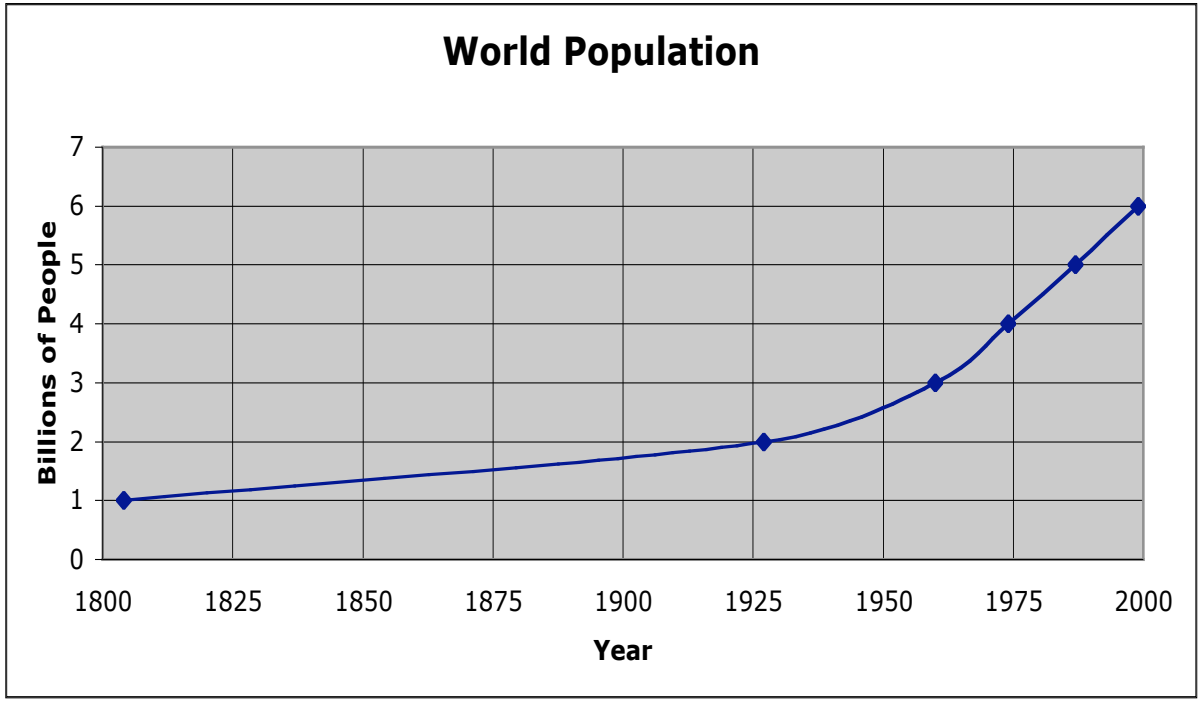
EARTH SYSTEMS INVESTIGATION AREA – MAKING CONNECTIONS
GLOBE SAMPLE STUDENT ASSESSMENT TOOL – HIGH SCHOOL (1)



Growing world population and inadequate food supply have become concerns in recent years. In an effort to increase the food supply, scientists and farmers have proposed cultivating land areas that are currently covered with native grasses. A variety of factors must be studied to determine the soil best suited to growing crops as well as what type of crops to plant.

In this activity, you will examine some of the complex variables t interact to influence the selection of cropland and the appropriate crop

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1) **(Plan Investigations: Specify measurements/variables to investigate) & (Interpret GLOBE data: Explain data & relationships)** Identify two qualitative observations about a study site that will give information about growing a crop at that site. Describe how each of these factors influence seed germination or affect the growth of food crops. For example: Is the land on a Northern slope? This is important because if the land is a north-facing slope, less direct sunlight will hit the ground, the soil will stay cool longer and it may take seeds longer to germinate.

Answers will vary and may include (but are not limited to):*Does the area get adequate drainage or is the area a wetland – marshy or continually covered by some areas of water. This is important to know because an area may get good rainfall and have warm temperatures for growing but if the soil stays water saturated during the growing season, a crop will not grow.*

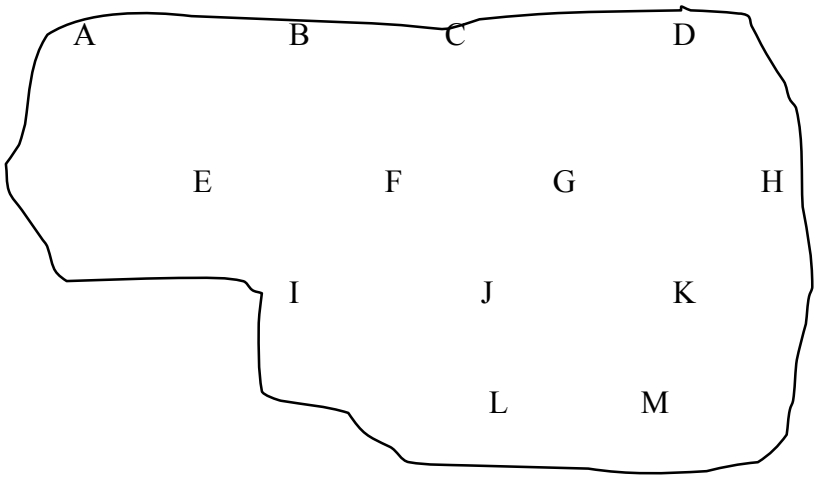
Is the soil suitable for growing crops or is it full of rocks or extremely hilly? This is important to know and will depend on the type of farming that is done in the area. If most of the farming is heavily dependent on machinery and technology, then the rocky, hilly soil will be a problem.

Is the land close to the people who will grow the crops, are there adequate roads to get people and materials to the area & to remove the crop harvest? This is important because growing food crops requires monitoring and removal of the crop must be easy also or the harvest will rot in the field.

Is the land area big enough to make the effort of planting a crop worthwhile? This is important to know so that the farmer can calculate cost-future income ratios.

2) **(Take Measurements: Use quality assurance procedures)** A map of Study Site T is shown below. Soil samples from sites A – M were collected and tested. Study where samples A – M are located and describe the sampling pattern. What are the advantages of this sampling pattern? What are the disadvantages? Would you make any changes to the sample sites? Why or why not?

Study Site T



The samples appear to be evenly spread around the Study Site. One row is staggered or offset from the row above and below it. This is an advantage because all areas within the Study Site appear to be covered. It may be a disadvantage because it still leaves some areas not sampled – for example the area under A and to the left of E or all the area under H. Re: changing the sampling sites – students may suggest using the GLOBE star or transect pattern protocol.

Table 1 shows some of the soil measurements taken from Study Site T. Soil salinity is a measure of how much dissolved solids are present in a sample. It is measured using a conductivity meter which records how much electric current will pass through the sample. It is measured in units called mmho's (milli mho's).

3) **(Interpret Data- Infer patterns, trends)** Soil pH is a measure of the acidity/alkalinity of the soil. pH values range from 1 – 14. A pH of 7 is neutral. pH < 6.5 is acidic, while pH > 7.5 is alkaline. Examine the soil pH for Study Site T in Table 1 below. Is the soil in this area acidic or alkaline? (circle one)

4) **(Interpret GLOBE Data: Create multiple formats to represent data)** The precipitation during the growing season has been measured for the past three years at Study Site T. Calculate the average precipitation during these three years. Add this value as another column in Table 1. Be sure to label the column and include the units used to measure the precipitation.

Table 1: pH, salinity and annual precipitation for Study Site T

Soil Sample	Salinity	pH	Growing season precipitation for past three years	*Average precipitation for past three years*
A	15mmho	6.0	13cm 14cm 15cm	*14cm*
B	14mmho	6.0	12cm 14cm 16cm	*14cm*
C	16mmho	5.5	14cm 16cm 17cm	*15.7cm*
D	9mmho	5.5	18cm 20cm 19cm	*19cm*
E	4mmho	5.5	24cm 24cm 24cm	*24cm*
F	6mmho	5.5	22cm 25cm 25cm	*24cm*
G	6mmho	5.5	21cm 24cm 25cm	*23.3cm*
H	9mmho	5.5	18cm 19cm 20cm	*19cm*
I	5mmho	4.5	9cm 9cm 12cm	*10cm*
J	6mmho	5.0	10cm 10cm 13cm	*11cm*
K	9mmho	5.5	19cm 20cm 21cm	*20cm*
L	10mmho	4.5	9cm 9cm 11cm	*9.7cm*
M	8mmho	5.5	20cm 21cm 22cm	*21cm*

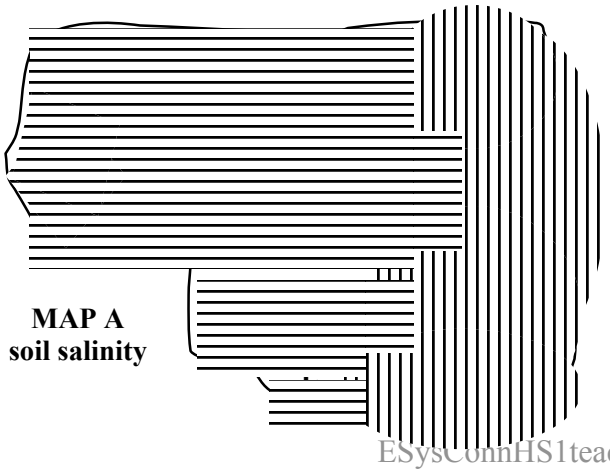
An important scientific activity is looking for trends & patterns in large amounts of data. One way to look for trends & patterns is to organize the data in tables. Another way is to chart the data on a map and draw lines that group together similar values and separate the different values. Drawing these contour lines is part of an activity called "Visualization".

5) **(Interpret GLOBE Data: Create multiple formats to represent data)** Chart the salinity measurements on Map A using the data in Table 1. Use these shading marks shown in the legend below to indicate areas of similar salinity.

Areas with salinity □ 6

Areas with salinity 6 – 9

Areas with salinity ≥ 9



MAP A
soil salinity

6) **(Interpret GLOBE Data: Create multiple formats to represent data)** Chart the average annual precipitation on Map C using the data you calculated in question 3. Draw contour lines to connect areas of similar precipitation. Use precipitation ranges

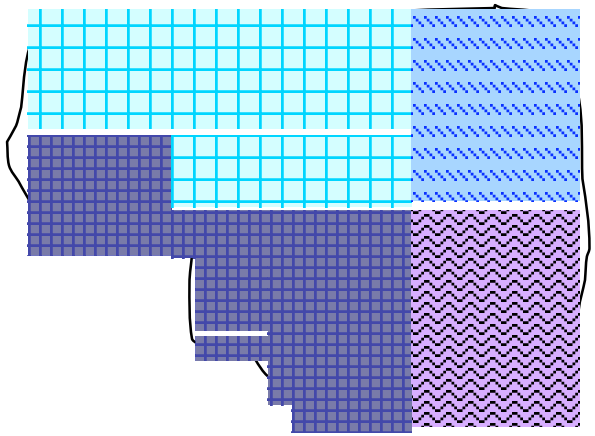
 <14cm,

 > 14cm but <17cm,

 >17cm but <20cm,

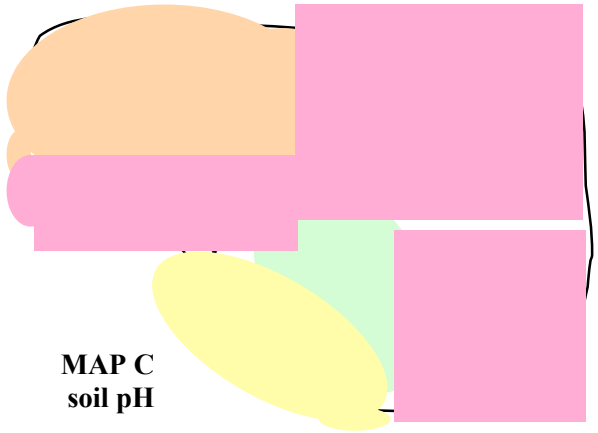
 >20cm

Color or shade the different precipitation regions. Include a legend as shown in question 4.



MAP B
Annual
precipitation

7) **(Interpret GLOBE Data: Create multiple formats to represent data)** Chart the pH measurements on Map B using the data in Table 1. Draw contour lines to connect areas of similar pH. Color or shade the different pH regions. Include a legend as shown in question 4.



MAP C
soil pH

pH 4.55

pH 5.0

pH 5.5

pH6.0

Table 2 shows the pH, salinity and minimum moisture needed for several food crops that grow in the general area of Study Site T.

Table 2: pH and salinity tolerance

Plants	pH*	salinity*	Minimum moisture needed to produce a crop yield
Crop W	6.0	12	16.8 cm
Crop X	5.5	9	17.3 cm
Crop Y	5.5	6	23.4 cm
Crop Z	4.5	9	8.9 cm
native grasses	Wide tolerance range		Wide range

* these values indicate the lower limit of pH and the upper limit of salinity at which plants grow and produce without damage to crop yields

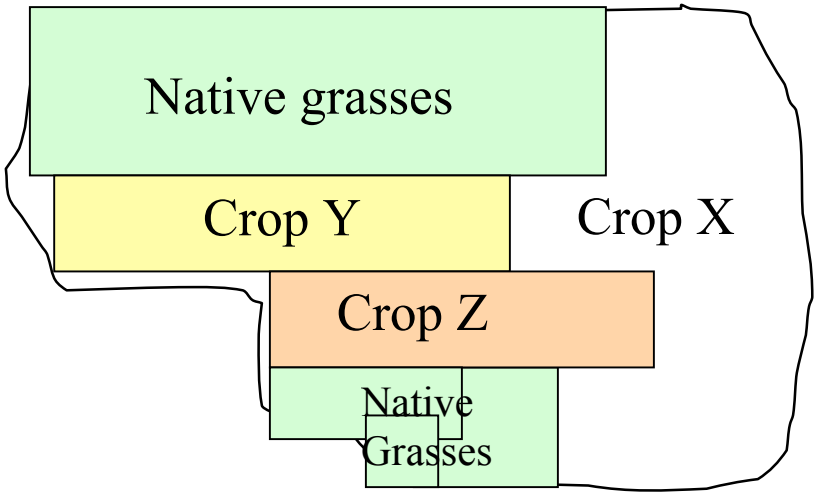
Divide the class into 4 groups. Assign each group 3 of the sites to analyze and then share their information with the rest of the class.

8) **(Interpret GLOBE Data: Explain data & relationships)** Make a table that shows what plants will grow in the various areas of Study Site T. Give the evidence that supports your claim. The plants for Area A are indicated to give an example.

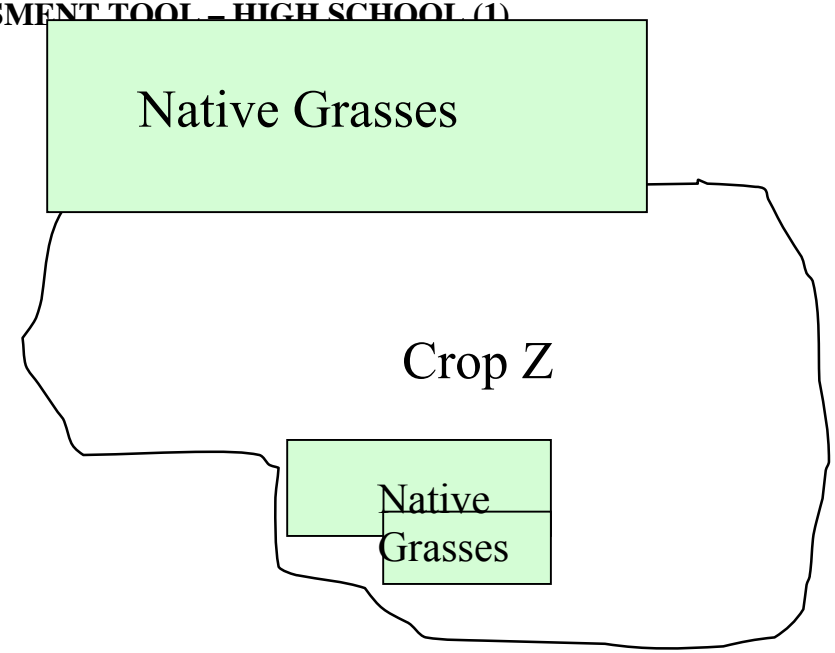
Area	*Plants that will grow*	*Evidence*
A	*native grasses*	*the salinity is too high for crops to grow, even though the pH and moisture are OK.*
B	*native grasses*	*the salinity is too high for crops to grow, even though the pH and moisture are OK.*
C	*native grasses*	*the salinity is too high for crops to grow, even though the pH and moisture are OK.*
D	*crop W and X*	*the salinity is OK for W, X and Z but too high for Y; pH is too high for crop Z, and moisture is too low for crop Y*
E	*crop X, Y & Z*	*the pH is too low for W*
F	*crop X, Y & Z*	*the pH is too low for W*
G	*crop X & Z*	*the pH is too low for W and the moisture is too low for Y*
H	*crop X & Z*	*the pH is too low for W and the salinity is too high for Y*
I	*crop Z*	*the pH is too low for the other crops*
J	*crop Z*	*the pH is too low for the other crops*
K	*crop X & Z*	*the pH is too low for W and the moisture is too low for Y*
L	*native grasses*	*the pH is too low for W, X and Y and the salinity is too high for Z*
M	*crop X & Z*	*the pH is too low for W and the salinity is too high for Y*

9) **(Interpret GLOBE Data: Explain data & relationships)** Divide Study Site T into growing areas. Explain how you decided to divide the land into these areas.

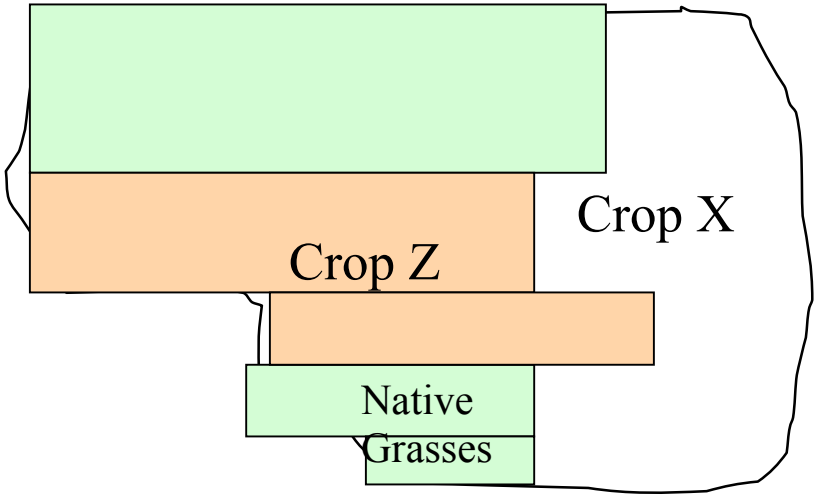
Answers will vary depending on how the student chooses to "farm" the area. Sites A, B, C and L will remain native grass growing areas.



Biodiversify – plant as many crops as possible



Minimum diversity = plant only one crop and leave other areas as native grasses



Compromise plan – plant the two crops that can grow in the most areas.

10) **(Interpret GLOBE Data: Create multiple formats to represent data) & (Communicate: Compose reports to explain or persuade)** Write a 1 – 2 page summary report to the farmers who work the land of Area X. Describe your recommendations for land use based on the data you studied in this activity. Explain how you made your decision and include one (1) map with summary data.