National Agricultural Statistics Service
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USDA has over 65,000 ESRI desktop licenses
Research, Education and Economics (REE) Mission Area

Agricultural Research Service

Economic Research Service

National Agricultural Statistics Service

National Institute of Food and Agriculture
NASS MISSION:

To provide timely, accurate, and useful statistics in service to U.S. agriculture

http://www.nass.usda.gov/
National Agricultural Statistics Service

- Agency in U.S. Department of Agriculture
  - Non-policymaking
  - Non-political -- career staff
  - Independent, objective, unbiased appraisers of Nation’s agriculture
NASS Regional Offices

12 regional offices
What does NASS do?

- Administer USDA’s Statistical Estimating Program
- Conduct the 5-year Census of Agriculture
- Coordinate Federal/State agricultural statistical needs
- Provide statistical consulting for Federal/State governments, universities, and other countries
- Collect and summarize agricultural data under reimbursable agreements
- Conduct statistical research
NASS issues about 500 statistical reports each year and about 9,000 reports and news releases.
A release schedule provides the dates for when the data is available.
Major Geospatial Products and Programs

- Survey Based State/County Estimates
- Census of Agriculture
- Vegetation Condition
- Cropland Data Layer
- Area Sampling Frame
Survey based estimates
Both estimates and census data can be accessed using *Quick Stats* interactive statistical database.

Survey and census statistical tabulate data were represented in county level charts and maps.

Data & Maps accessible at: [www.nass.usda.gov](http://www.nass.usda.gov)
Planted Acres
Harvested Acres

Corn for Grain 2007
Harvested Acres by County

Corn for Grain 2008
Harvested Acres by County

Corn for Grain 2009
Harvested Acres by County for Selected States
Yield Per Harvested Acre
Production

Corn for Grain 2007 Production by County

Bushels
- Not Estimated
- < 1,000,000
1,000,000 - 4,999,999
5,000,000 - 9,999,999
10,000,000 - 14,999,999
15,000,000 - 19,999,999
20,000,000 +

U.S. Department of Agriculture, National Agricultural Statistics Service

Corn for Grain 2008 Production by County

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U.S. Department of Agriculture, National Agricultural Statistics Service

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U.S. Department of Agriculture, National Agricultural Statistics Service
Census of Agriculture

- Census of Agriculture is conducted every 5 years
  - A complete accounting of crops and livestock on all farms
  - Collects information on operator characteristics, demographics, income and expenses

  - The 2012 Census of Agriculture is in processing and will be available soon.

- Users can view, query, print or download Census tablea and static maps.

- Data can be downloaded as csv files for use in a spreadsheet or in a GIS
250 Static Atlas Maps for each census are available in the following areas

- Crops and Plants
- Economics
- Farms
- Livestock and Animals
- Operators
Choropleth (shaded) Maps

Average Size of Farms in Acres: 2007

United States Average: 418

0 200 Miles

0 100 Miles

U.S. Department of Agriculture, National Agricultural Statistics Service
Dot Density Maps

Number of Farms: 2007

1 Dot = 200 Farms

United States Total 2,204,792

U.S. Department of Agriculture, National Agricultural Statistics Service
Farms

Average Size of Farms in Acres: 2007

United States Average: 413

Source: U.S. Department of Agriculture, National Agricultural Statistics Service
Farms

Acres of Land in Farms as Percent of Land Area in Acres: 2007

Percent
Less than 10
10 - 29
30 - 49
50 - 69
70 - 89
90 or more

United States 46.8 Percent

U.S. Department of Agriculture, National Agricultural Statistics Service

07-M079
Farms

Percent of Farms with Internet Access

Percent
Less than 40
40 - 49
50 - 59
60 - 69
70 or more

United States
56.5 Percent

U.S. Department of Agriculture, National Agricultural Statistics Service
Total Farm Production Expenses: 2007

1 Dot = $20,000,000

United States Total
$241,113,666,000
Expenses for Gasoline, Fuels, and Oils as Percent of Total Farm Production Expenses: 2007

Percent
- Less than 4
- 4 - 5
- 6 - 7
- 8 - 9
- 10 - 11
- 12 or more

United States 5.4 Percent

0 200 Miles

0 100 Miles

U.S. Department of Agriculture, National Agricultural Statistics Service
Operators

Percent of Farms with Female Principal Operator: 2007

United States 12.9 Percent

U.S. Department of Agriculture, National Agricultural Statistics Service
Crops

Corn for Grain, Harvested Acres: 2007

1 Dot = 10,000 Acres

United States Total
86,246,542

U.S. Department of Agriculture, National Agricultural Statistics Service
Watershed data published at the 6 digit hydrologic unit code for 38 selected land use characteristics
Vegetation condition from VegScape:
http://nassgeodata.gmu.edu/VegScape/
Vegetation Condition Monitoring

- Daily, weekly composited from MODIS daily reflectance data
- Vegetation condition are based on NDVI, which measures vegetation vigor (greenness) caused by “photosynthetic activity”
  - Lower NDVI values are likely to show areas under stress due to
    - drought
    - excessive moisture
    - disease
  - Higher NDVI values represent healthy vegetation
- NDVI based indices are used to monitor changing vegetation conditions throughout the growing season
Vegetation Condition Indices

\[
NDVI = \frac{(IR-R)}{(IR+R)}
\]

\[
MVCI = \frac{NDVI(x, y) - NDVI_m(x, y)}{NDVI_m(x, y)} \times 100
\]

\[
RMVCI = \frac{NDVI_i(x, y) - NDVI_{med}(x, y)}{NDVI_{med}(x, y)} \times 100\%
\]

\[
RVCI = \frac{NDVI_i(x, y) - NDVI_{i-1}(x, y)}{NDVI_{i-1}(x, y)} \times 100\%
\]

\[
VCI = \frac{NDVI(x, y) - NDVI_{min}(x, y)}{NDVI_{max}(x, y) - NDVI_{min}(x, y)} \times 100\%
\]
1998 Drought in Texas

1996 Drought in Winter Wheat Areas
The USDA/NASS Cropland Data Layer Program

48 State Continental US Coverage
What is a Cropland Data Layer (CDL)?

Identifies agriculture type and location

Each pixel represents a type of crop or land cover

- **Yellow**: Corn
- **Brown**: Winter Wheat
- **Blue**: Rice
- **Green**: Soybeans
- **Red**: Cotton
- **Pink**: Alfalfa
**Cropland Data Layer (CDL) Objectives**

- **“Census by Satellite”**
  - Annually cover major program crops and regions
  - Crops accurately geo-located

- Deliver in-season remote sensing acreage estimates
  - NASS Official Reports
  - Update planted area
  - Reduce respondent burden

- Provide timely, accurate, useful estimates
  - Measurable error
  - Unbiased/independent estimator
  - State, District, County

- Public domain crop specific crop classification
  - Available @ CropScape [http://nassgeodata.gmu.edu/CropScape/](http://nassgeodata.gmu.edu/CropScape/) or
  - Google “Cropland Data Layer”
1997 – 2007 Coverage

All historical CDL products use standardized: color scheme, categories names and codes, projection, metadata.
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Cropland Data Layer Program Components

- **Inputs**
  - DMC Deimos–1, UK2 and Landsat imagery
  - Farm Service Agency – Common Land Unit
  - NASS June Ag Survey
  - Ancillary data – USGS NLCD & derivative products

- **Outputs**
  - Acreage Estimates
  - Cropland Data Layer

- **Process**
  - Supervised Classification – See 5
  - Crop Acreage Estimation using Linear Regression Model
  - Commercial software
Cropland Data Layer Inputs/Processes/Outputs

Satellite Imagery – Deimos-1, UK2 & Landsat 8

Ground Truth: Farm Service Agency Common Land Units

2006 NLCD & Derivative products

Classification

Cropland Data Layer

Major Land Cover Categories (by decreasing acreage)

Agriculture
- Pasture/Grass
- Corn
- Soybeans
- All Wheat
- Other Hay

Non-Agriculture
- Fallow Cropland
- Alfalfa
- Cotton
- Other Small Grains
- Rice

CROP ACREAGE ESTIMATES

Linear Regression

Reported = 1.34 + 1.03(Classified)
R² = 0.948

Outliers
- Deleted
- 4
- 3
- 2
Growing Season Satellite Images

April

May

June

July

August with farm data

Final CDL

Land Cover Categories

- Agriculture
- Pasture/Grass
- Alfalfa
- Fallow/Idle Cropland
- Winter Wheat
- Barley
- Cotton
- Almonds
- Corn
- Durum Wheat
Ground Truth – Land Cover

Agriculture Ground Truth
- Provided by Farm Service Agency
  - Identifies known fields and crops
- Divide known fields into 2 sets
  - 70% used for training software
  - 30% used for validating results

Non-Agriculture Ground Truth
- USGS National Land Cover Dataset
- Identifies urban infrastructure and non-agriculture land cover
  - Forest, grass, water, cities
Processing a CDL

- Satellite Imagery
- Ancillary Data
- MODIS Data
- Ground Truth

Sampling

See5

Decision Tree

Classification

Iowa Cropland Data Layer

Land Cover Categories
(Ordered by Decreasing Acreage)

- Agriculture
  - Corn
  - Soybeans
  - Pasture/Grazing
  - Alfalfa
  - Cows
  - Winter Wheat
  - Spring Wheat
  - Sweet/Coal Grass
  - Barley
  - Clover/Weeds
  - Other Crops
  - Fallow/Striped/Other
  - Durum Wheat
  - Sorghum
  - Rye
  - Dry Beans

- Non-Agriculture
  - Urban/Developed
  - Hedgerow
  - Wetlands
  - Water
  - Barren
  - Shrubland
CDL Access, Visualization, Analysis and Dissemination Platform - CropScape

http://nassgeodata.gmu.edu/CropScape/
CDL Colors & Categories

- National scope
- Capture all major crops
- Unique categories & colors
NASS Area Sampling Frame Program
How Does Agricultural Statistics Collected at NASS?

- Agriculture Census every five years
- Estimates from Remote Sensing
- Agricultural surveys
  - Estimates from samples based on NASS area sampling frames (ASFs) and list frames

… providing timely, accurate, and useful statistics in service to U.S. agriculture.”
What Is An Area Sampling Frames?

• An area sampling frame is a collection of segmented land parcels for the area of interest, such as a state. A land parcel can be defined by its attributes, such as ownership, land usage, land cover, etc.

• NASS ASFs are based on a stratification of land cover in the U.S. defined by percent cultivated cropland, i.e. all land parcels are classified different land cover categories!

• NASS Area Sampling Frames have been used as the primary tool to conduct agricultural surveys since 1954.

• The NASS Area Sampling Frames are the basis for the annual June Area Survey in which approximately 11,000 segments are enumerated in early June to collect crop acreage and other agricultural information.
Why Area Sampling Frames

Pro:
- Multiple uses for sampling units
- Frame longevity for coverage
- Robust for crop acreage
- Better performance

Con:
- Expensive
National Agricultural Statistics Service
Land Use Area Frame

Strata: Land Use
- 50% > cultivation
- 50% to 15% cultivation
- 15% < cultivation
- Low density urban
- High density urban
- Non-agriculture
- Water

0 500 1,000 Miles

[Map of the United States with different land use categories shaded]
What is an Area Frame?

Pennsylvania Area Frame
What is an Area Frame?

PSU Segments

County PSUs

Counties
Area Frame Construction Steps

1. Land Use Stratification
2. Sample Allocation
3. Sample Selection
4. Sample Preparation
Stratification is the division of a land area into broad land use categories:

<table>
<thead>
<tr>
<th>Stratum Definition</th>
<th>PA</th>
<th>Stratum</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 50% Cultivated</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>15% – 50% Cultivated</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Agri–Urban</td>
<td>31</td>
<td></td>
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<tr>
<td>Intensive Urban</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>&lt; 15% Cultivated</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Non–Agricultural</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>
Product: Land Use Stratification Map of Statewide Merged Strata Values

Stratification of Pennsylvania 1999
Workfile of PSU 118 and Segments
Program Summary

- **Survey based State/County Estimates**
  - Accessing NASS County maps and County data

- **Census of Agriculture**
  - Accessing AgAtlas maps and Census data

- **Vegetation Condition**
  - Accessing vegetation condition maps

- **Cropland Data Layer**
  - Accessing the CDL from CropScape

- **Area Sampling Frame**
Thank You

- For further questions or comments:
- Contact: zhengwei_yang@nass.usda.gov