An Evaluation of Single Crop Planting Intensity and Crop Rotation Patterns in Nebraska, Iowa and Illinois 2004-2008

Claire Boryan, Mike Craig, Patrick Willis
USDA/NASS
NASS Overview

Provider of timely, accurate, and useful statistics in service to U.S. agriculture
Remote Sensing Acreage Estimation Program

Objectives

- “Census by Satellite”
  - Without area duplication
  - Major corn and soybean regions

- Provide timely, accurate, useful independent estimates
  - Measurable error
  - County and state level

- Output crop specific Cropland Data Layer
  - Distribute to public at the cost of reproduction
    - NRCS Geospatial Data Gateway
  - Publish accuracy statistics/metadata
  - County and state level
Kansas 2008 Cropland Data Layer

Land Cover Categories
(Ordered by Decreasing Acreage)

Agricultural
- Winter Wheat
- Corn
- Sorghum
- Soybeans
- Alfalfa
- Sunflowers
- Rye
- Cotton
- Other Small Grains
- Clover/Wildflowers
- Oats
- Potatoes
- Seed/Sod Grass
- Canola
- Millet
- Other Crops
- Barley
- Other Tree Nuts
- Peas
- Apples
- Misc. Vgs. & Fruits

Non-Agricultural
- Grass/Pasture/Non-Ag
- Urban/Developed
- Woodland
- Fallow/Idle Cropland
- Water
- Wetlands
- Shrubland
- Barren
Cropland Data Layer Program

• Inputs
  – Resourcesat-1 AWiFS imagery
  – Farm Service Agency – Common Land Unit
  – Ancillary data
  – Commercial software suite

• Outputs
  – Acreage Estimates
  – Cropland Data Layer
Goals of Single Crop Planting Intensity and Crop Rotation Assessment

To determine the specific counties with high percentages of single crop planting intensity and derive the predominant crop rotation patterns in Nebraska, Iowa and Illinois.

Corn

Soybeans
Single Crop Planting Intensity Methodology

1. Inputs include: Cropland Data Layers (CDLs) for 2004-2008

2. CDLs are recoded such that crop under evaluation = 1

3. The recoded CDL’s are added together using the ERDAS Imagine Modeler

4. The output is the Crop Intensity Image which is ready for evaluation
Single Crop Planting Intensity, 2004 - 2008
Nebraska, Iowa and Illinois

Cropland Data Layers (CDLs) utilized in assessment: 2004 - 2008
## Corn Planting Intensity in Nebraska 2004 - 2008

### Years Planted to Corn

<table>
<thead>
<tr>
<th>County</th>
<th>Hall County</th>
<th>Chase County</th>
<th>Dawson County</th>
<th>State Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 years in a row planted to corn</td>
<td>43%</td>
<td>28%</td>
<td>21%</td>
<td>7%</td>
</tr>
<tr>
<td>4 out of 5 years planted to corn</td>
<td>22%</td>
<td>21%</td>
<td>29%</td>
<td>13%</td>
</tr>
</tbody>
</table>

### Diagram

- Dawson, NE
- Chase, NE
- Hall, NE

- Map of Nebraska with color-coding indicating years planted to corn.
Corn Planting Intensity, 2004 - 2008
Hall County, Nebraska

<table>
<thead>
<tr>
<th>Hall County</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 years in a row planted to corn: <strong>43%</strong> <em>(5% &gt; than 2003-2007)</em></td>
</tr>
<tr>
<td>4 out of 5 years planted to corn: <strong>22%</strong> <em>(2% &lt; than 2003-2007)</em></td>
</tr>
</tbody>
</table>

AWiFS 8/13/2007
Bands 3/4/2
Red/Green/Blue

Percentages derived from total acreage in corn production
## Dawson County

<table>
<thead>
<tr>
<th>Years Planted to Corn</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>21%</td>
</tr>
<tr>
<td>(1% &gt; than 2003-2007)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>29%</td>
</tr>
<tr>
<td>(1% &gt; than 2003-2007)</td>
<td></td>
</tr>
</tbody>
</table>

Percentages derived from total acreage in corn production.
Why is the continuous cropping of corn sustainable in Nebraska?

Irrigation from the High Plains Aquifer

http://co.water.usgs.gov/nawqa/hpgw/images/figure1.jpg

USGS
# Corn Planting Intensity in Iowa
## 2004 - 2008

### Delaware County
- 5 years in a row planted to corn: **19%**
- 4 out of 5 years planted to corn: **25%**

### Hamilton County
- 5 years in a row planted to corn: **9%**
- 4 out of 5 years planted to corn: **16%**

### Dubuque County
- 5 years in a row planted to corn: **16%**
- 4 out of 5 years planted to corn: **16%**

### Iowa State Totals
- 5 years in a row planted to corn: **3%**
- 4 out of 5 years planted to corn: **9%**

Percentages derived from total acreage in corn production
Corn Planting Intensity, 2004 - 2008
Delaware County, Iowa

Delaware County, IA

5 years in a row planted to corn: 19%
(4% > than 2003-2007)

4 out of 5 years planted to corn: 25%
(3% < than 2003-2007)

AWiFS 8/10/2007
Bands 3/4/2
Red/Green/Blue

Percentages derived from total acreage in corn production
Corn Planting Intensity
5 years vs. 9 years
Illinois

Years Planted to Corn

2004-2008

2000-2008

Years Planted to Corn

0
1
2
3
4
5
6
7
8
9
Corn Planting Intensity in Illinois 2004 - 2008

**Bureau County**
- 5 years in a row planted to corn: 14%
- 4 out of 5 years planted to corn: 20%

**Illinois County**
- 5 years in a row planted to corn: 16%
- 4 out of 5 years planted to corn: 26%

**Ogle County**
- 5 years in a row planted to corn: 13%
- 4 out of 5 years planted to corn: 24%

**Illinois State Totals**
- 5 years in a row planted to corn: 5%
- 4 out of 5 years planted to corn: 10%

Percentages derived from total acreage in corn production
Trending toward increased levels of single crop planting to corn: 2004 - 2008

Percent increase - 5 years planted to corn from 2003-2007 assessment

- All States: 1%
- Nebraska:
  - Hall: 5%
  - Dawson: 1%
  - Chase: 2%
- Iowa:
  - Delaware: 5%
  - Hamilton: 1%
  - Dubuque: 2%
- Illinois:
  - Bureau: 3%
  - Illinois: 4%
  - Ogle: 3%
Crop Rotation Methodology

1. Inputs include: Cropland Data Layers (CDLs) for 2004 - 2008

2. CDLs are recoded to
   **2008**: Corn: 1, Soy: 2, Other: 3
   **2007**: Corn: 10, Soy: 20, Other: 30
   **2006**: Corn: 100, Soy: 200, Other: 300
   **2005**: Corn: 1,000, Soy: 2,000, Other: 3,000
   **2004**: Corn: 10,000, Soybeans: 20,000, Other: 30,000

3. The recoded CDLs are added together using the ERDAS Imagine Modeler

4. The output is the Crop Rotation Image which is ready for evaluation
Crop Rotation Results
Nebraska

Crop Rotation Patterns (Corn and Soybean) 04-08
As Percentage of Total Cultivated Cropland

<table>
<thead>
<tr>
<th>Crop Rotation Pattern</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn (04), Soy (05), Corn (06), Soy (07), Corn (08)</td>
<td>10.1%</td>
</tr>
<tr>
<td>Soy (04), Corn (05), Soy (06), Corn (07), Soy (08)</td>
<td>9.3%</td>
</tr>
<tr>
<td>Corn (04), Corn (05), Corn (06), Corn (07), Corn (08) (.3% &lt; than 2003-2007)</td>
<td>7.5%</td>
</tr>
</tbody>
</table>

Additional acreage into corn production (07): 309,688 acres
Additional acreage into corn production (08): 503,221 acres

Total Cultivated Cropland derived from NASS’ Nebraska 2008 CDL
Crop Rotation Results
Iowa

Crop Rotation Patterns (Corn and Soybean) 04-08
As Percentage of
Total Cultivated Cropland

<table>
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<tr>
<th>Pattern Description</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Corn (04), Soy (05), Corn (06), Soy (07), Corn (08)</td>
<td>22.5%</td>
</tr>
<tr>
<td>Soy (04), Corn (05), Soy (06), Corn (07), Soy (08)</td>
<td>22.7%</td>
</tr>
<tr>
<td>Corn (04), Corn (05), Corn (06), Corn (07), Corn (08) (.75% &gt; than 2003-2007)</td>
<td>3.8%</td>
</tr>
</tbody>
</table>

Additional acreage into corn production (07):
124,261 acres

Additional acreage into corn production (08):
200,580 acres

Total Cultivated Cropland derived from NASS’ Iowa 2008 CDL
Crop Rotation Results
Illinois

Crop Rotation Patterns (Corn and Soybean) 04-08
As Percentage of
Total Cultivated Cropland

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<tr>
<td>Soy (04), Corn (05), Soy (06), Corn (07), Soy (08)</td>
<td>16.5%</td>
</tr>
<tr>
<td>Corn (04), Corn (05), Corn (06), Corn (07), Corn (08) (1.4% &gt; than 2003-2007)</td>
<td>5.26%</td>
</tr>
</tbody>
</table>

Additional acreage into corn production (07): 148,234 acres
Additional acreage into corn production (08): 112,758 acres

Total Cultivated Cropland derived from NASS’ Illinois 2008 CDL
Conclusions

- Historic Cropland Data Layer image products (2004-2008) of Nebraska, Iowa and Illinois were utilized to evaluate continuous corn and soybean cropping patterns. Counties with high rates of continuous corn cropping were identified.

- Nebraska had the highest rates of corn cropping intensity fed by irrigation from the High Plains Aquifer.

- Analysis of crop rotation patterns indicate a predominant corn/soybean rotation in all three states with Nebraska experiencing the highest rate of continuous cropping to corn and adding the largest percentage of new acreage (over 500,000 acres) into corn production in 2008.
Thank You

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