

# Yield Mapping

Yield maps are some of the most valuable sources of spatial data for precision agriculture. They represent the output of crop production. Processed yield maps can be used to investigate factors affecting the yield. Or you can use them to choose variable rate applications of agricultural inputs based on the yield potential or spatially variable yield goal.

In this activity, you'll overlay soybean yield data for the year 2002 and the boundary layer of a selected field at Mead, Nebraska ([University of Nebraska-Lincoln Agricultural Research and Development Center](#)) for yield mapping.

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## *Explorer's Guide*

### **Before You Start**

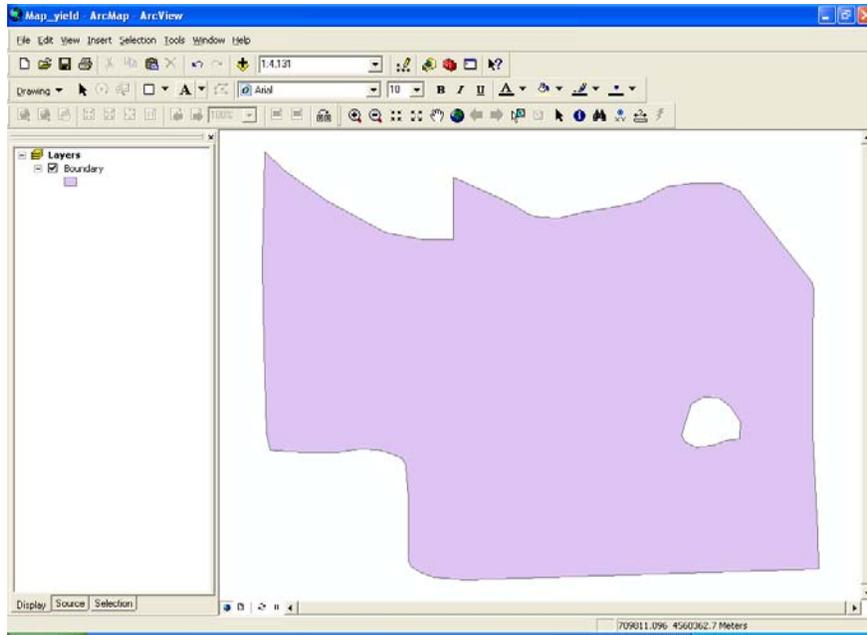
Your helper will give you a piece of colored paper, based on your birthday (winter, spring, summer, fall), class, or other characteristic. You'll stand in a big square on the floor surrounded with your peer explorers. When your helper tells you to, set the colored paper on the floor and step out of the square.

What do the colors tell you? Suppose the colored papers were showing you a characteristic about the ground under it instead of about birthdays. Imagine the red squares are spots with higher yield and the green squares are lower yielding spots. Does it show the distribution of birthday times like the yield data shows the location of low and high yielding spots? How would it be helpful to have this on a map? What could you do with this information if you were trying to grow a crop in the field?

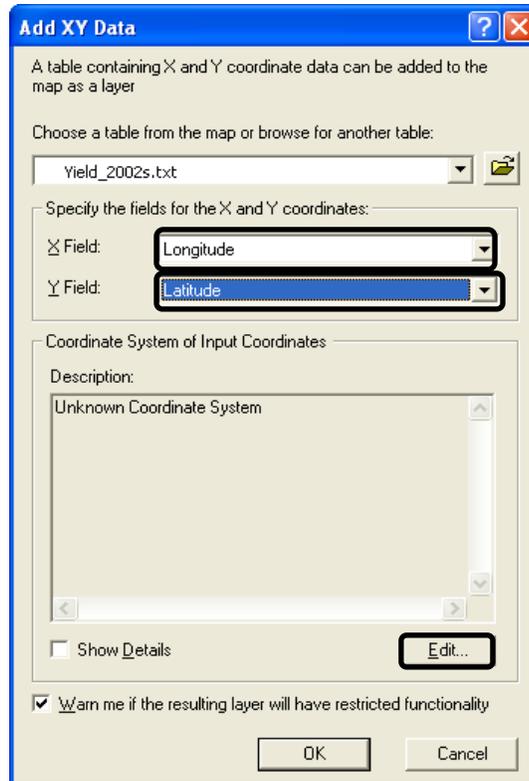
### **Learning by Doing**

1. Start ArcMap and add Boundary.shp

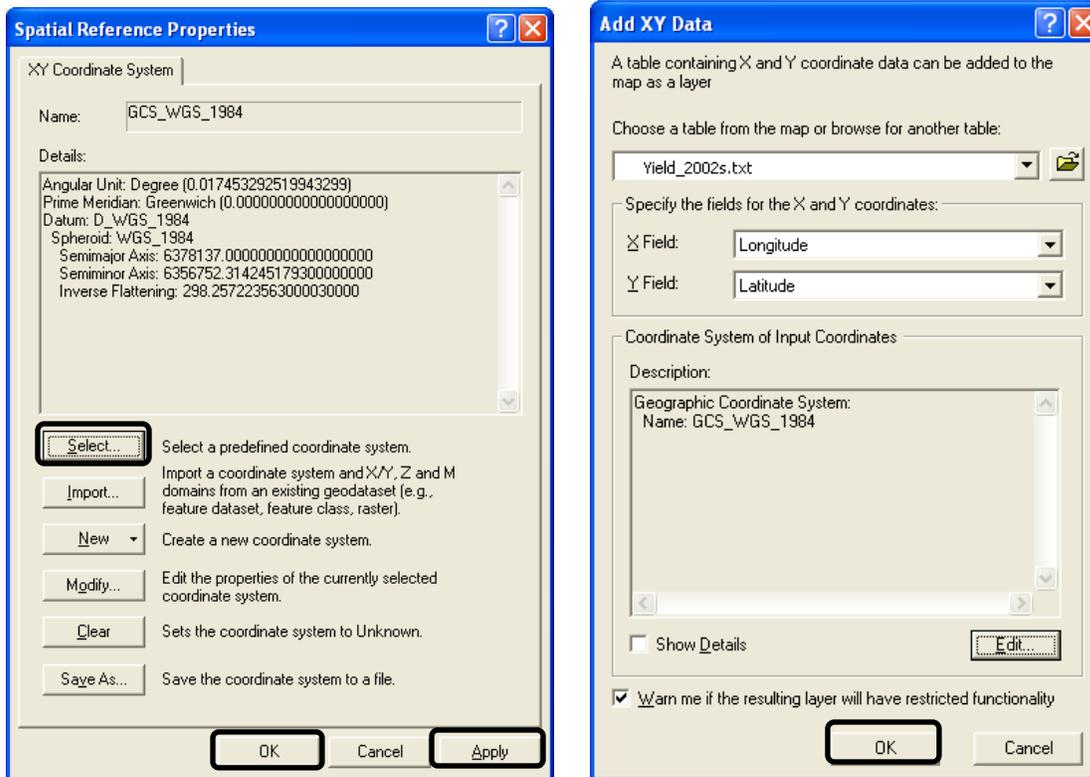




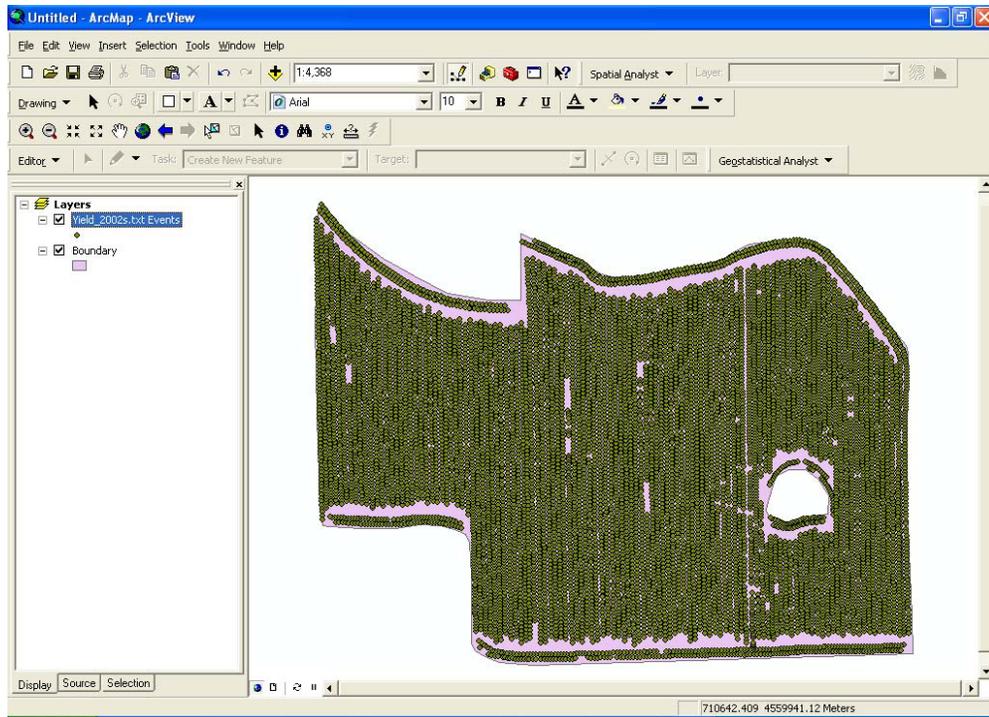
2. Now you need to add the yield data which is in txt format. Add the yield data into ArcMap using the Tool> Add XY data. X field should show the longitude and Y field should show the latitude.



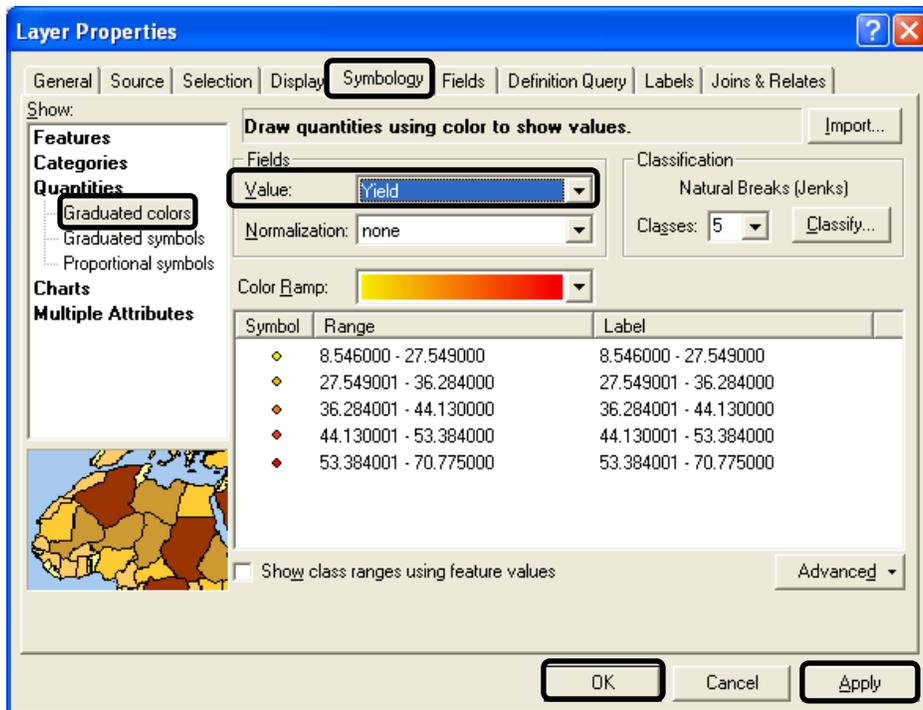
- Now click the **Edit** button as shown here, to specify a coordinate system for the yield data. Choose **Select** as shown here and navigate to *Geographic Coordinate system > World > WGS84.prj*. Click **Apply** and **OK** when done.



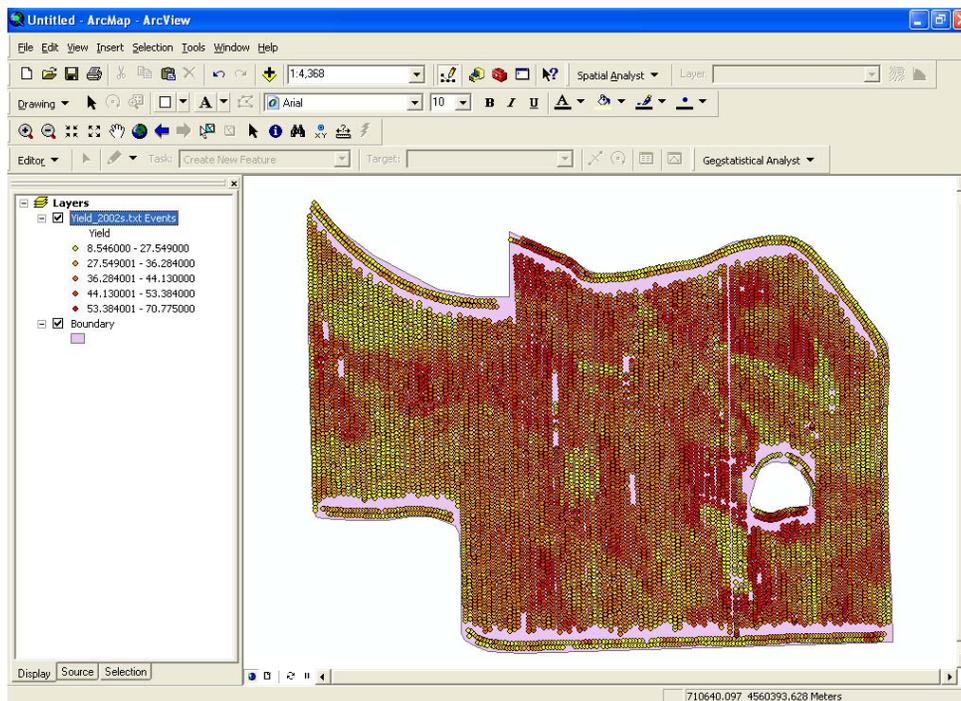
- Click **OK** to the warning message. Your XY event data should look like this.



5. Change the symbology of the yield events layer. Right click the yield\_2002s.txt Events to get layer properties. Click the **Symbology** tab. Choose Quantities> Graduated Colors. Select **Yield** as value field. Click **Apply** and **OK**.



- Your map should look like this. Looking at the map, you'll see it's now easy to find the areas with maximum yield and minimum yield. Save your map.

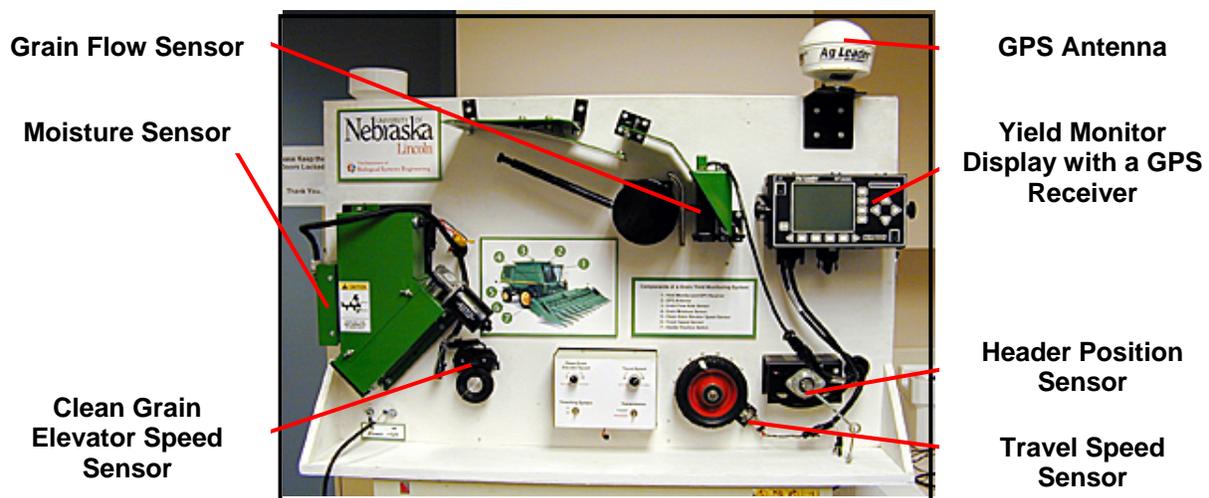


## How Does It Work?

Yield mapping refers to the process of collecting georeferenced data on crop yield and characteristics--such as moisture content--while the crop is being harvested. Various methods, using a range of sensors, have been developed for mapping the yield of a variety of crops from small grains to fruits and vegetables.

Creating a yield map is one of the primary tasks of precision agriculture., There are many GIS applications similar to yield mapping in which users enter measurements done throughout the area of investigation and color the markers for each measurement according to the value obtained.

The basic components of a grain yield mapping system are shown here.



The amount of grain harvested by the combine in a unit of time is usually determined with a **grain flow sensor** mounted at the exit of the clean grain elevator.

A **moisture sensor** is used to compensate for grain moisture variability.

A **yield monitor display** and a **Global Positioning System (GPS) receiver** are used to georeference and record data.

A **header position sensor** is used to remove measurements logged during turns.

A **travel speed sensor** determines the distance the combine travels during a certain logging interval. (In most cases, travel speed is measured with a GPS receiver, or, less often, a radar or ultrasonic sensor.)

Finally, the speed of the clean **grain elevator speed sensor** is used by some yield mapping systems to improve the accuracy of grain flow measurements.

Each sensor has to be properly calibrated according to the operator's manual for best results. Calibration converts the sensor's signal to an actual readout. During harvest, a proprietary binary log file is created, recording the output of all sensors as a function of time.

To get ready for yield data analysis you convert the log files from proprietary binary code to an ASCII text with columns corresponding to geographic latitude, longitude, yield and other relevant attributes.

You need to process data carefully to avoid creating records that might turn out to have problems and to assure high quality for the yield maps you'll be creating. You can use a GIS software package to display the yield calculated at each field location.

You need a long yield history so you don't wind up drawing conclusions that are affected by the weather or other unpredictable factors during a particular year. Typically, you should have at least five years of yield maps to make sure that some areas of the field indeed are low yielding. Also, yield maps are needed to investigate field variability.

### **Additional Challenge**

Create a map to show the grain moisture content.

Q & A

#### **Share what you did!**

What did the colored paper exercise tell you about yield mapping?

What was it like to work through the steps to create the yield map?

#### **Process what's important!**

What was the easiest part of this activity? Why?

What was the hardest part? Why?

#### **Generalize to you life!**

Think about what the weather has been like for the last three months. How would that affect your map?

How useful would your map be with data from just one season or year?

#### **Apply what you've learned!**

What decisions could you make based on what a yield map tells you?

Would a paper yield map be more or less helpful?

### **Vocabulary**

**Precision Agriculture:** *managing each crop production input--fertilizer, insecticide, seed etc on a site-specific basis to reduce waste, increase profits and maintain the quality of the environment*

**Crop Yield** *is a measure of the output per unit area of land under cultivation. The units are bu/ac, lb/ac or ton/ac.*

**Yield monitor:** *used to measure and record yields and grain moisture content. A yield monitor consists of several sensors and a small computer to integrate, display and save the information.*

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