Research to Operational: A Paradigm Shift for the Cropland Data Layer Program

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USDA/NASS
NASS Overview

Provider of timely, accurate, and useful statistics in service to U.S. agriculture
Cropland Data Layer 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

- Deliver estimates months earlier
  - October estimates ( Operational) to meet Agricultural Statistics Board deadline
  - December estimates (Research)
Acreage estimates are essential for:

- the smooth operation of Federal farm programs.
- farmers who rely on them in making production and marketing decisions.
Acreage estimates are essential for…….

- planning and administering Federal and State programs in areas such as conservation, environmental quality, trade and food safety.

- agribusiness including: the transportation sector, storage companies, banks and other lending institutions, commodity traders and food processors.
Agenda

- **Acreage Program Updates**
  - Advanced Wide Field Sensor (AWiFS)
  - Ground truth: FSA/CLU + 578 & NLCD
  - Ancillary data sets
  - Commercial software suite

- **What’s next**
Cropland Data Layers
1997 - 2007
Cropland Data Layer Components

- AWiFS sensor
IRS Resourcesat-1 AWiFS Imagery

340 km swath per head
740 km combined

5-day revisit

4 spectral bands
- B2: 0.52 - 0.59
- B3: 0.62 - 0.68
- B4: 0.76 – 0.86
- B5: 1.55 – 1.7

56 m nadir/70 m field edges

Data provided by Arctic Slope Regional Corporation

13 Aug 2007
AWiFS Imagery Time Series

May 18

June 21

July 15

August 27
Cropland Data Layer Components

- **AWiFS sensor**

- **Common Land Unit/578 Admin Data**
  - USDA/Farm Service Agency
    - Training/testing datasets
  - NLCD 2001 (non agriculture)
  - Ancillary datasets
    - MODIS, NED, NLCD Canopy, NLCD Impervious
Ground Truth - Agriculture

- Farm Service Agency (FSA)
  - Common Land Unit (CLU)
  - 578 reporting data

NASS June Agricultural Survey (JAS) data still used for acreage estimation
Ground Truth - Agriculture

NASS June Agricultural Survey (JAS) data still used for acreage estimation
Ground Truth – Non Agricultural

- Proportional sampling
- Use categorized 2001 National Land Cover Dataset from USGS
Ancillary Data – USGS Products

Elevation

Slope

Aspect

Impervious

Canopy
MODIS NDVI Imagery

NASA MODIS Terra (16-day NDVI composite)
Time series of current growing season
Fall scenes from previous year
Image Timing

Crop Progress: Corn in Iowa, 2007

Crop Progress: Soybeans in Iowa, 2007

http://www.nass.usda.gov/Charts_and_Maps/Crop_Progress_&_Condition/
Cropland Data Layer Components

- AWiFS sensor
- Common Land Unit/578 Admin Data
  - USDA/Farm Service Agency
- Ancillary data sets
- Commercial software suite
Commercial Software Suite

- Imagery Preparation
  - Leica Geosystems ERDAS Imagine

- Image classification
  - Decision tree software
    - See5.0 [www.rulequest.com](http://www.rulequest.com)

- Ground Truth Preparation
  - ESRI ArcGIS

- Acreage Estimation
  - SAS/IML workshop
Example Classification Subset

CDL Classification

Resourcesat-1 AWiFS, 13 Aug 2007
Non Ag NLCD Updates (urban sprawl)
Non Ag NLCD Updates (forest clearing)
# Accuracy Assessment

<table>
<thead>
<tr>
<th>Crop-specific covers only</th>
<th>Correct</th>
<th>Accuracy</th>
<th>Error</th>
<th>Kappa</th>
<th>User's</th>
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<td>Clover/Wildflowers</td>
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<td>Fallow/Idle Cropland</td>
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<td>30612</td>
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<tr>
<td>Other Tree Nuts &amp; Fruit</td>
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<td>69</td>
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<td>66.18%</td>
<td>0.3382</td>
<td>83.13%</td>
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</tbody>
</table>

*Correct Pixels represents the total number of independent validation pixels correctly identified in the error matrix.
Regression-based Acreage Estimator

Regression used to relate categorized pixel counts to the ground reference data

- (X) – Cropland Data Layer (CDL) classified acres
- (Y) – June Agricultural Survey (JAS) reported acres

Using both CDL and JAS acreage results in estimates with reduced error rates over JAS alone

Outlier segment detection - correction or removal from regression analysis

Acreage not just about counting pixels
2007 State Level Estimates +/- 2% CVs

% Over/Under ASB Final

Source of Estimate

IA  IL  IN  MN  NE

Corn  Soybeans
CDL 2008 Status

- **Operational Program**
  - Early delivery of estimates
    - Winter Wheat - June
    - Corn and Soybeans - mid-August & mid-October

- **Expand geographic scope?**
  - Wheat states next priority
  - Cotton, Durum and Spring Wheat

- **Derivatives?**
  - Change detection
  - Crop rotation patterns
Thank You

Claire Boryan, Rick Mueller, Mike Craig, Dave Johnson, Bob Seffrin, Patrick Willis, Larry Beard, Zhengwei Yang and Lee Ebinger

www.nass.usda.gov
datagateway.nrcs.usda.gov