Intro to Precision Agriculture

- Students will be able to define/describe:
  - Precision Agriculture, GIS, GPS, DGPS, VRT, Remote Sensing, Pixel, Spatial Resolution, Multi-spectral, Data, Information, Knowledge, Wisdom
- Students will be able to draw diagrams to describe the following technologies:
  - Yield Monitor
  - Variable Rate Planting
  - Variable Rate Chemical Application
  - Real-Time Differential GPS

Precision Agriculture

AKA:
- Precision Farming
- Farming by the Inch
- Site-specific farming/agriculture/application
- Prescription Farming
- Spatially-Variable Crop Production
Site-Specific Process

Technologies

- Global Position System - GPS - Latitude and Longitude
- Yield Monitor
- Geographical Information Systems - GIS
- Decision Support Systems - DSS
- Site-Specific Sampling of Soil Properties
- Variable-Rate Application of Fertilizers and Pesticides

The enabling technology for precision agriculture is position sensing, namely GPS.
Global Position System: Overview

Latitude and Longitude Coordinates
Ag Mall, Lafayette, Indiana

Decimal Degrees

<table>
<thead>
<tr>
<th>Latitude:</th>
<th>40.42233854</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitude:</td>
<td>-86.91510721</td>
</tr>
</tbody>
</table>

Degrees, Minutes, Seconds: DMS

<table>
<thead>
<tr>
<th>Latitude:</th>
<th>40° 25' 20.4&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitude:</td>
<td>-86° 54' 54.4&quot;</td>
</tr>
</tbody>
</table>

Note the minus (-) sign indicates Longitudes which are West of the Prime Meridian.

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**GPS Information**

- ABE local:  
  [http://danpatch.ecn.purdue.edu/~asm322/GPS/GPS.html](http://danpatch.ecn.purdue.edu/~asm322/GPS/GPS.html)
- Smithsonian NASM Tutorial:  
  [http://www.nasm.si.edu/exhibitions/gps/index.htm](http://www.nasm.si.edu/exhibitions/gps/index.htm)
GPS Precision - Uncertainty

- GPS Receiver
  - Number of satellites which can be received
  - Accuracy of clocks
- Satellite Geometry
- Atmospheric Conditions
- Differential Correction Source
  - None - ~50 feet
  - WAAS (Wide Area Augmented Service) - ~10 feet
  - Coast Guard Beacon - ~3 feet (distance to station and weather)
  - Satellite Subscription - ~3 feet

GPS Precision - Uncertainty Reporting

**CEP** - Circular Error Probability - 50% are inside circle of this radius for stated time period
  - Trimble Ag 132 DGPS receiver - CEP of 1 meter for 24 hours

**Pass to Pass** - measured over a short time period
  - Trimble Ag 132 DGPS receiver - Pass to Pass uncertainty of less than 12 inches.
GPS Hardware

GPS Applications

- Position Logging:
  - Boundaries – fields, crop areas, areas of interest
  - Points – locations of obstacles, sites of interest
  - Paths – location of fence, watercourse, etc.
- Guidance
  - Navigate to point for site-specific sampling
  - Swath-width guidance, e.g. light-bars
- Controlled Steering – automatic, self-guided vehicles
Position Logging

Farmworks
SiteMate

BlueTooth Airlink

Guidance to a Predetermined Point
Guidance: Swath-Width

Agleader PF3000 + GPS + Lightbar

Lightbar (Trimble)

Approach LED
Text Display Area
Guidance LED
Guidance: Swath Width

Guidance: Swath Width

Pass to Pass
Accuracy:
~6 to 18”
(10 minutes)
Controlled Steering: AutoTrac

Advertised Accuracies:
~10 inches
~1 inch with RTK

Hydraulic Control Valve on Power Steering

Base Station within ~10 miles

Controlled Steering: Auto-Guide
Questions ????