



Growing Energy: Comparing Bioenergy Crop Biomass

Featured scientist: Dr. Gregg Sanford

Scientific Question:

1. What scientific question are the scientists trying to answer in this experiment?

Scientific Data:

Part 1: Comparing Average Biomass Across Both Sites

To answer their question, the scientists started by calculating the average biomass for each crop across both sites. They organized the data in the following table:

| Crop | Type | Average harvest biomass (Mg DM ha ⁻¹ yr ⁻¹)* | Variation (standard error)** |
|------------------|-----------|--|---------------------------------|
| corn | annual | 14.2 | 0.6 |
| prairie | perennial | 3.3 | 0.2 |
| switchgrass | perennial | 6.5 | 0.3 |
| miscanthus grass | perennial | 14.0 | 0.9 |
| poplar trees | perennial | 8.5 | 1.4 |
| weed field | perennial | 2.7 | 0.2 |

*Harvest biomass is measured as the amount of dried biomass harvested from a certain area. In this study the units are "Megagrams of dried biomass per a hectare (Mg DM ha⁻¹)."

** Standard error is a measure of how much variation there is in the biomass measurements around the average.

2. What data will you graph to answer your question?

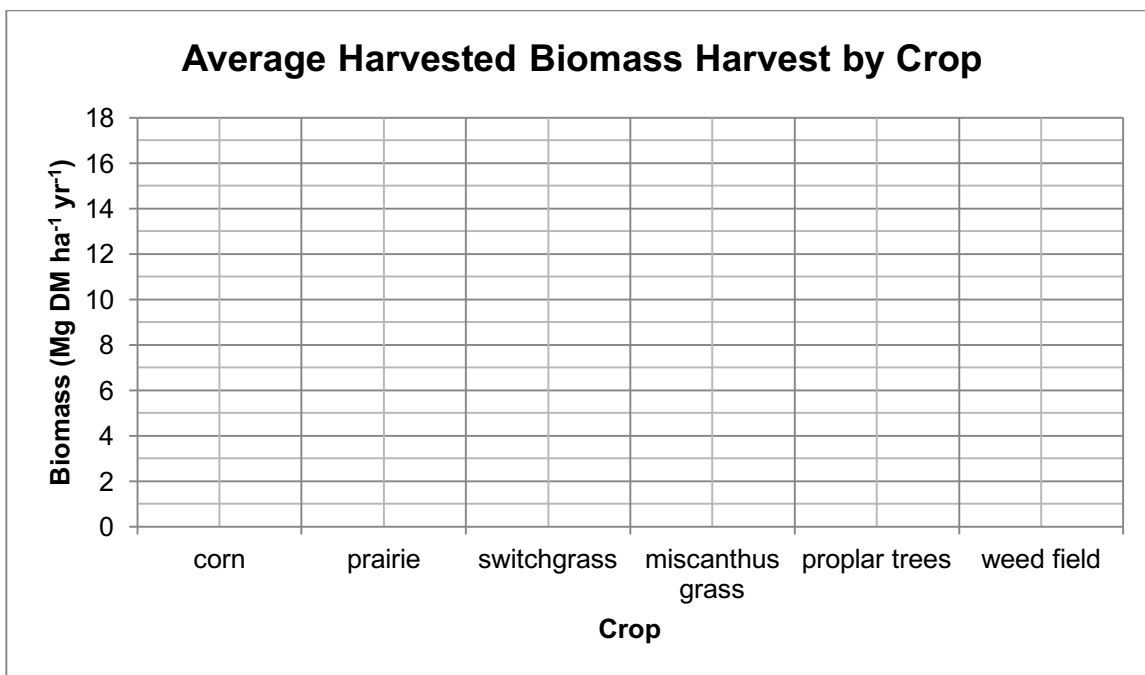
Independent variables: (a) _____

(b) _____

Dependent variable: _____

Name: _____ Date: _____ Section: _____

Graphing and interpreting data: Draw a graph of the data on the outline below.



3. Based upon this evidence, write a statement that helps answer the scientific question. Justify your reasoning using data.

4. Your next step as a scientist: Science is an ongoing process. Did this study fully answer your original question? What new questions do you think should be investigated? What future data should be collected to answer them?

Part 2: Comparing Average Biomass between Sites (WI and MI)

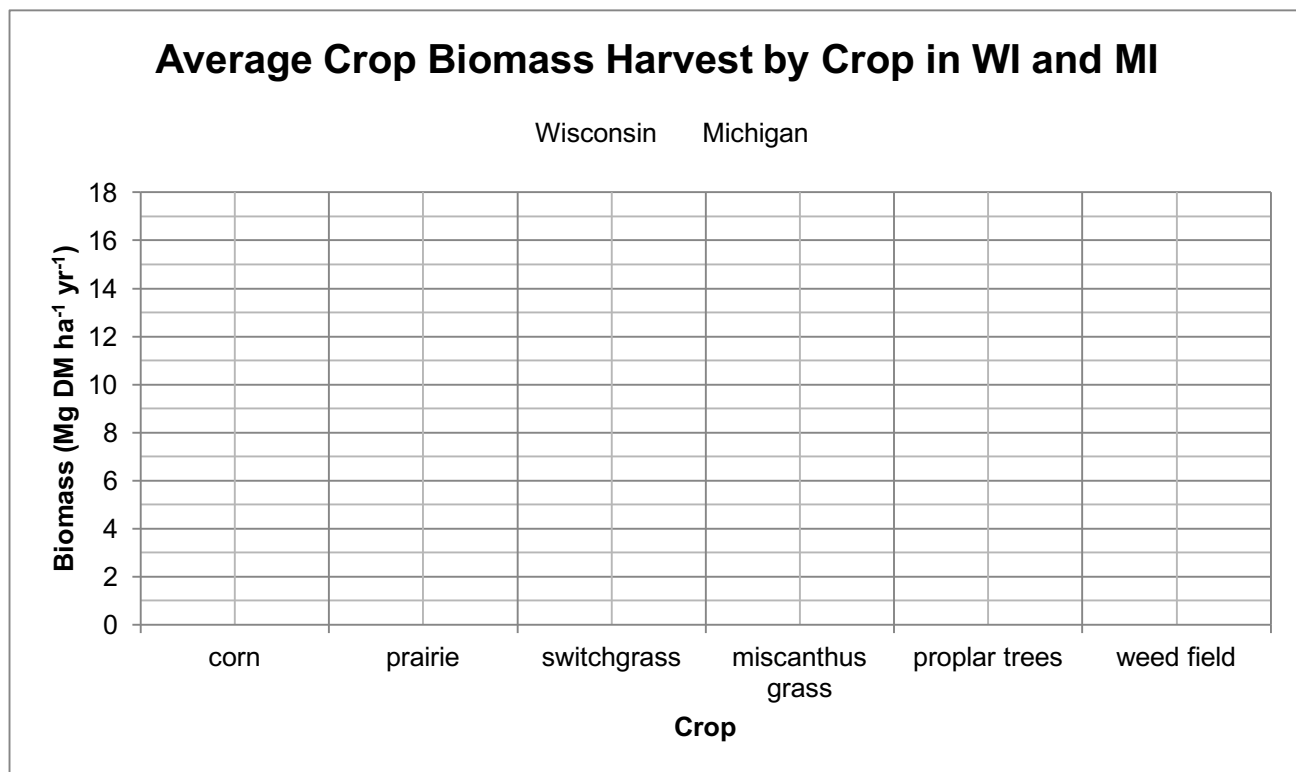
Next, the scientists wondered if they would observe the same pattern in crop biomass if they compared the results from each site. As mentioned in the introduction, differences in climate and soils could affect the results. They organized the data in the following table:

| Crop | Type | Wisconsin: Average biomass (Mg ha ⁻¹ yr ⁻¹) | Variation** | Michigan: Average biomass (Mg ha ⁻¹ yr ⁻¹)* | Variation** |
|------------------|-----------|---|-------------|---|-------------|
| corn | annual | 16.1 | 0.6 | 12.3 | 0.9 |
| prairie | perennial | 3.7 | 0.3 | 2.8 | 0.2 |
| switchgrass | perennial | 6.9 | 0.3 | 6.0 | 0.6 |
| miscanthus grass | perennial | 12.0 | 1.2 | 15.6 | 1.3 |
| poplar trees | perennial | 4.6 | 0.9 | 12.5 | 0.3 |
| weed field | perennial | 2.8 | 0.3 | 2.6 | 0.2 |

*Harvest biomass is measured as the amount of dried biomass harvested from a certain area. In this study the units are "Megagrams of dried biomass per a hectare (Mg DM ha⁻¹)."

**Standard error is a measure of how much variation there is in the biomass measurements around the average.

Graphing and interpreting data: Draw a graph of the data on the outline below.



Name: _____ Date: _____ Section: _____

1. Review the scientific question and your proposed answer for Part 1. How would you answer the question differently if you used only the data from Michigan or Wisconsin? Justify your reasoning using the data.

2. A. Explain what you learned from comparing the two sites.

B. Based upon the new information you have gathered from comparing the sites, how would you revise your original answer to the research question from Part 1? Write an updated statement below. Justify your reasoning using the data.

Name: _____ Date: _____ Section: _____

3. In large scale experiments like this one that include multiple sites across the country, what are some of the benefits and limitations in taking averages of all samples rather than looking at local patterns?

4. Your next step as a scientist: Science is an ongoing process. Did this study fully answer your original question? What new questions do you think should be investigated? What future data should be collected to answer them?