***Climate Change & Agriculture Data Investigation***

*Purpose: The purpose of this investigation is to explore different variables that impact crop yields in the Midwestern United States. In addition, students will explore the implications of climate change on Midwest agriculture.*

*Pre-Investigation Questions:*

1. Using online sources, *identify* the top three corn-producing states in the United States. Use quantitative data on state-level corn production to make your case.
2. Using online sources, *describe* the optimal growing conditions for corn. Make sure to detail the growing season, temperature ranges, and rainfall amounts.
3. Both Ames, Iowa and Decatur, Illinois are cities found in high corn-producing U.S. states. Fill in the following table describing their specific corn growing conditions. HINT: When you’re calculating the average for the growing season, you must consider months May-September. Report temperatures in both Celsius and Fahrenheit. Conversion: °F = °C\*(9/5) + 32

| *Location (City, State)* | *Average Growing Season Temperature (°F)* | *Average Growing Season Temperature (°C)* | *Total Growing Season Precipitation (Inches)* |
| --- | --- | --- | --- |
| Ames, Iowa |  |  |  |
| Decatur, Illinois |  |  |  |

1. Using your learning gains from questions 3 and 4, *compare* the existing growing conditions in Ames and Decatur to the optimal corn growing conditions.

*Crop Model Investigation:*

Using the [web-based map](https://rcweb.dartmouth.edu/Geospace/agroexplorer/lite.html), explore the relationship between climate and corn production across the Midwestern United States.

Fill out the table below for your two states. Each pair contains a more northern state in **bold**, and a more southern state in *italics*.

Group 1: **North Dakota**, *Iowa*

Group 2: **South Dakota**, *Nebraska*

Group 3: **Minnesota**, *Kansas*

Group 4: **Wisconsin**, *Illinois*

→ Temperature Analysis (complete for both states)

1. Map Settings
   1. Change “View” setting from “Crop” to “Climate”
   2. Change “Climate variable” from “Average temperature (°C, historical)” to “Change in temperature (°C, future)”
2. Calculation
   1. Calculate state-wide averages of Historical Temperature and Future Temperature by clicking on and averaging across all districts
   2. Calculate Change in Temperature using state-wide averages, report each value to the nearest whole number

→ Yield Analysis (complete for both states)

1. Map Settings
   1. View: Crop
   2. Crop variable: Yield, future (kg/ha)
   3. Planting date: Historical
   4. Time to maturity: Historical
   5. Heat tolerance: Historical
2. Calculation
   1. Calculate state-wide averages of Historical Yield and Future Yield by clicking on and averaging across all districts
   2. Calculate percent Change in Yield using state-wide averages, report each value to the nearest whole number

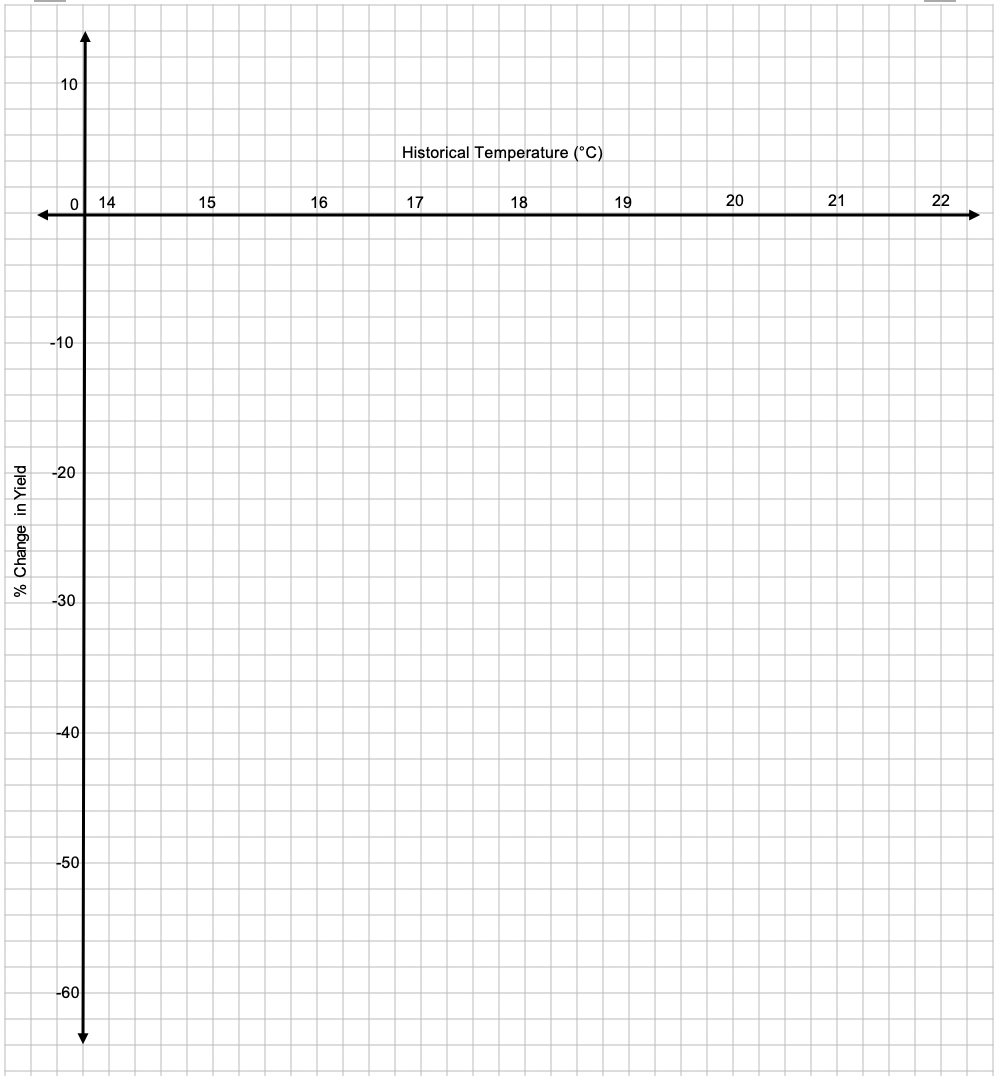
*Data Table:*

Title: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  | *Map Data Acquisition, State-wide Averages* | | *Calculate* | *Map Data Acquisition,*  *State-wide Averages* | | *Calculate* |
| --- | --- | --- | --- | --- | --- | --- |
| **Historical Temperature (°C)** | **Future**  **Temperature (°C)** | **Change in Temperature (°C)** | **Historical Yield (kg/ha)** | **Future Yield (kg/ha)** | **Change in Yield (%)** |
| **North Dakota** |  |  |  |  |  |  |
| **South Dakota** |  |  |  |  |  |  |
| **Minnesota** |  |  |  |  |  |  |
| **Wisconsin** |  |  |  |  |  |  |
| *Iowa* |  |  |  |  |  |  |
| *Nebraska* |  |  |  |  |  |  |
| *Kansas* |  |  |  |  |  |  |
| *Illinois* |  |  |  |  |  |  |

→ Check-In Question: *Identify* the type of graph that would best present the relationship between yield and historical temperature. *Explain* your choice.

Graph Title: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



→ Write a Claim Statement based on the data depicted in the graph:

*Post-Investigation #1 Questions:*

1. Hypothetically, say you want to become a farmer and grow corn in the Midwestern United States. Based on the quantitative data you collected and analyzed during this investigation, *identify* where you would buy land for your farm and *explain* your reasoning.
2. Using online sources, *describe* what it means for a crop variety to be “heat tolerant”. In addition, use the “Heat tolerance” setting on the web-based map to help *explain* how planting heat tolerant corn would impact yields.
3. Using quantitative evidence from the web-based map, *describe* how precipitation is predicted to change over the Midwest and how this might affect corn yields. Using additional online sources, how could farmers adapt to this predicted change?