Types of Hardware

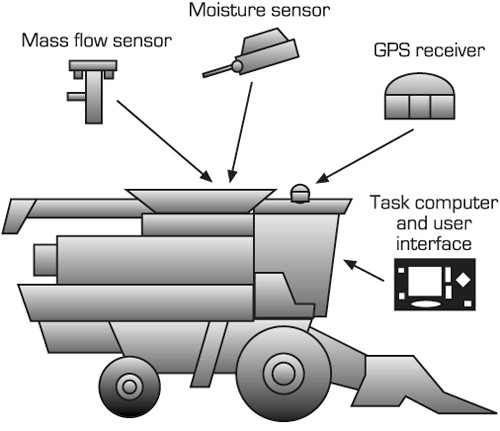
* Any electronic technology system consists of\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_.’
  + Hardware is \_\_\_\_\_\_\_\_\_\_\_\_\_\_ equipment.
  + Software is \_\_\_\_\_\_\_\_\_\_\_\_\_\_ equipment.
  + Within precision ag there are three main types of hardware:

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *←--Review from lesson 1*

3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

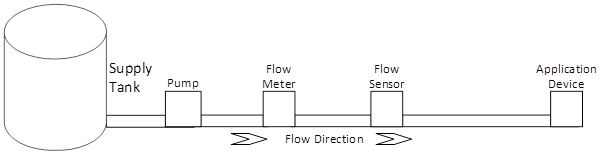
Sensors

* Sensors sense something using lasers, \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_, thermometers, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, impact plates, scales and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Sensors can monitor characteristics of the environment such as; location on a map, when a seed is planted, how close the seeds are, if a seed is \_\_\_\_\_\_\_\_\_\_\_\_\_\_, if more than one seed is planted, and how much of something is being used.
* An example of a complex sensor being used in Precision Planting is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* A second example and less complex or technical sensor is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ sensor. This sensor measures the weight of the grain being harvested.
* A third example and less complex sensor is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ sensor which measures the amount of moisture in the grain on a combine.
* Both these sensors are located on a combine near the flow of clean \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on the combine.

Meters

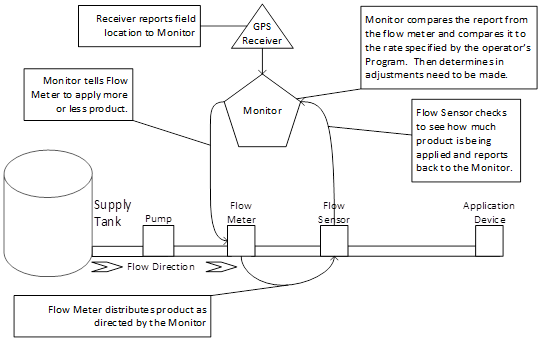
* A meter \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the amount of something that is applied
* An example of a meter is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ meter.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ meters are valves that are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ controlled and work with a flow sensor to control the amount of fluid that is allowed to flow through a sprayer, injector or transfer system.

Flow Sensor Simple delivery system

Monitors:

* Pieces of hardware that contain the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the system.
* Monitors take in signals from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and interprets if any \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are needed.
* If changes are needed, the monitor will send a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to the meter.

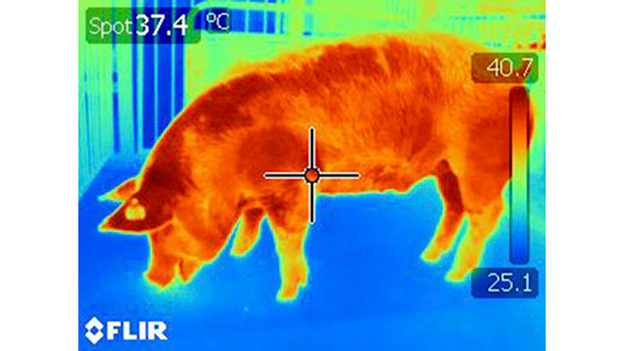
**Review:** To the right is an example of a complete Precision Ag system including many \_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_ captures all the information so it can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ later for future planning and evaluation of management \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Assignment 1 (see separate sheet)**

**Assignment 2 (see separate sheet)**

What can be controlled?

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ can be controlled by Precision Agriculture management practices.
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - can change as the planter moves across the field
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - (seeding rate)
  + Seed depth
  + Irrigation
    1. When it’s time to water
    2. How much is applied
    3. Can be varied as the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ moves across the field
  + Fertilizer
    1. Initial
    2. Starter
    3. Subsequent
    4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Herbicides
    1. Rate can be varied based on weed pressure
    2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ types can be ID
    3. Can be shut off in areas where it is against the law to apply (waterways)
  + Fungicides
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Soil moisture
  + Soil \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Soil \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Organic matter
  + Yield
  + In Animals
    1. Location
    2. Maximize milk production
    3. Last time animal drank/ate
    4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ temperature
    5. Heart rate
    6. Invisible \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Thermal Images show promise in determining heat tolerance for pigs and poultry.



In-class computer search: How are collars like the one shown in this image used in the dairy industry today?

Scalability of Precision Agriculture

* There are three \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ about precision agriculture among operators today.

Myth 1) I have to be a big \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_to use precision agriculture

Myth 2) The operator has to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ an entire precision

agriculture package across the operation in order to see a benefit.

Myth 3) The operator has to \_\_\_\_\_\_\_\_\_\_ all new \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in

order to implement Precision Ag, costing additional tens if not thousands

of dollars. Any \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ equipment can be equipped with

Precision Ag technology.

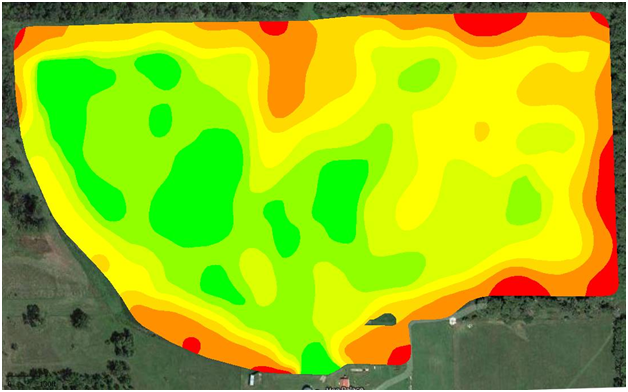
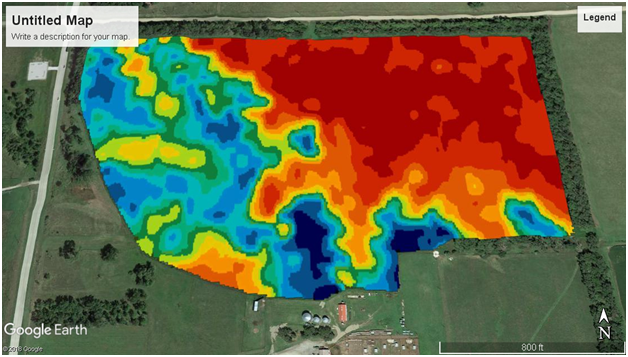
* Three of the most well-known vendors who set up older equipment with Precision Ag technology are:

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

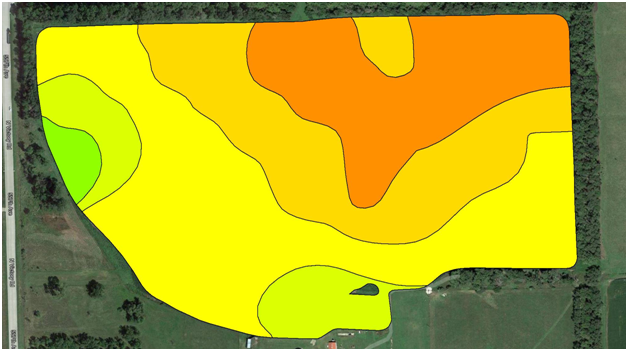
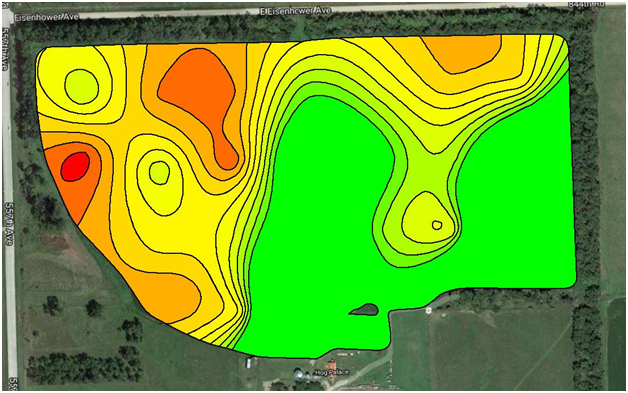
Types of Precision Ag Maps

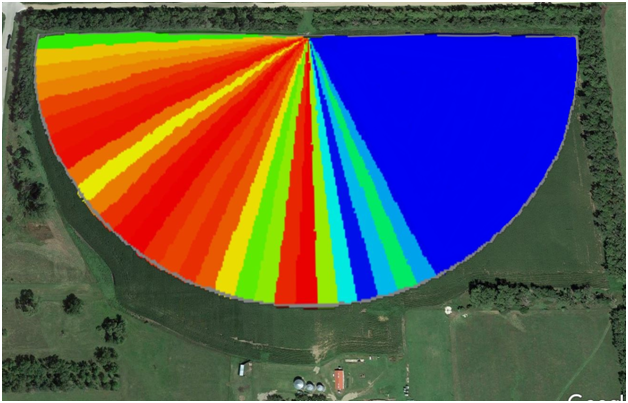
* Each map was produced when information was \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Each kind of map \_\_\_­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ different kinds of data. Here are examples.

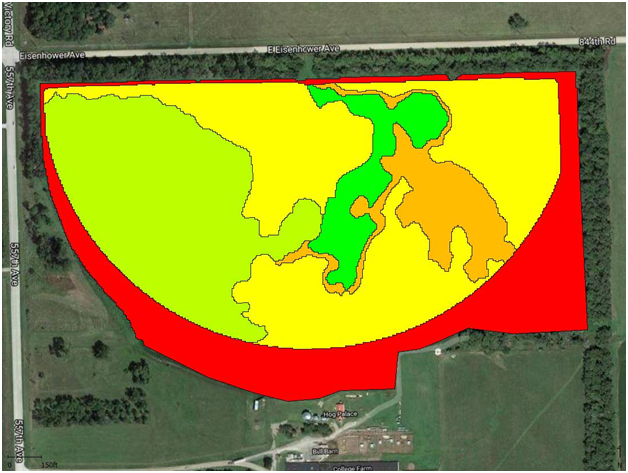
\*\*layers are built in, starting with yield first. The following maps go in “order.

1. Yield Map 2. Subsoil Moisture Map

3. Nutrient Maps (fertility)

3.A) Organic Matter Map 3.B) Soil Phosphorus Map

3.C) Fertilizer Application Map 4. Water- Irrigation Application Map



**Map Review:**

Based on the Subsoil Moisture Map and The Irrigation Application map: Write down in the space below telling about the decisions that were made based on what the maps show?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Lesson 2 Review:** Fill in the blanks for the Pros and Cons of Precision Agriculture. Go ahead and list more of what is required if you can!

**Pros**

1. Get more information about the operation
2. Make better informed decisions
3. GPS allows fields to be surveyed with ease
4. Yield and soil characteristics can be mapped
5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Cons**

1. Will take several years to gather the data needed to fully implement the system
2. Steep learning curve to analyze data
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Activity 1 (see separate sheet)**