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Precision Ag Technology …it's all about the data

Growing Michigan Agriculture Conference

January 23nd, 2013

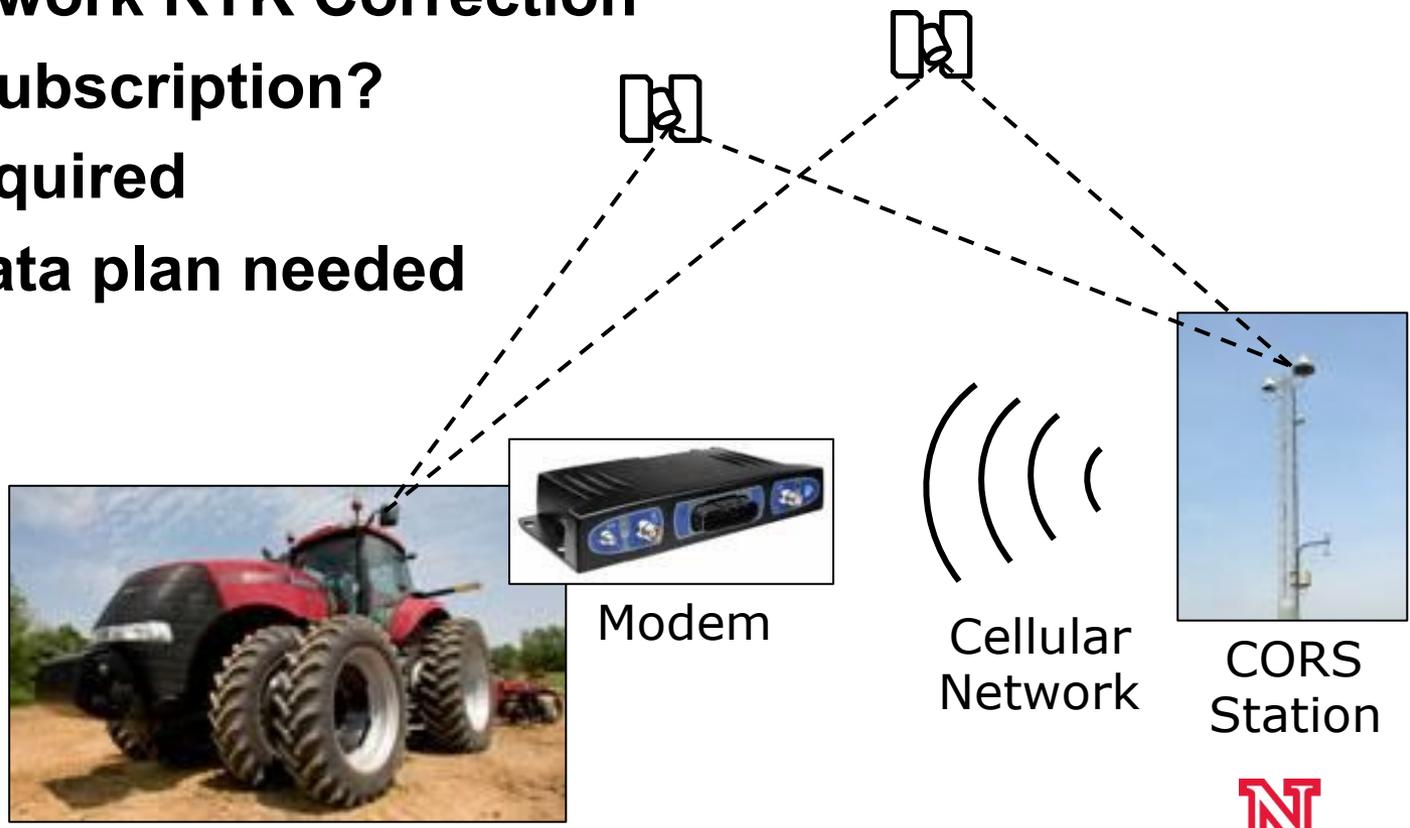## **Joe D. Luck**

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Presentation Outline

- **GPS and Network Technologies**
  - **Cellular**
  - **GPS + GLONASS**
  - **Satellite RTK**
- **Data Collection and Analysis**
- **Data Filtering and Processing**
- **Automated Data Processing**
- **Telematics/Analytics**

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GPS and Network Technologies

- **Continuously Operating Reference Stations**
- **CORS Network RTK Correction**
- **Network subscription?**
- **Modem required**
- **Cellular data plan needed**

Modem

Cellular Network

CORS Station

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GPS and Network Technologies

- **MDOT CORS Network**

GPS and Network Technologies

- **NDOR CORS Network**

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GPS and Network Technologies

- **Raven Slingshot Network**

- **Cellular RTK Delivery**
- **Multiple Networks:**
  - **MDOT**
  - **MyWayRTK**
- **Data Transfer:**
  - **Field to Office**
  - **Office to Field**
- **Cloud Data Storage**
- **Mobile Access**

GPS + GLONASS Receivers

- **The United States network: GPS**
- **The Russian network: GLONASS**
- **Each has about 30 satellites in orbit**
- **Other networks? (China, EU)**

- **The benefits may include:**
  - **Improvements in accuracy**
  - **Faster initialization times**

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GPS Network

- **United States**

GLONASS Network

- **Russia**

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Satellite-based RTK correction

- **Trimble CenterPoint RTX**
- **Horizontal accuracy of ± 1.5 inches**
- **Susceptible to typical GPS errors**
- **Standard initialization (up to 30 minutes)**
  - **Satellite or cellular network delivery**
- **One-minute initialization**
  - **Satellite network delivery**

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Satellite-based RTK correction

- **RTX One-minute initialization (in blue)**

Data Collection and Analysis

- **Farm Management Software (FMS)**
- **Many FMS packages are available:**
  - **Apex**
  - **SMS**
  - **Farmworks**
  - **SST**
  - **SGIS**
  - **MapShots**

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Data Collection and Analysis

- **Today FMS is more user friendly**
- **Handle data from multiple manufacturers**
- **Store and analyze field data**
- **FMS can perform many functions:**
  - **Comparison analysis (soil type, topography)**
  - **Prescription (Rx) map development**
  - **Batch data processing**
  - **Yield data normalization**

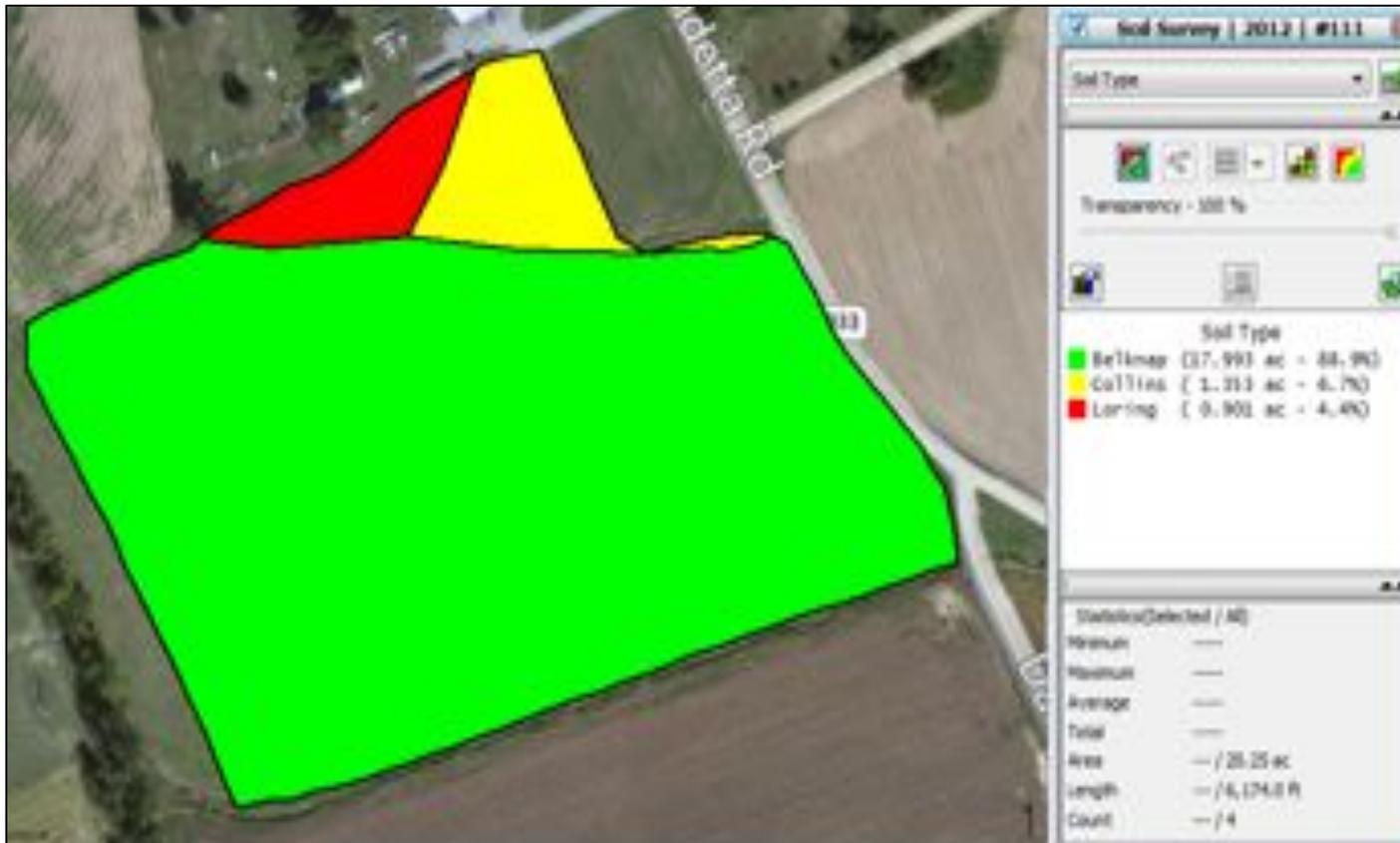**University of Nebraska–Lincoln**

Data Collection and Analysis

- **Comparing Yield to Soil Type**
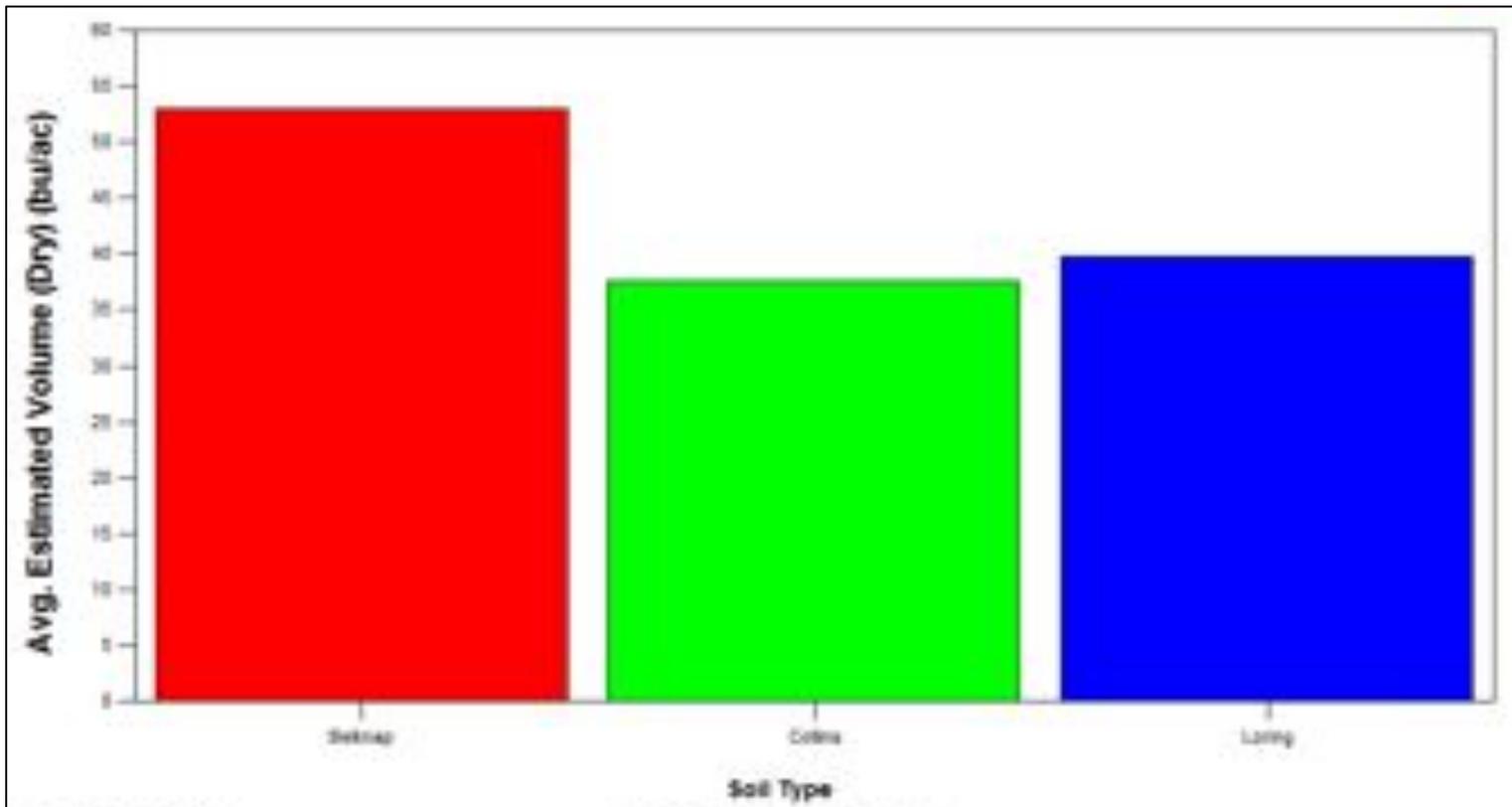- **Soybean harvest data:**
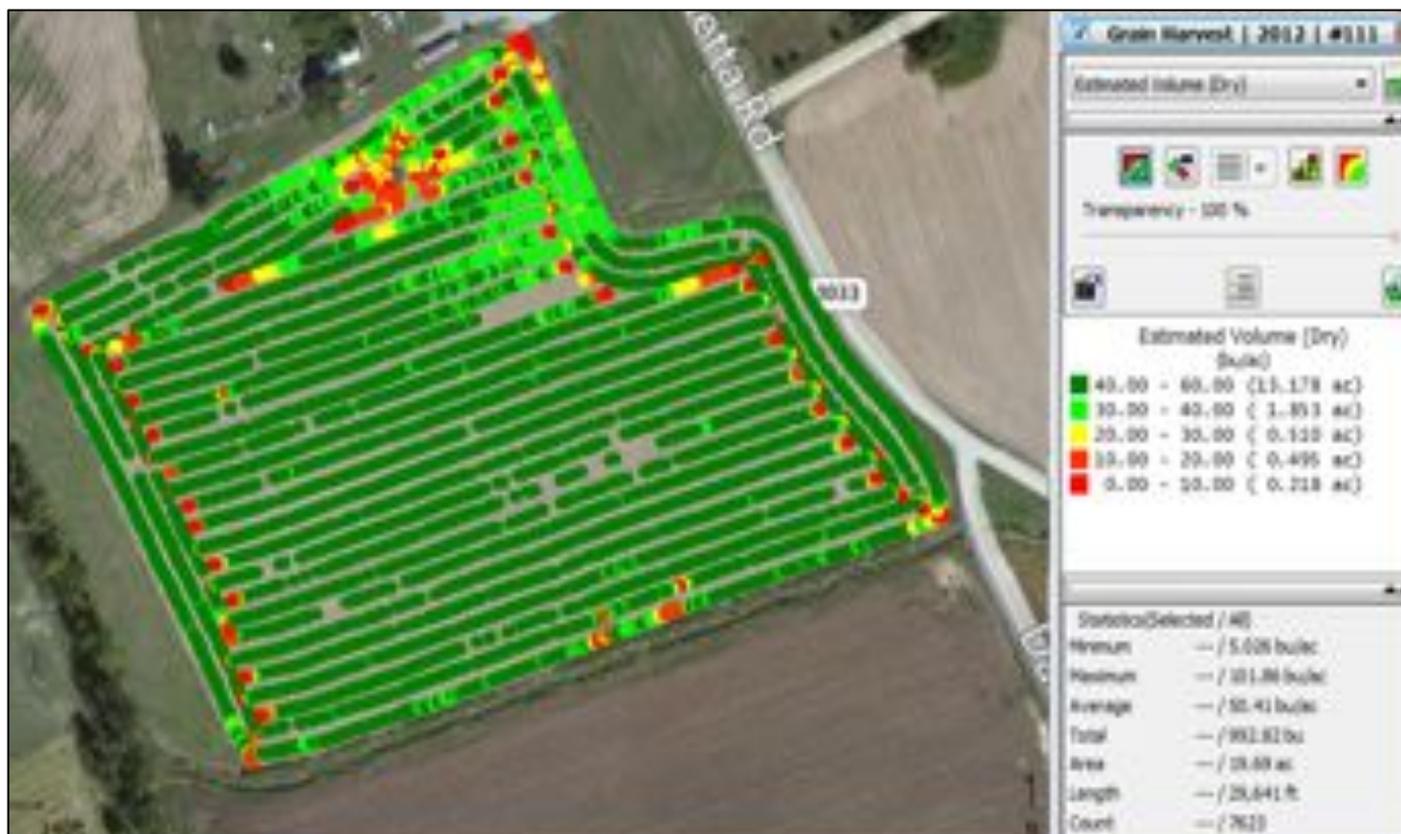
Data Collection and Analysis
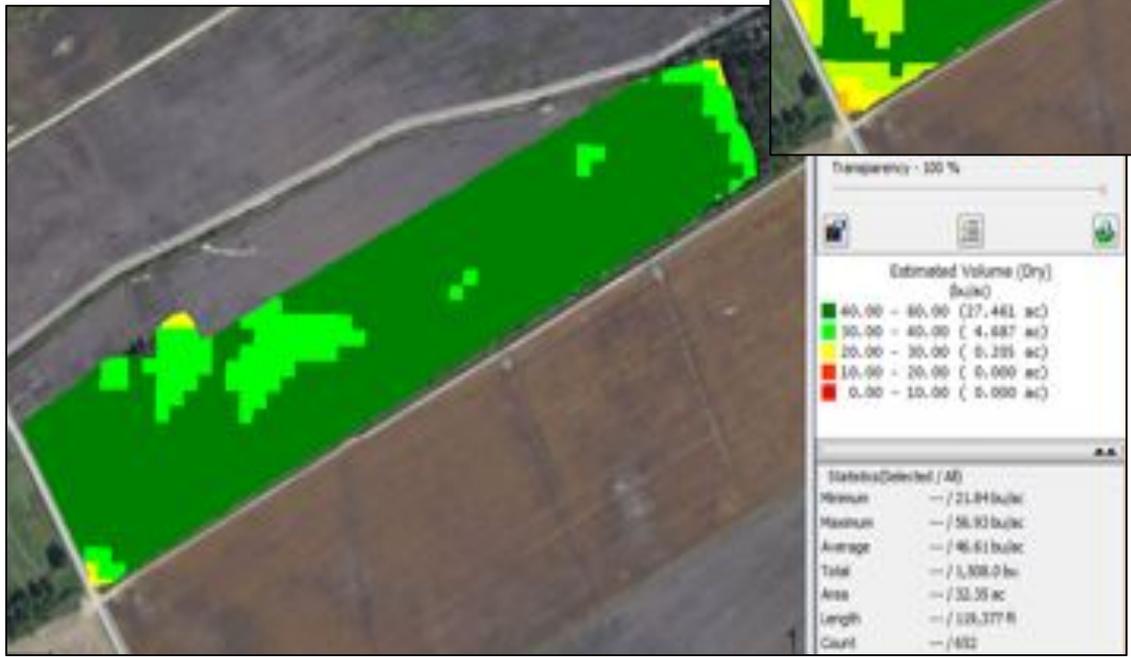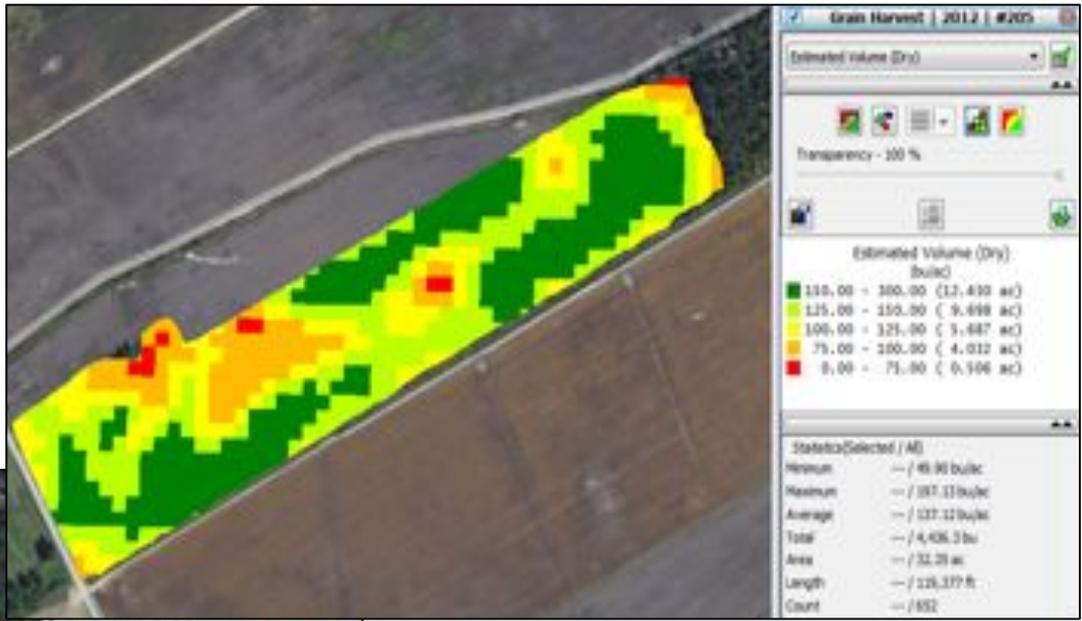
- **Comparing Yield to Soil Type**
- **Soil survey data:**

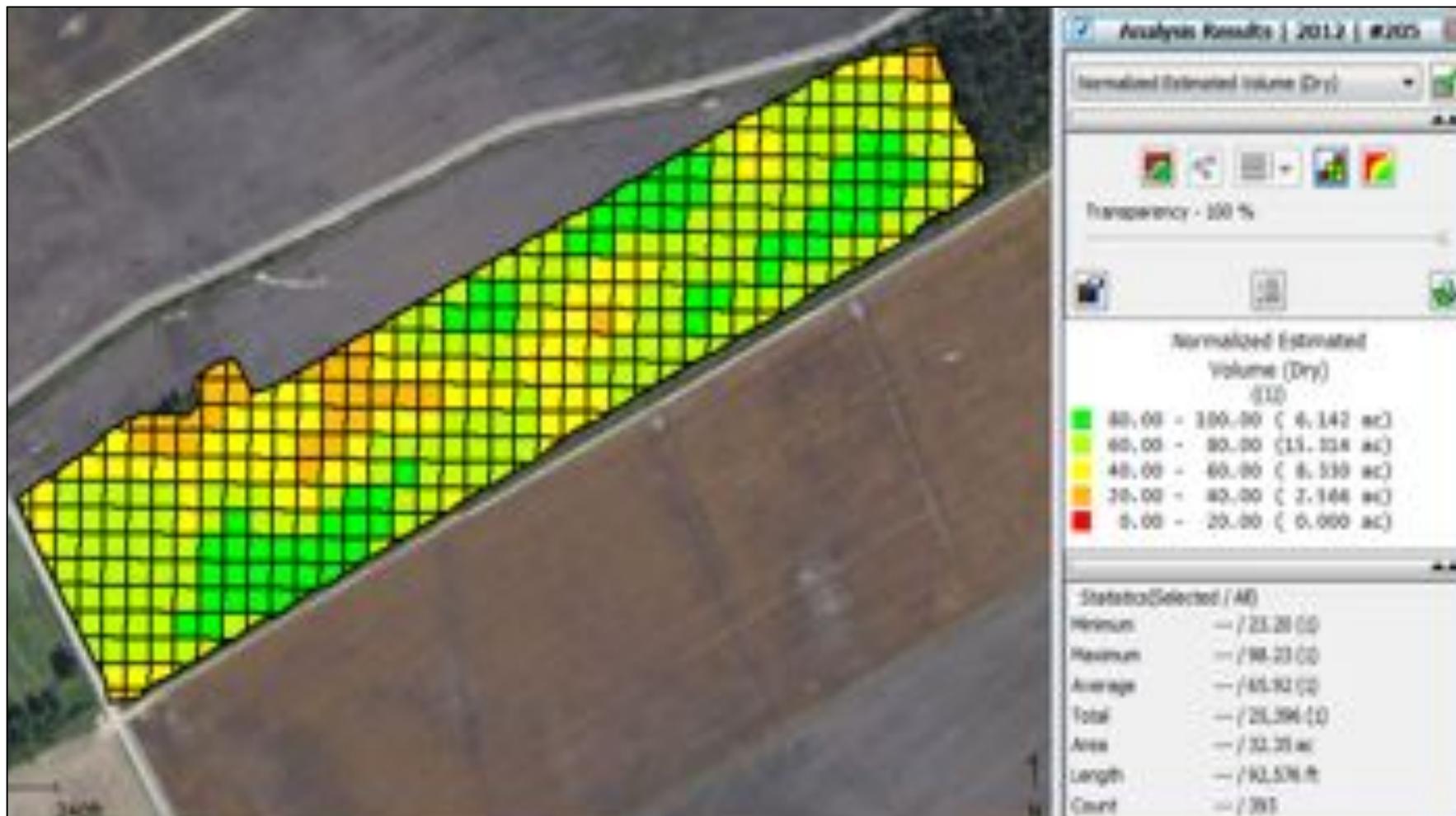# Data Collection and Analysis

- **Comparing Analysis Results:**

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Yield Data Normalization

- **Corn (right)**
- **Soybean (below)**

Yield Data Normalization

- **Multi-year analysis using different crops:**

Yield Data Normalization

- **Provides a yield range in % (not bu/ac)**
- **Allows for comparison with different crops**
- **Still need to consider the "year" (wet or dry)**
- **Baseline yield data (3-5 years) is good starting point**
- **May be useful for:**
  - **Identifying management zones**
  - **Locating test plots**
  - **Evaluating management changes**
- **Next step…yield "stability" maps**

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Automated Data Processing

- **Automated processing is our goal (saves time)**
  - **Data analysis or Rx map development**
  - **Accurate data is <u>critical</u>**
  - **Good data in = Good data out**
  - **Bad data in = _____**
- **Processing yield data is a good idea:**
  - **Improves total harvested grain estimates? No**
  - **Improves accuracy of information gained? Yes**
- **Yield Editor software, USDA (free download)**

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Data Filtering and Processing

- **Raw yield data contains errors:**

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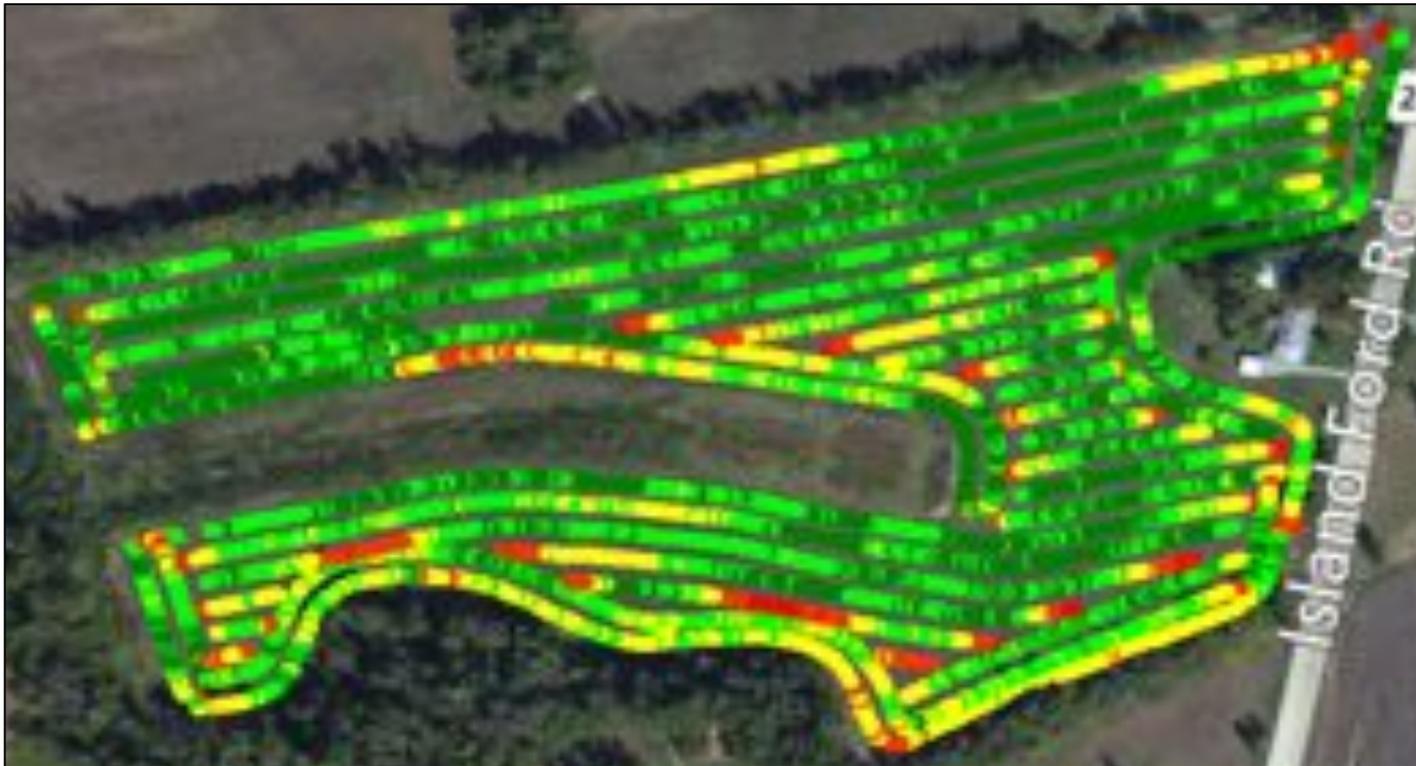
Data Filtering and Processing

▪ **Yield Editor Software (USDA):**

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Data Filtering and Processing

- **Processing (Yield Editor) can remove errors:**
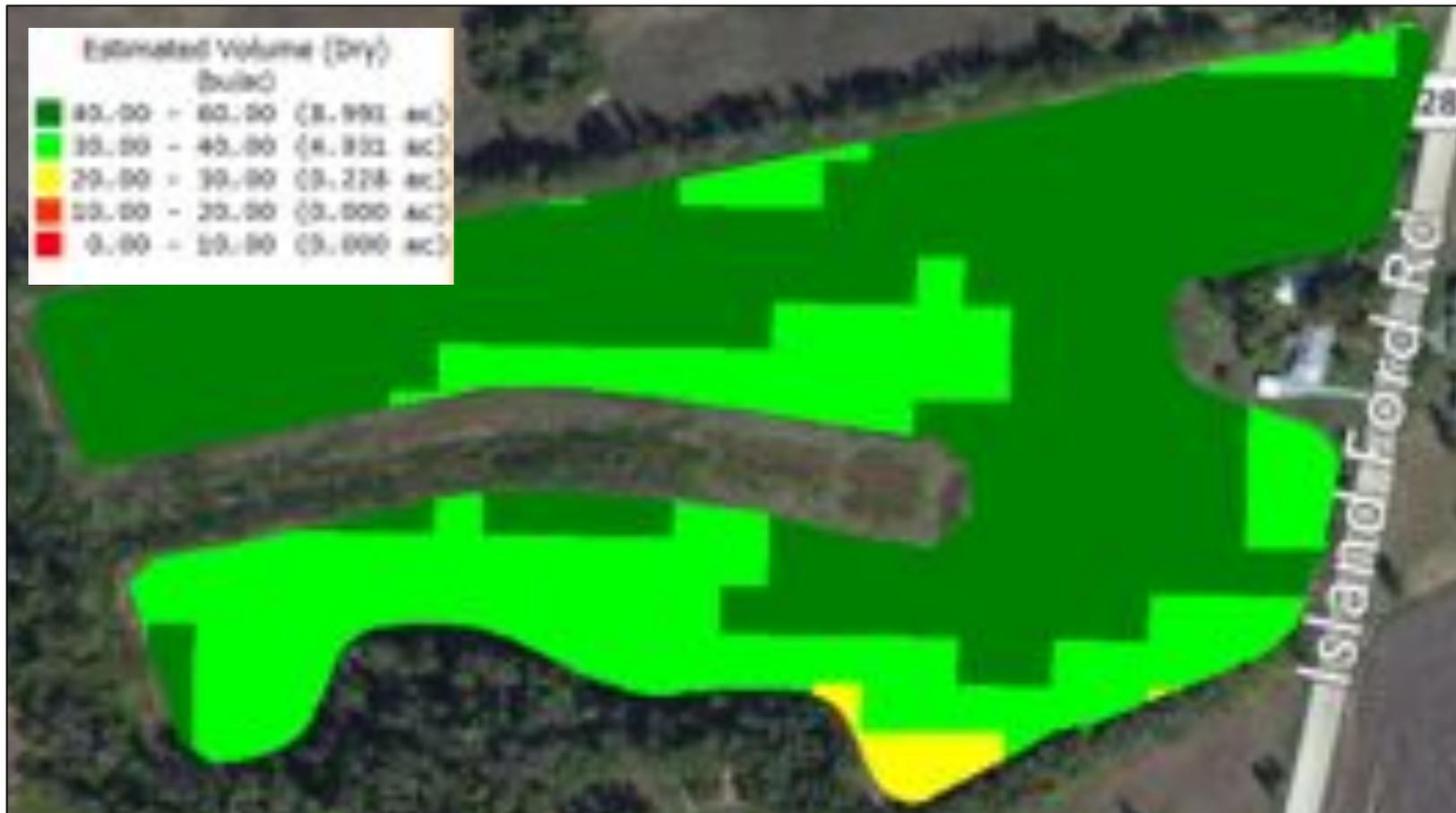

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Data Filtering and Processing

- **Interpolating with raw points to create a grid:**
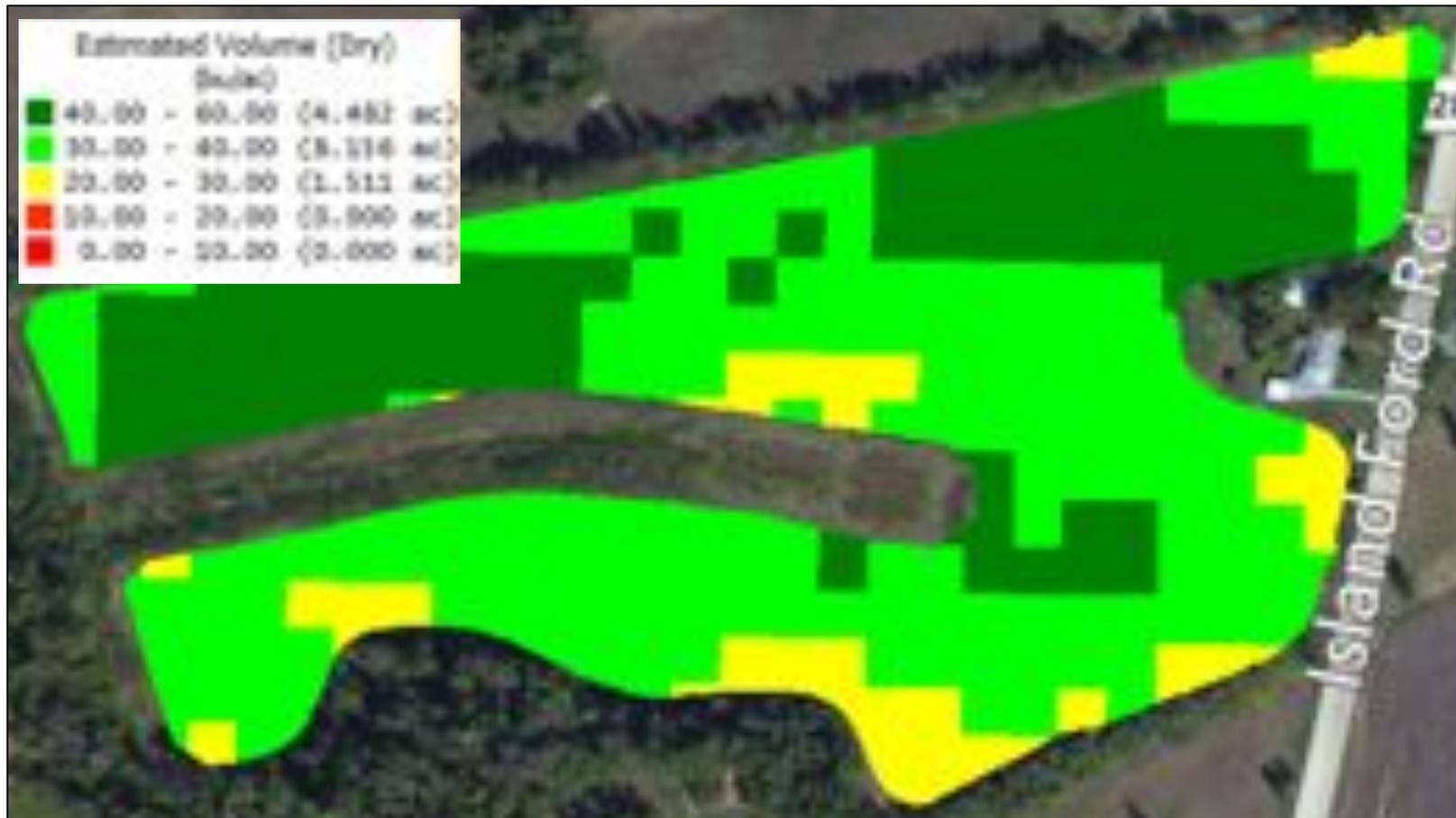
Data Filtering and Processing

- **Interpolating with the filtered data:**

Raw versus Cleaned Grid Data

Contour (zone) maps?

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Telematics and Analytics

- **Telemetry:**
  - **Data transmission from source to central**
  - **Storage, processing and analysis at central**
  - **Transmission back to source, remote control**
  - **Mobile-central or source-to-source transmission**
- **Analytics:**
  - **Finding or detecting patterns in data**
  - **Computer programming and statistical analysis**
  - **Data visualization and communication**
  - **Provides information for decision-making**

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Telematics and Analytics

- **Telemetry has numerous Ag applications:**
  - **Weather data**
  - **Soil moisture status**
  - **Grain bin monitoring**
  - **Machine performance**
  - **Irrigation systems**

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Telematics and Analytics

- **Analytics follow the data:**
    - **Industrial/Marketing**
    - **Healthcare**
    - **Social Media**
- **Ag systems are starting to generate large datasets**
    - **May range from 0.25 to 2.5 MB/operation/acre**
    - **What data do we really want/need?**
- **BIGDATA**
    - **New U.S. R&D Initiative**
    - **How to manage/utilize HUGE datasets**

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Thank You!

- **Questions/Comments?**
- **Feel free to contact me:**

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