Remote Sensing Experience in Production Fields*

*Funding provided by Wisconsin Corn Promotion Board, Wisconsin Soybean Marketing Board and North Central Soybean Research Program. The UW-Madison Environmental Remote Sensor Center provided support for processing remotely sensed data.
Objectives:

- Evaluate remotely sensed data and relate to anomalies found on the ground.
- Evaluate multi-spectral and hyper-spectral remotely sensed data with respect to crop health.
- Evaluate issues associated with collecting remotely sensed data on production fields.
Application of Remote Sensing in Precision Agriculture

• Improve crop scouting efficiency by identifying field anomaly locations

• Identify cause of the field anomaly
Characteristics of Remote Sensing

• Spatial resolution - size of smallest object observed
• Spectral response - spectral bands - color (visible) and infrared
• Spectral resolution - differentiate between spectral bands
• Frequency of coverage
Data Collection

- Fields (Seven crop production fields in corn soybean rotations from 35 to 105 acres)
- Field data
- Remotely sensed data
- Duration - 2 to 5 seasons
The map illustrates the location of the WI Soybean Project Fields. The fields are marked by green icons on a map of Wisconsin. The locations are labeled as follows:

- Siewert
- Franz
- Punwick
- Caldwell
- Watzke
- Stone Corp
- Madison
Field data

• Soil sampling, 1 acre grid, once during initial season
• Plant stand
• Plant height
• Field scouting-anomalies
• Yield
• Moisture
Sources of Remotely Sensed Data

• Aircraft
  NASA-ATLAS (15)*
  Airborne Data Systems(7)
  3di LLC(16)
  Spectral Visions(120)
• Satellite(4)
• Radiometer, Handheld(8)

* Number of bands
**Sources of Remotely Sensed Data (cont.)**

**NASA ATLAS Spectral Coverage (15 bands)**

<table>
<thead>
<tr>
<th><strong>Visible - 4</strong></th>
<th><strong>Wavelength (nm)</strong></th>
<th><strong>Color</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>450-520</td>
<td>Blue</td>
</tr>
<tr>
<td></td>
<td>520-600</td>
<td>Green</td>
</tr>
<tr>
<td></td>
<td>600 - 630</td>
<td>Orange</td>
</tr>
<tr>
<td></td>
<td>630 - 690</td>
<td>Red</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Infrared (Near) - 4</strong></th>
<th><strong>Wavelengths (nm)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>690 - 760</td>
</tr>
<tr>
<td></td>
<td>760 - 900</td>
</tr>
<tr>
<td></td>
<td>1550 - 1750</td>
</tr>
<tr>
<td></td>
<td>2080 - 2350</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Infrared (Thermal) - 6</strong></th>
<th><strong>Wavelengths (nm)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8200 - 8600</td>
</tr>
<tr>
<td></td>
<td>8600 - 9000</td>
</tr>
<tr>
<td></td>
<td>9000-9400</td>
</tr>
<tr>
<td></td>
<td>9600-10200</td>
</tr>
<tr>
<td></td>
<td>10200-11200</td>
</tr>
<tr>
<td></td>
<td>11200 - 12200</td>
</tr>
</tbody>
</table>

nm-nanometers
Sources of Remotely Sensed Data (cont.)

Spectral Visions:
  Number of Bands: 120
  Range: 471-828 nm (3 nm widths)

3di LLC:
  Number of Bands: 16
  Range: 530 - 900 nm

Airborne Data Systems
  Number of Bands: 7
  Range: 400 - 1400 nm
Sources of Remotely Sensed Data (cont.)

Okonos:

Number of Bands: 4
Visible - 3(480, 551, 665), NIR - 1(805)
Sources of Remotely Sensed Data (cont.)

Okonos:
  Number of Bands: 4
  Visible - 3(480, 551, 665), NIR - 1(805)

Radiometer (Handheld)
  Number of Bands: 8
  Range: 460-810
## Image Data Collected of Targeted Agricultural Fields

### 1997
1. May 12. Airborne Data Systems Multispectral and Thermal
2. July 5. Airborne Data Systems Multispectral
4. September 26. ATLAS 15-band and CIR photography

### 1998
1. July 20. Airborne Data Systems Multispectral
2. September 9. Airborne Data Systems Multispectral

### 1999

### 2000
1. July 12. Radiometer, Handheld
2. August 5. Airborne Data Systems Multispectral

### 2001
1. May 5. Ikonos
2. July 10. Ikonos
3. August 21. 3di Multispectral
4. August 23. Ikonos

Other data sets:
- Dane Co. 1m orthophotos
- Assorted GIS coverages
NASA-ATLAS
Near-Infrared (nm)
690-760
760-900
1550-1750
Soybean Yield Map
Soybean Yield Map

Remotely Sensed Data:
630-690 (Red)
690-760 (NIR)
760-900 (NIR)
Causes of some anomalies

- Perennial weeds
- Spray skips
- Wheel tracks (from POST herbicide application)
- White mold
- Waterways
Need a cloudless sky

Satellite Image

July 10, 2001

File: Po-73601 nrg

Field of Interest
Problem:
Error in Flight Altitude- Flying 250 feet lower than planned
Problem:

Error in Flight
Altitude- Flying
250 feet lower than planned
Concluding Remarks:
Remotely sensed data can be used to identify anomaly areas
Concluding Remarks:
Remotely sensed data can be used to identify anomaly areas
Conditions for collecting remotely sensed data - cloudless skies
Concluding Remarks:
Remotely sensed data can be used to identify anomaly areas
Conditions for collecting remotely sensed data - cloudless skies
Remotely sensed data needed:
  Spatial resolution 3 to 6 feet
  Spectral bands: 3 in visible and one in near-infrared
Concluding Remarks:
Remotely sensed data can be used to identify anomaly areas
Conditions for collecting remotely sensed data - cloudless skies
Remotely sensed data needed:
  Spatial resolution 3 to 6 feet
  Spectral bands: 3 in visible and one in near-infrared
Collection must be timely
Concluding Remarks:
Remotely sensed data can be used to identify anomaly areas.
Conditions for collecting remotely sensed data - cloudless skies.
Remotely sensed data needed:
- Spatial resolution 3 to 6 feet
- Spectral bands: 3 in visible and one in near-infrared
Collection must be timely.
Data availability must be timely.
Concluding Remarks:
Remotely sensed data can be used to identify anomaly areas
Conditions for collecting remotely sensed data - cloudless skies
Remotely sensed data needed:
  Spatial resolution 3 to 6 feet
  Spectral bands: 3 in visible and one in near-infrared
Collection must be timely
Data availability must be timely
Data must be consistent