

DATA *Nugget*

Springing forward

Featured scientists: Shaun Davis, Mark Hammond, Elizabeth Schultheis,
and Jen Lau from Michigan State University

Research Background:

Every day we add more greenhouse gases to our air when we burn fossil fuels like oil, coal, and natural gas. Greenhouse gasses trap the sun's heat, so as we add more the Earth is heating up! What does climate change mean for the species on our planet? The timing of life cycle events for plants and animals, like flowering and migration, is largely determined by cues organisms take from the environment. The timing of these events is called **phenology**. Scientists studying phenology are interested in how climate change will influence different species. For example, with warming temperatures and more unpredictable transitions between seasons, what can we expect to happen to the migration timings of birds, mating seasons for animals, or flowering times of plants?

Plants are the foundation for almost all life on Earth. Through photosynthesis, plants produce the oxygen (O₂) that we breathe, food for their own growth and development, food for animals and microbes, and crops that provide food and materials for human society. Because plants are so important to life, we need to find out how climate change could affect them. One good place to start is by looking at flowering plants, guided by the question, how will increased temperatures affect the phenology of flowering? One possible answer to this question is that the date that flowers first emerge for a species is driven by temperature. If this relationship is real, we would expect flowers to emerge earlier each year as temperatures increase due to climate change. But if flowers come out earlier and earlier each year, this could greatly impact plant reproduction and could cause problems for pollinators who count on plants flowering at the same time the pollinators need the pollen for food.

Shaun, Mark, Elizabeth, and Jen are scientists in Michigan who wanted to know if higher temperatures would lead to earlier flowering dates for



Scientists collecting phenology data in the climate change experiment. They are recording the date that the first flowers emerge for dame's rocket (*Hesperis matronalis*).

plants. They chose to look at flowers of dame's rocket, a leafy plant that is related to the plants we use to make mustard! Mark planted dame's rocket in eight plots of land. Plots were randomly assigned to one of two treatments. Half of the plots were left to experience normal temperatures (**normal**), while the other four received a heating treatment to simulate climate change (**heated**). Air temperatures in heated plots increased by 3°C, which mimics climate change projections for what Michigan will experience by the end of the century. Mark, Elizabeth, and Jen measured the date that each plant produced its first flower, and the survival of each plant. The scientists predicted that dame's rocket growing in the heated plots would flower earlier than those in the normal plots.



An aerial view showing one of the heated plots. The silver boxes are electric ceramic heaters, raising the temperature inside the ring.



Dame's rocket growing in the field. This species of mustard was introduced to the US from Eurasia.

Scientific Question: How does temperature influence the phenology of dame's rocket?

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 question:

Treatment	# of plants surviving to flower	calendar date when first flower appeared	average # of days until first flower (since start of experiment)	standard error (SE)
Normal	28	May 20, 2013	16.11	0.66
Heated	25	May 10, 2013	6.08	1.65

* *Standard error (SE) tells us how confident we are in our estimate of the mean, and depends on the number of replicates in an experiment and how much variation is in the data. A large SE means we are not very confident, while a small SE means we are more confident.*

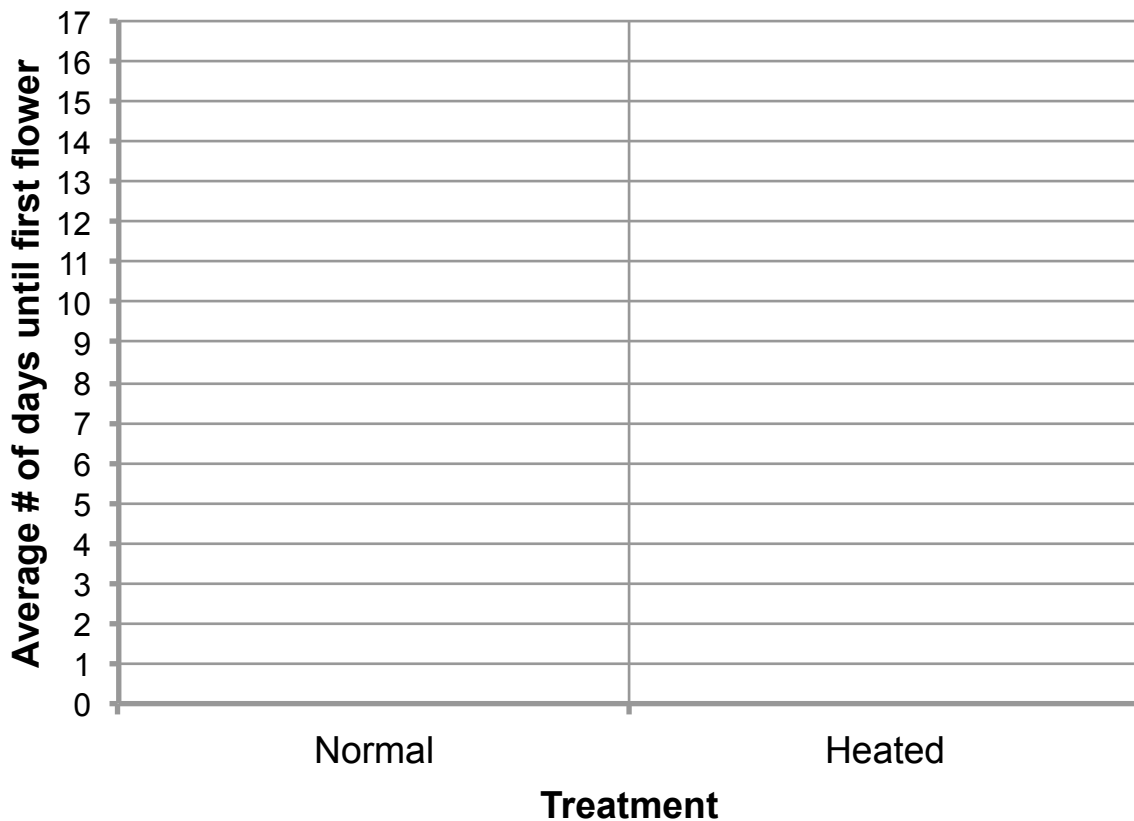
Name _____

What data will you graph to answer the question?

Independent variable: _____

Dependent variable: _____

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.

Name_____

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

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about climate change and how this could affect flowering time.

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

Name_____

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