the purple flowers of spotted knapweed.

because invasive species have already survived transport from one habitat to another, they may be species that are better able to handle change, like temperature increases. Second, the new habitat of an invasive species may have temperatures that allow it to survive, but are too low for the invasive species to do their absolute best. This could happen if the invasive species was transported from somewhere warm to somewhere cold. Climate change could increase temperatures enough to put the new habitat in the species' range of preferred temperatures, making it ideal for the invasive species to grow and survive.

To determine if climate change will benefit invasive species, Katie, Mark, and Jen focused on one of the worst invasive plants in Michigan, **spotted knapweed**. They looked at spotted knapweed plants growing in a field experiment with eight rings. Half of the rings were left with normal, **ambient** air temperatures. The other half of the rings were **heated** using ceramic heaters attached to the side of the rings. These heaters raised air temperatures by 3° C to mimic future climate change. At the end of the summer, Mark and Katie collected all of the spotted knapweed from the rings. They recorded both the (1) **abundance**, or number of spotted knapweed plants within a square meter, and (2) the **biomass** (dry weight of living material) of spotted knapweed. These two variables taken together are a good measure of performance, or how well spotted knapweed is doing in both treatments.

Scientific Question: Is there evidence that climate change will have a positive impact on the performance of the invasive species spotted knapweed?

Mark collecting data on the spotted knapweed plants one of the eight experimental rings.

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Scientific Data:

Use the data below to answer the scientific question:

Temperature treatment	Ring number	Number of spotted knapweed plants per square meter	Dried spotted knapweed biomass per square meter (g)
Ambient	2	49	165.3
Ambient	5	45	25.9
Ambient	7	12	18.5
Ambient	8	4	63.6
Ambient average			
Elevated	1	44	77.9
Elevated	3	56	170.1
Elevated	4	35	111
Elevated	6	55	36
Elevated average			

Note 1: *Ambient refers to the surrounding temperature (normal, or control), whereas elevated refers to the plants growing in rings with heat added.*
Note 2: *The number of plants and the dried plant biomass per 1 meter square are good measures of the amount of a plant species in a given area. Calculate average number of spotted knapweed plants and the average biomass per 1 meter square for ambient and elevated rings and use when graphing below.*

What data will you graph to answer the question?

Independent variable(s): _____

_____

Dependent variable(s): _____

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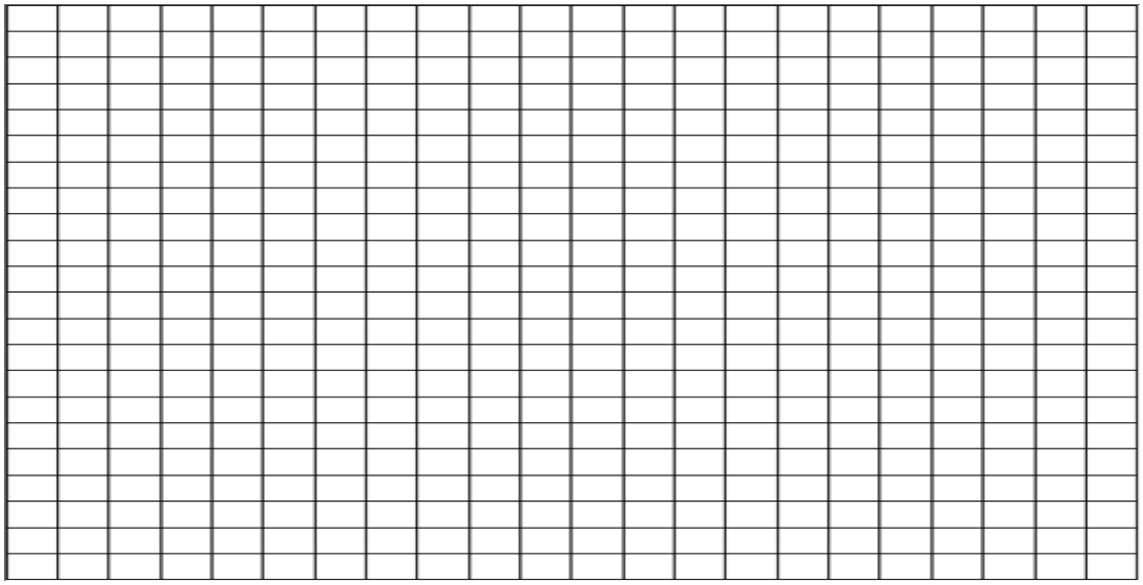
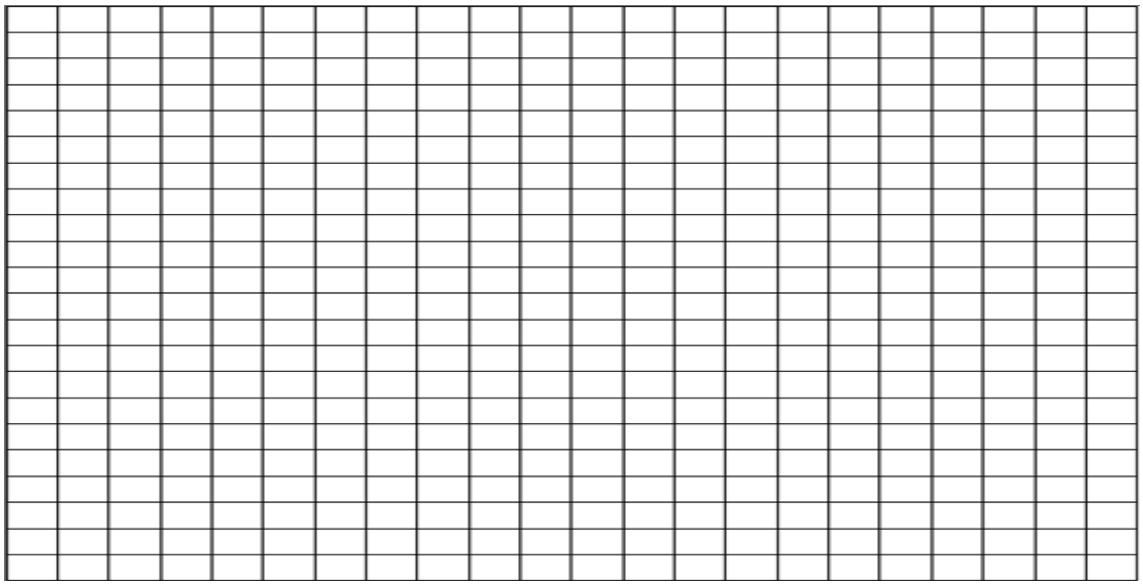
Name_____

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





Name_____

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 graphs.

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about how climate change might interact with the temperature preferences of invasive species.

Name_____

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