# Precision Agriculture

## Lesson 3, Part A

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# Traditional Farming vs. Precision Agriculture

- Compare/Contrast
  - How data is gathered
  - Detail of the data
  - Decision making and implementation based on data

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# Gathering Data

| ***Traditional Farming Practices*** | ***Precision Agriculture*** |
| --- | --- |
| One piece of data gathered per location at one time. | Several pieces of data may be collected at each location. |
| Extra time required for physical observations. | Data recorded instantaneously. |
| Number of sites observed limited due to time constraints. | Significantly higher number of sites observed and recorded. |
| Accuracy dependent upon viewpoint of observer. | Data is accurate to level of equip-ment calibration. |

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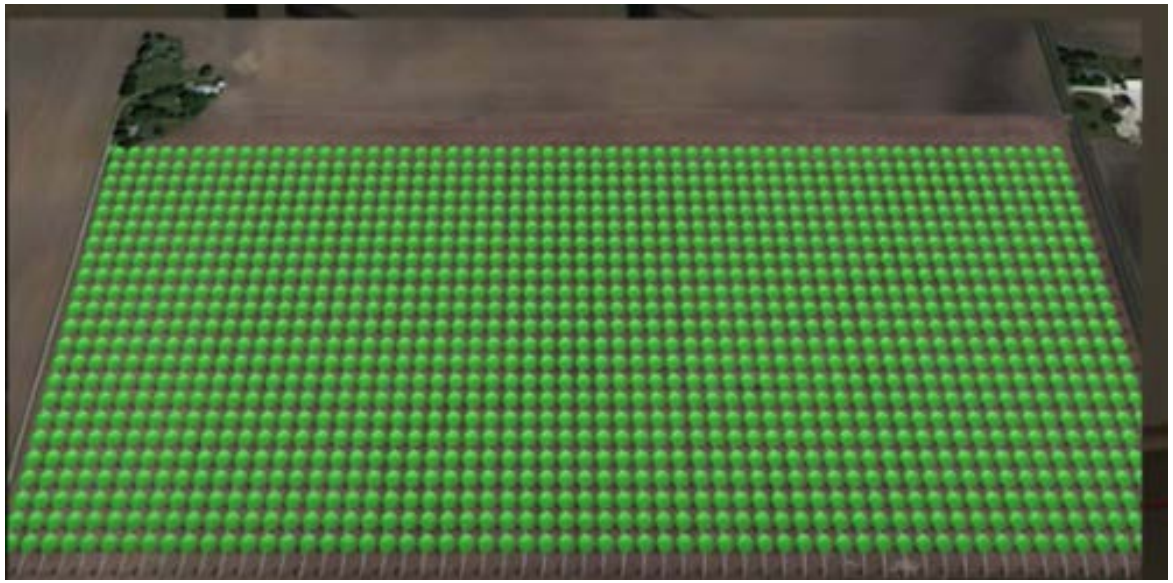
The green pin indicates how often data is taken for this field using physical observation.

Using Precision Ag, data can be gathered up to 200 times per second, and combine that with a GPS receiver, the data can be mapped at each location recorded. Giving us a coverage map looking like this.



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# Detail of the Data

| ***Traditional Farming Practices*** | ***Precision Agriculture*** |
| --- | --- |
| Detail is subject to amount of time observer has to record what is observed. Very ***subjective*** | Detail is exact as observations are taken and recorded to same level of accuracy. Very ***objective***. |
| Fewer observations are made per field making data less applicable as distance from point of observation becomes greater. | Because observations are taken constantly, data is completely applicable to the entire operation. |

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# Decision Making and Implementation

| ***Traditional Farming Practices*** | ***Precision Agriculture*** |
| --- | --- |
| Decisions are applied to large, broad areas of the operation such as an entire field or section of field. | Decisions applied to much smaller areas because observations are being taken all the time. |
| All adjustments must be made manually. | Many adjustments are made automatically based upon parameters set in equipment because of sensors. |
| Management implemented is applied to large areas based on very limited data. | Management implemented is applied precisely to an area based upon its data. |

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# Where Does the Data Come From?

- Websites
- Remote Sensing
- Digitized Historical Maps
- Physical Sampling
- Equipment with Sensors Installed

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# Websites

- Atmospheric Data
  - Temperature
  - Rainfall
  - Etc.
    - https://www.usclimatedata.com/
    - https://www.wunderground.com/
    - https://www.climate.gov/
    - https://www.ncdc.noaa.gov/
    - https://www.agweb.com/weather/temperature-band/
    - https://weatherspark.com/



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# Websites (continued)

- Historical weather data analyzed for Growing Degree Days or Heat Units.
  - Growing Degree Days (GDD) or Growing Degree Units (GDU)
    - Organisms such as plants, insects, etc. require a certain number of heat units to reach different stages of maturity.
    - (Max Temp + Min Temp)/2 - Base Temp
    - Example for corn: (83 + 61)/2 -50 = 22 GDD for that day
    - NOTE: The max temp used cannot exceed 85 and the min temp used cannot be less than 50.
- http://www.nutrien-ekonomics.com/tools-to-calculate-fertilizer-needs/calculators/gdd/
- http://www.greencastonline.com/growing-degree-days/home



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# Remote Sensing

- Analyzed satellite or drone images
  - https://farmlogs.com/
  - geovantage.com/
  - Can supply crop health images on a given date.
    - Helpful to identify issues before noticeable to the eye.
  - A field boundary is drawn around a field on a web tool.
    - http://www.gmapgis.com/
    - Field boundary is used to identify AOI on which to gather data.

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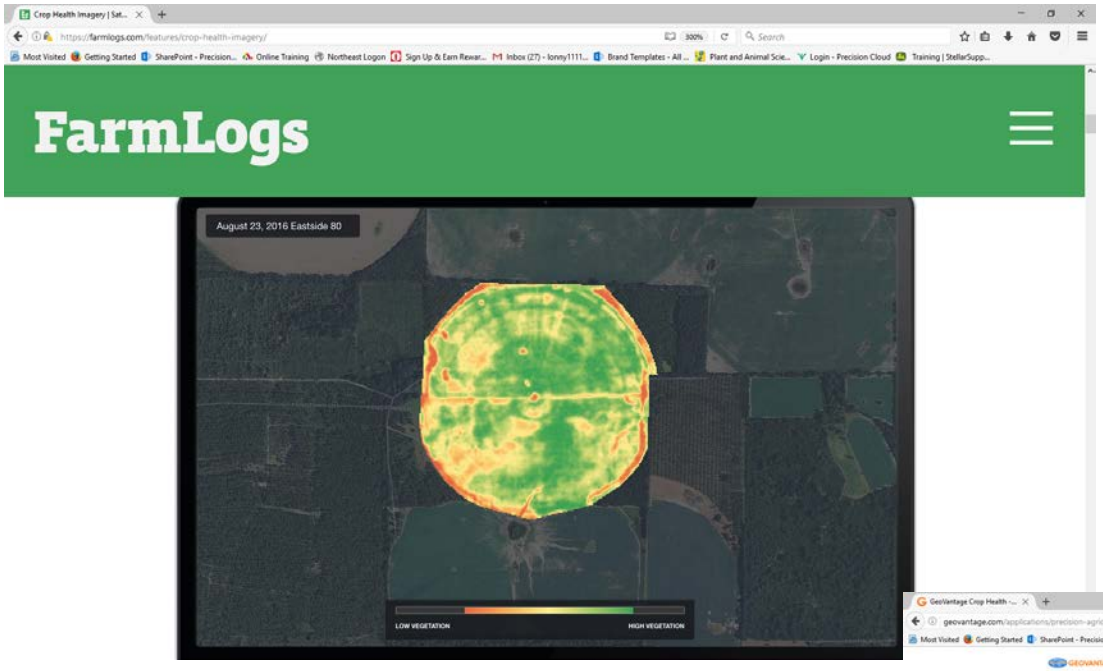
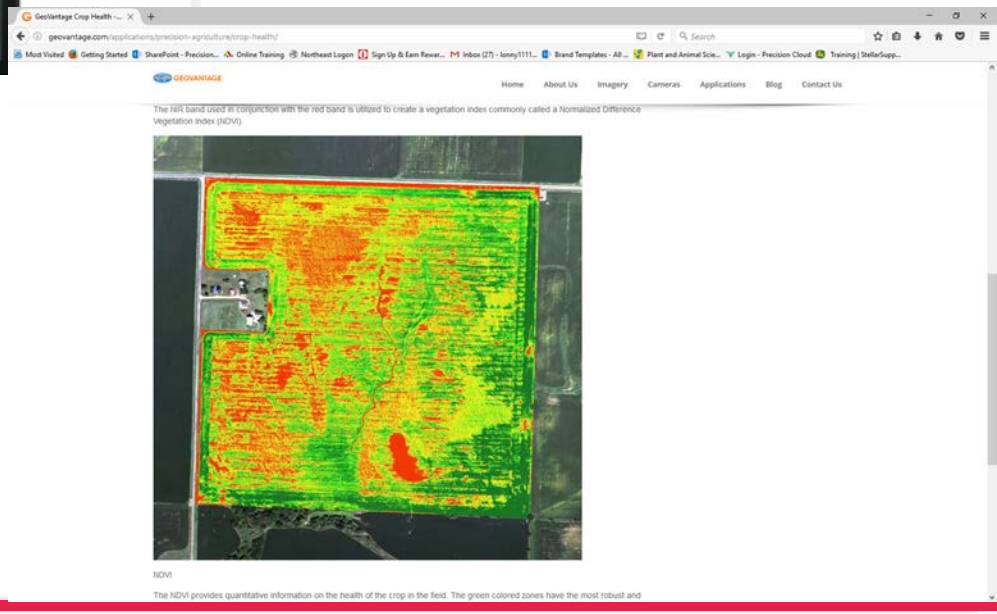



Example of image from FarmLogs




Example of imagery from geovantage.com

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# Digitized Historical Maps

- Soil Maps
- Topographical Maps
  - This type of data experiences very minimal change over the years.
  - Maps from 5, 10 or even 50 years ago are still valid and valuable today!

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# Physical Sampling

- Example - Soil Sampling
  - Identifies:
  - Soil pH
  - Soil's ability to hold water
  - Soil's ability to release water
  - Fertility available
  - Fertility needs



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# Soil Sampling

- Drive to the field to be sampled
- Use a soil probe to remove a sample of soil from the ground.
  - May be taken from different zones.
  - Several samples may be taken within a zone.
    - All soil samples within the zone are mixed to get an average.
- Soil samples are sent to a lab for analysis.

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Using a soil probe to collect a soil sample.


Preparing soil for shipment to the lab for analysis.

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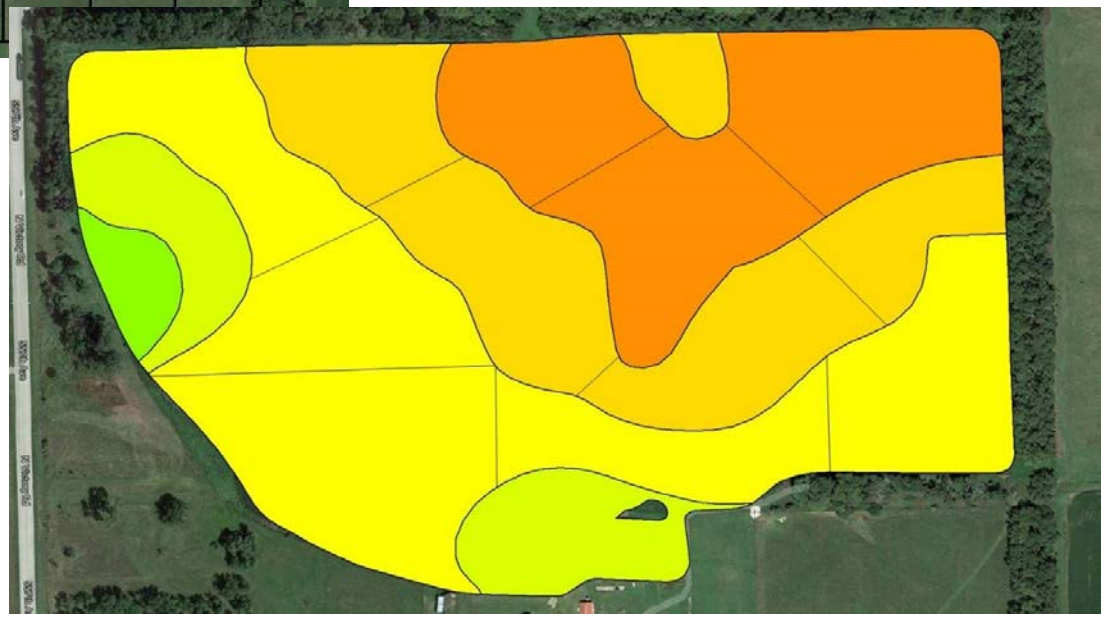
***Grid Sampling*** - a soil sample is taken within each square across the field map. Very time consuming and expensive.



***Zone Sampling*** - fewer soil samples are taken and less costly for lab testing. Lose some of the detail.

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# Sensors

## Passive Data Collection

- *Examples:*
  - Soil temperature
  - Soil moisture
  - pH
  - Organic matter

## Active Data Collection

- *Examples:*
  - Planting population
  - Seed depth
  - Seed spacing

Need to be known on a higher level of ***granularity*** so sensors provide more precise rather than general information.

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Sensors in the SmartFirmer can capture multiple points of data such as seed spacing, soil moisture, organic matter, etc.

Sensors can also be found on weather stations to gather wind direction, speed, rainfall, etc.

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# Saving and Transferring Collected Data

- When data is collected it is stored in a temporary memory module within the equipment.

- Stored data is transferred by a variety of methods.
  - Download to a portable memory module.
    - USB Drive, SD Card, etc.
  - Transfer directly to iPad or tablet with a cable.
  - WiFi or cellular transmitter sending it to the cloud to access directly.



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