Name_____

DATA Nugget

The ground has gas!

Featured scientist: Iurii Shcherbak from Michigan State University

Research Background:

If you dig through soil, you'll notice that soil is not hard like a rock, but contains many air pockets between soil grains. These spaces in the soil contain gases, which together are called the **soil atmosphere**. The soil atmosphere contains the same gases as the atmosphere that surrounds us above ground, but in different concentrations. It has the same amount of nitrogen, slightly less oxygen (O_2), 3-100 times more carbon dioxide (CO_2), and 5-30 times more nitrous oxide (N_2O, which is laughing gas!).

Nitrous oxide and carbon dioxide are two greenhouse gasses responsible for much of the warming of global average temperatures. Sometimes soils give off, or emit, these **greenhouse gases** into the earth's atmosphere, adding to climate change. Currently scientists are working to figure out why soils emit different amounts of these greenhouse gasses.

During the summer of 2010, Iurii and his fellow researchers at Michigan State University studied nitrous oxide (N_2O) emissions from farm soils. They measured three things: (1) the concentration of nitrous oxide 25 centimeters below the soil's surface (2) the amount of nitrous oxide leaving the soil (3) and the average temperature on the days that nitrous oxide was measured. The scientists reasoned that the amount of nitrous oxide entering the atmosphere is positively associated with how much nitrous oxide is in the soil and on the soil temperature.

Measuring nitrogen (N_2O) *gas escaping from the soil in a variety of conditions, like varying temperatures throughout the year. Photo credits: J.E. Doll MSU*

Name_____

Fill in the table below with the names and abbreviations of the **three gases** mentioned in the Research Background and whether it is a greenhouse gas.

Full Gas Name	Chemical Abbreviation	Is it a greenhouse gas?

Scientific Question: What relationship is there, if any, between soil N_2O concentrations and soil temperature and soil N_2O emissions?

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:

Day	N_2O Concentration in the Soil (ppm)	N_2O Emissions (g/ha*day)	Temperature (°C)
180	4.5	9.3	16.1
186	3.8	11.9	27.3
194	4.8	19.5	23.7
201	4.5	27.7	22.7
205	7.9	24.3	24.8
212	4.1	11	22.7
217	3.4	8.8	23.8
221	3.5	18.4	25.3
236	2.4	11.9	21.1
243	1.9	3.4	26.9
257	1.6	4.2	16

- **N_2O emissions** are the amount of nitrous oxide gas leaving the soil, in units of grams per hectare per day. A hectare is about the size of a football field. An N_2O emission rate of 10 g/ha*day means that in one day, 10 grams of nitrous oxide over a hectare of soil moves from the soil into the air.
- **N_2O concentration in the soil** is the amount of nitrous oxide gas in the soil atmosphere. It is measured in units of parts per million (ppm), which is the number of atoms of a specific gas for every million atoms of all gasses. For example, 4.0 ppm N_2O means that for every million atoms of gas in the air, there are 4 atoms of nitrous oxide.

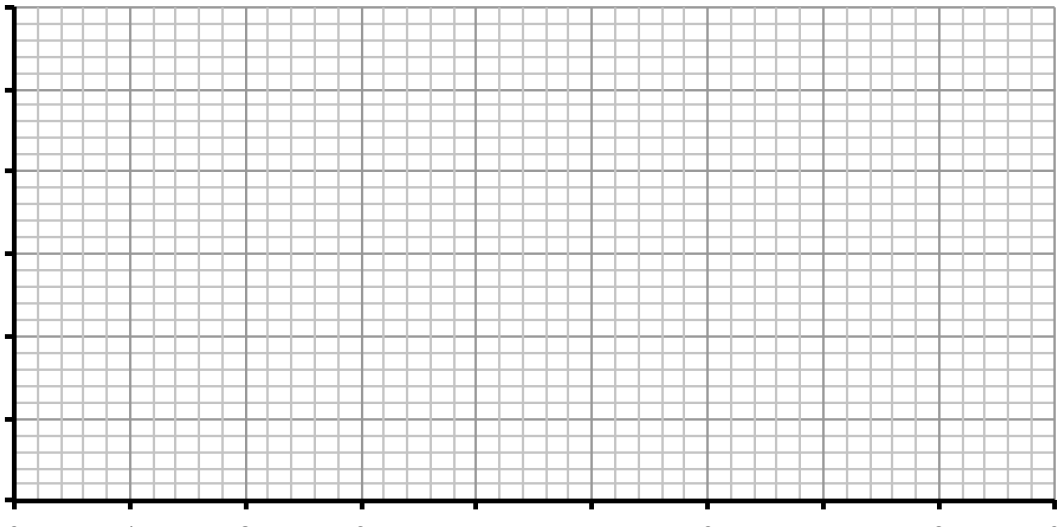
What data will you graph to answer the question?

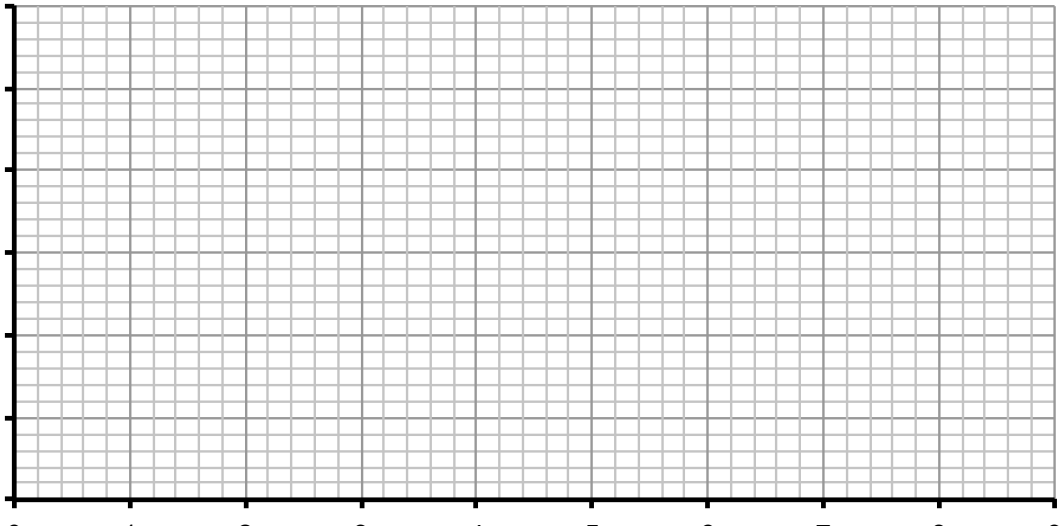
Independent variables: _____

Dependent variable: _____

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 N_2O and how it influences climate change when released into the atmosphere from the soil.

Name_____

Did the data support Iurii'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 Iurii's research? What future data should be collected to answer your question(s)?s