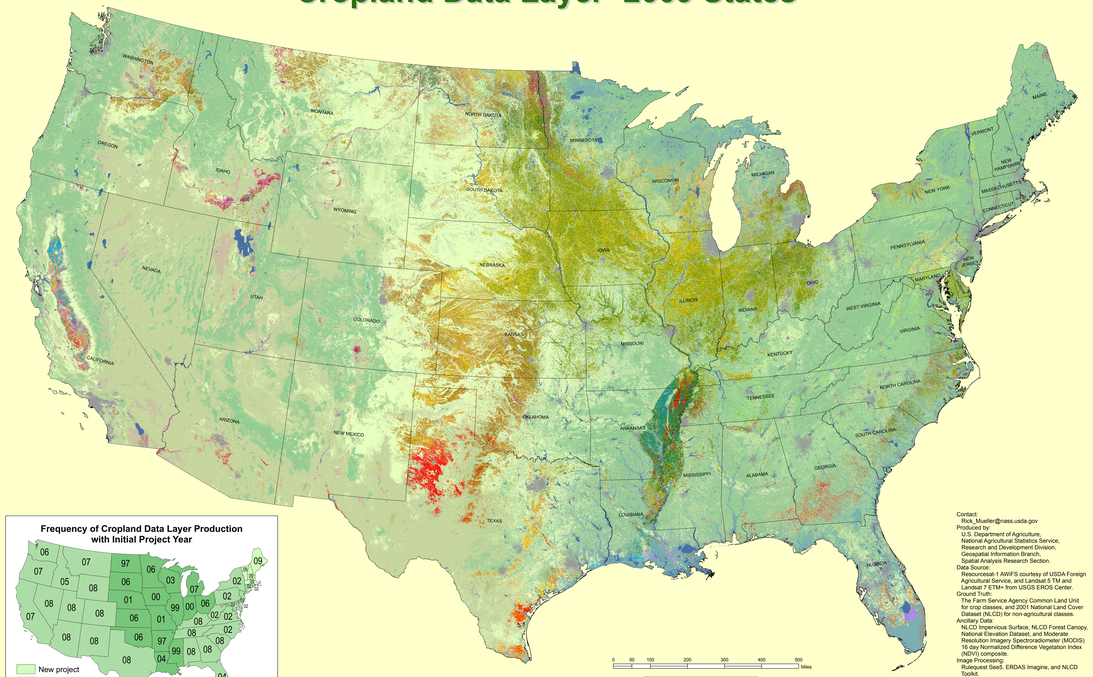
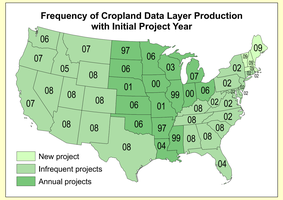
U.S. Department of Agriculture, National Agricultural Statistics Service

The Cropland Data Layer & Acreage Estimation Process

http://www.nass.usda.gov/research/Cropland/SARS1a.htm

Cropland Data Layer- 2009 States





Contact:
Rick_Mueller@nass.usda.gov
Produced by:
U.S. Department of Agriculture,
National Agricultural Statistics Service,
Research and Development Division,
Geospatial Information Branch,
Spatial Analysis Research Section.
Data Source:
Resourcesat-1 AWIFS courtesy of USDA Foreign Agricultural Service, and Landsat 5 TM and Landsat 7 ETM+ from USGS EROS Center.
Ground Truth:
The Farm Service Agency Common Land Unit for crop classes, and 2001 National Land Cover Dataset (NLCD) for non-agricultural classes.
Ancillary Data:
NLCD Impervious Surface, NLCD Forest Canopy, National Elevation Dataset, and Moderate Resolution Imagery Spectroradiometer (MODIS) 16 Day Normalized Difference Vegetation Index (NDVI) composite.
Image Processing:
Rulequest See5, ERDAS Imagine, and NLCD Toolkit.
Projection:
Albers Equal Area Conic,
North American Datum 1983.
Map Production:
ESRI ArcGIS 9.3.

Land Cover Categories (by decreasing acreage)

Agriculture

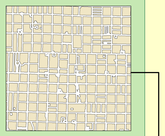
- Pasture/Grass
- Corn
- Soybeans
- Winter Wheat
- Other Hays
- Fallow/Idle Cropland
- Spring Wheat
- Alfalfa
- Cotton
- Sorghum
- W. Wht./Soy. Dbl. Crop
- Rice
- Durum Wheat
- Barley
- Sunflowers
- Oats
- Dry Beans
- Peanuts
- Oranges
- Potatoes/Sweet Potatoes
- Sugarbeets
- Seed/Sod Grass
- Peas
- Almonds
- Canola
- Sugarcane
- Walnuts/Pistachios/Pecans
- Grapes
- Misc. Vegs. & Fruits
- Millet
- Other Tree Nuts/Fruits
- Rye
- Lentils
- Apples/Cherries/Pears
- Flaxseed
- Other Crops
- Aquaculture
- Citrus
- Tomatoes
- Clover/Wildflowers
- Other Small Grains
- Safflower
- Peaches/Plums/Apricots
- Herbs
- Blueberry

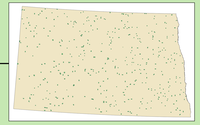
Non-Agriculture

- Woodland
- Shrubland
- Urban/Developed
- Wetlands
- Water
- Barren
- Perennial Ice/Snow

Input Vector Data

FSA Common Land Units

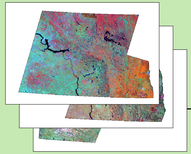




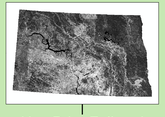
NASS JAS Segments

Input Raster Data

IRS Resourcesat-1 AWIFS, Landsat 5 TM, Landsat 7 ETM+ Spring/Summer Imagery

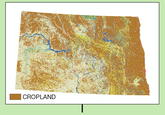


NASA Terra MODIS 16-day NDVI Mosaic



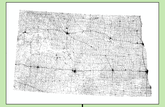
Use Prior Fall and Spring Time Series Mosaics

USGS NLCD 2001 Land Cover

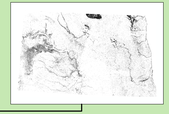


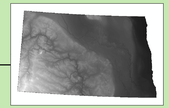
Sample Only Non-Cropland for Ground Truth

USGS NLCD 2001 Impervious



USGS NLCD 2001 Canopy





USGS NED Elevation

Input Tabular Data

NASS June Area Survey Segment Data

CropName	Seg	PSU	Co	St	Acres	Pixels
Wht_Wintr	7	140	103	ND	57	76
Wht_Wintr	11	62	41	ND	67.1	0
Wht_Wintr	19	215	55	ND	135.5	131
Wht_Wintr	57	105	99	ND	42	39
Wht_Wintr	117	22	51	ND	40	14
Wht_Wintr	120	149	101	ND	108	97
Wht_Wintr	121	34	41	ND	134.5	7
Wht_Wintr	123	66	99	ND	151.8	109
Wht_Wintr	175	181	101	ND	51	36
Wht_Wintr	185	60	75	ND	138	61
Wht_Wintr	229	84	9	ND	80	0
Wht_Wintr	81	8	73	ND	145	93
Wht_Wintr	140	159	55	ND	90	27
Wht_Wintr	143	97	41	ND	241.5	252
Wht_Wintr	34	99	95	ND	130	97
Wht_Wintr	93	110	71	ND	148	127
Wht_Wintr	99	70	105	MD	40	12
Wht_Wintr	147	109	83	ND	60	41
Wht_Wintr	206	124	55	ND	146	175
Wht_Wintr	363	16	43	ND	60	69
Wht_Wintr	366	81	23	ND	118.2	200

FSA '578' Administrative Data -- Cropping Intentions and Acreages

ST	CO	CROP	CROPTY	INT	FSA_CR	ACRES	STAT	IRR	FIELD	TRACT	YR
38	069	0091	SPE		GR	BARLEY	157.60	2	0000001	0000002	2009
38	069	0236	SOS		LS	MIXFO	0.00	2	0000001	0000047	2009
38	069	0296	GMA		FG	MIXFO	15.50	2	0000001	0000048	2009
38	069	0296	SOS		FG	MIXFO	0.00	2	0000001	0000048	2009
38	069	0296	GMA		FG	MIXFO	9.10	2	0000001	0000048	2009
38	069	0296	GMA		FG	MIXFO	6.20	2	0000001	0000048	2009
38	069	0296	GMA		FG	MIXFO	15.00	2	0000001	0000048	2009
38	069	0296	GMA		FG	MIXFO	28.90	2	0000001	0000048	2009
38	069	0296	GMA		FG	MIXFO	17.50	2	0000001	0000048	2009
38	069	0296	GMA		FG	MIXFO	56.00	2	0000001	0000048	2009
38	069	0011	HRS		GR	WHEAT	9.40	2	0000001	0000004	2009
38	069	0011	HRS		GR	WHEAT	293.10	2	0000001	0000004	2009
38	069	0011	HRS		GR	WHEAT	10.20	2	0000001	0000874	2009
38	069	0011	HRS		GR	WHEAT	69.00	2	0000001	0000874	2009
38	069	0011	HRS		GR	WHEAT	75.90	2	0000001	0000875	2009
38	069	0011	HRS		GR	WHEAT	6.50	2	0000001	0000875	2009
38	069	0011	HRS		GR	WHEAT	129.30	2	0000001	0000008	2009
38	069	0011	HRS		GR	WHEAT	4.40	2	0000001	0000008	2009
38	069	0101			FALOW		9.50	2	0000001	0000008	2009
38	069	0011	HRS		GR	WHEAT	174.50	2	0000001	0000008	2009
38	069	0011	HRS		GR	WHEAT	23.70	2	0000001	0000008	2009
38	069	0011	HRS		GR	WHEAT	121.80	2	0000001	0000009	2009
38	069	0152	NAG		FG	GRASS	0.70	2	0000001	0000009	2009
38	069	0101			FALOW		7.20	2	0000001	0000054	2009

Build Ground Truth

ESRI ArcGIS

Link and assess datasets

Agricultural ground truth

Land Cover Classification

Manage and visualize datasets

ERDAS IMAGINE® 9.1

Leica

Derive decision tree-based classification rules

RULEQUEST RESEARCH data mining tools

See5.0

Generated rule set

```
See5 [Release 2.02a]    Wed Jun 14 09:41:17 2006
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  Options:
    XX boosting trials

  Class specified by attribute 'dep'

Read 7500 cases (9 attributes) from tm-cart.data

-----  Trial 0:  -----

Decision tree:

: :...band04 > 101:
: :...band04 > 124:
: :   :...band02 <= 24:
: :   :   :...band05 <= 99:
: :   :   :   :...band03 > 19: 3 (1130/2)
: :   :   :   band03 <= 19:
: :   :   :   :...band04 <= 711: 2 (2)
: :   :   :       band04 > 711: 3 (1976/4)
: :   :   band02 > 99:
: :   :   :...band04 <= 851: 3 (9)
: :   :       band04 > 851:
: :   :       :...band04 <= 1491: 5 (4)
: :   :           band04 > 1491: 3 (3172)
: :   band04 <= 124:
: :   :...band04 <= 551:
: :       :...band04 <= 133: 3 (43)
: :       :   band04 <= 153:
: :       :   :...band02 <= 31: 3 (4/2)
: :       :       band02 > 31: 5 (2)
: :       band04 > 153:
: :       :...band03 > 21:
: :           :...band02 > 27: 2 (19/1)
: :           :   band02 <= 27:
: :           :   :...band04 <= 215: 2 (2)
: :           :       band04 > 215: 3 (57)
: :           band03 <= 21:
: :           :...band03 <= 21:
```

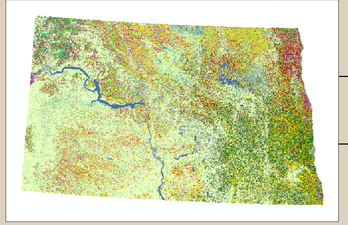
Extract Pixels

ESRI ArcGIS

Extract JAS pixels intersecting with Cropland Data Layer

Outputs

Cropland Data Layer



State	Year	CropName	Board Acres
ND	09	Barley_HV	1,130,000
ND	09	Barley_PL	1,210,000
ND	09	Corn_HV	1,700,000
ND	09	Corn_PL	1,950,000
ND	09	Dry_Beans	510,000
ND	09	Hay_Other	1,120,000
ND	09	Peas	490,000
ND	09	Soybeans	3,900,000
ND	09	Sunflowers	885,000

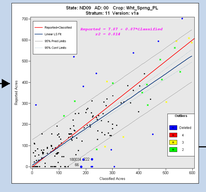
State and county crop-specific acreage statistics (for NASS internal use only)

Acreage Estimation

Customize SAS for acreage estimation

SAS®

Regression estimator: Pixel count versus reported acreage



Output Diagnostics

Confidence Layer

Accuracy Assessment

	Correct	Total	Accuracy	Error	Kappa
Overall (FSA+NLCD)	1307107	1506826	86.74%	13.26%	0.8236
FSA Crops only	1172888	1364478	85.97%	14.03%	0.7961

by Class	Correct	Total	Producer	Omission	Kappa	Total	User	Commiss	Kappa
Dry Beans	22	169722	0.0013	99.87%	0.0013	1	2200.00%	-119.72%	0.0007
Spring wheat	2,0	169584	859154	91.81%	18.09%	0.8036	155857	87.85%	14.76%	0.8422
Winter wheat	24	124163	61939	84.33%	15.78%	0.8346	62384	61.53%	38.47%	0.8077
Other grains	25	54	247	21.86%	78.14%	0.2186	93	58.06%	41.94%	0.5806
WW / Soybeans	26									
Rye	27	478	1358	35.20%	64.80%	0.3518	532	89.85%	10.15%	0.8986
Flaxseed	28	1,0	1,0	0.00%	100.00%	0.0000	1,0	0.00%	100.00%	0.0000
Millet	29	636	2190	29.13%	70.87%	0.2911	1196	53.34%	46.66%	0.5331
Speltz	30	2	6	33.33%	66.67%	0.3333	2	100.00%		1.0000
Canola	31	41284	56400	92.23%	7.77%	0.9205	74225	82.57%	17.43%	0.8221
Flaxseed	32	13998	21434	65.31%	34.69%	0.6514	16395	85.43%	14.57%	0.8534
Safflower	33	1982	2811	70.51%	29.49%	0.7049	2811	84.54%	15.46%	0.8413
Rape seed	34									
Mustard	35	1066	1480	72.09%	27.11%	0.7286	1131	96.02%	3.98%	0.9602
Alpha	36	19965	33603	56.65%	41.15%	0.5671	27340	73.03%	26.17%	0.7306
Other hays	37	134149	248111	54.07%	45.93%	0.5084	233708	57.40%	42.60%	0.5401

CROPLAND DATA LAYER PROCESSING SYNOPSIS

The **Cropland Data Layer Program** has been in development since the early 1970's. The methodology and resources used for crop identification and estimation processes in NASS are common to many remote sensing projects. Inputs include vector and tabular data to build ground truth and estimate acreage, and current satellite imagery plus derived products for the classifier. Outputs are categorized land cover imagery and acreage statistics.

The project phases are:

1) Ground data collection and preparation linking digitized Farm Service Agency (FSA) Common Land Units with 587 Administrative Data on farmers' cropping intensions and acreages, and utilizing the National Land Cover Dataset (NLCD) for non-cropland ground truth data;

2) Selection of current satellite imagery using Resourcesat-1 AWiFS and Landsat TM as primary sources and Terra MODIS as a backup source;

3) Training the decision tree classifier against the satellite and ancillary imagery based on known crop/non-crop sample information from the FSA and NLCD;

4) Building of the classification utilizing the derived decision rules;

5) Evaluation of the classifier by examining user and producer accuracies from independent ground truth;

6) Acreage estimation by regressing classified pixel counts against June Area Survey segments' reported acreages;

7) Creation of the Cropland Data Layer (CDL) -- a GIS-compatible crop-specific land cover data layer.

This technique classifies every acre in a given area and produces state and county crop acreage statistics. This can lead to more accurate seasonal assessments due to late plantings or intentions to plant during the growing season.