Sharing and Exploring Cropland Data Layer through OGC Web Services

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Cropland Data Layer (CDL)

- Released by National Agricultural Statistics Service (NASS) each year (from 1997 to 2009)

- Provide the official annual estimation of crop (i.e. corn, soybean, rice, and cotton) production in the agricultural regions like Midwestern and Mississippi Delta States

- Generated from reports of state and local field personnel and satellite pictures of the Resource Sat-1 AWiFS sensor

- Be very useful and helpful for government agencies to observer the primary crops grown and make better decisions as well as for researchers to study land use and land cover.
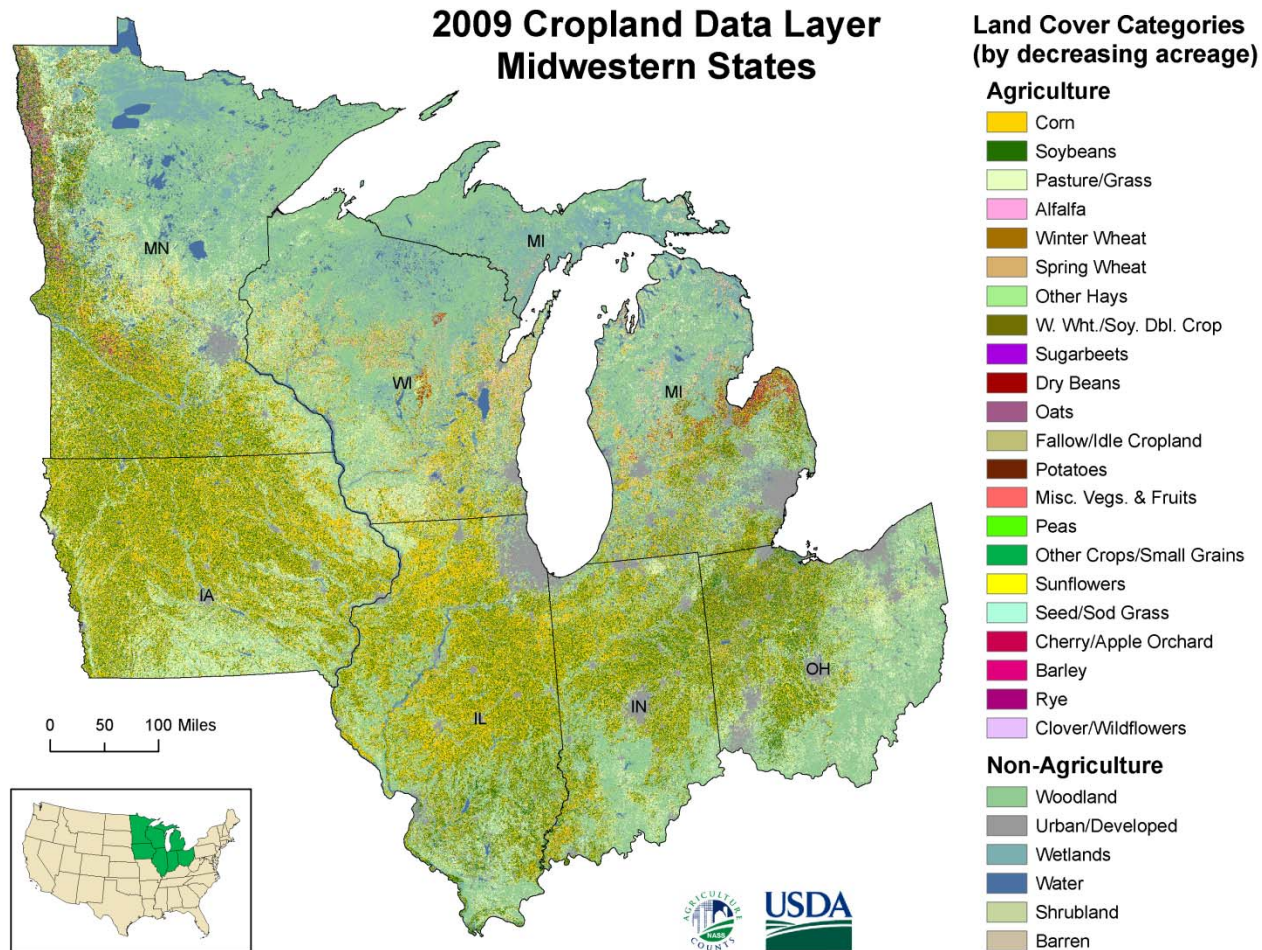
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Cropland Data Layer (CDL)

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

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Cropland Data Layer (CDL)

2009 Cropland Data Layer
Midwestern States

Land Cover Categories
(by decreasing acreage)

Agriculture
- Corn
- Soybeans
- Pasture/Grass
- Alfalfa
- Winter Wheat
- Spring Wheat
- Other Hays
- W. Wht./Soy. Dbl. Crop
- Sugarbeets
- Dry Beans
- Oats
- Fallow/Idle Cropland
- Potatoes
- Misc. Vegs. & Fruits
- Peas
- Other Crops/Small Grains
- Sunflowers
- Seed/Sod Grass
- Cherry/Apple Orchard
- Barley
- Rye
- Clover/Wildflowers

Non-Agriculture
- Woodland
- Urban/Developed
- Wetlands
- Water
- Shrubland
- Barren

0   50   100 Miles

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Why Is CDL Web Portal Needed?

- **Current dissemination channels**
  - ❑ NASS Marketing Channel (external users)
  - ❑ NRCS Geospatial Data Gateway (external users)
    - ➢ Online bulk file download (http://datagateway.nrcs.usda.gov/)
  - ❑ Special request & delivery
    - ➢ Printed maps
    - ➢ CD/DVD delivery
    - ➢ Email generated
- **No online geospatial information access and dissemination**
  - ❑ No direct and interactive crop data customization
  - ❑ No geospatial crop visualization & browsing
  - ❑ No geospatial query capability
  - ❑ No geospatial online analysis

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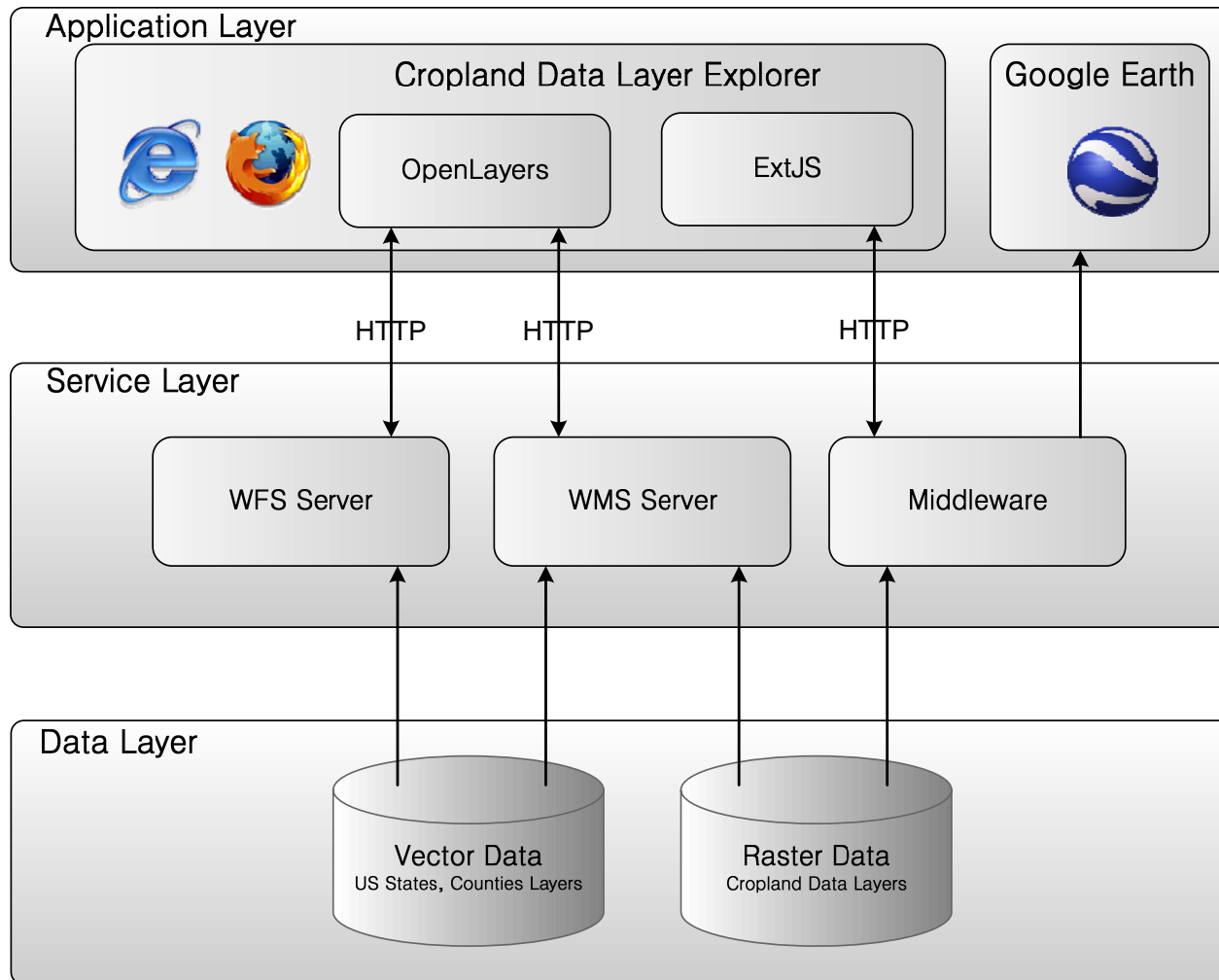
CDL Web Portal Requirement

- **Disseminate CDL data via online publishing, access, and retrieval**

- **Deliver CDL data via industry standard compliant geospatial web services**

- **No burden for users**

  - ❑ No client software development & installation

  - ❑ No special software tools needed for CDL data visualization, geospatial queries and online analytics

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System Architecture

Application Layer

Cropland Data Layer Explorer

OpenLayers

ExtJS

Google Earth

HTTP   HTTP   HTTP

Service Layer

WFS Server   WMS Server   Middleware

Data Layer

Vector Data
US States, Counties Layers

Raster Data
Cropland Data Layers

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Data Layer

- Vector data files (in PostgreSQL DB)
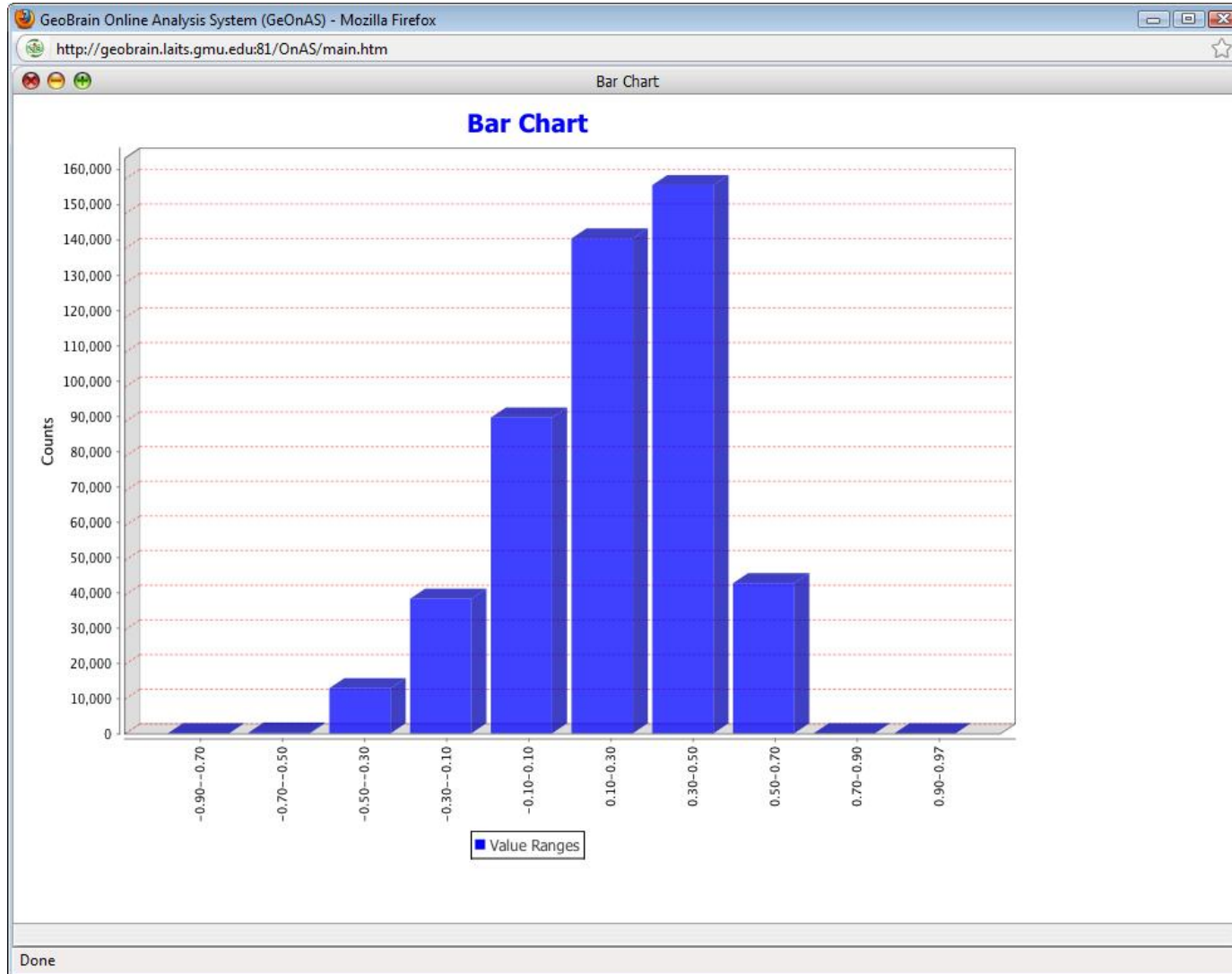 - ❑ US state, county, ASD or other boundaries

- Raster data
  - ❑ Global Land Cover and CDL (2006 – 2008)

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Service Layer

- WFS
  - ❑ Vector files - boundaries and their attributes are retrieved and encoded in GML when WFS *GetFeature* request is processed.
- WMS
  - ❑ *GetMap* - Retrieve geo-registered map images from one or more distributed geospatial databases.
  - ❑ *GetFeatureInfo* - Provide feature information by identifying a point on a map based on its pixel location.
- WCS
  - ❑ *GetCoverage* - Retrieve coverage with specified parameters.
- WPS
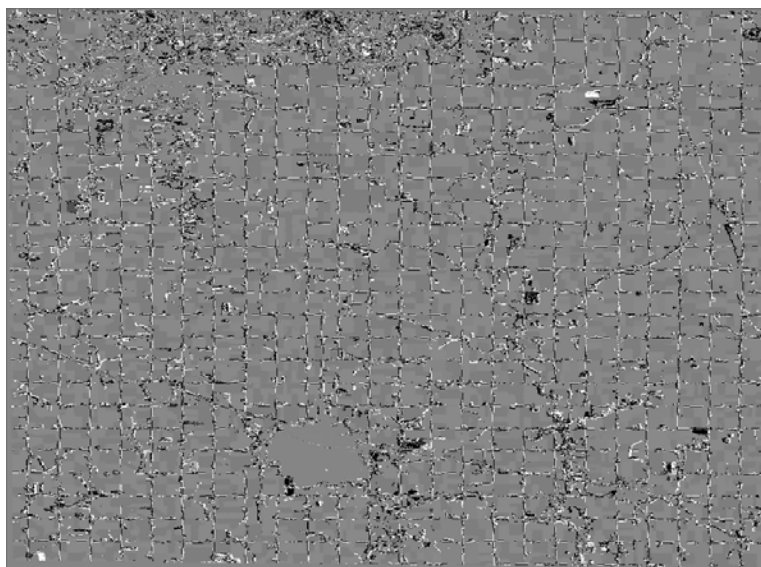 - ❑ GeoBrain Web Statistics Services
  - ❑ GeoBrain Map Algebra Services
  - ❑ ……

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Web Statistics Services

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Change Detection
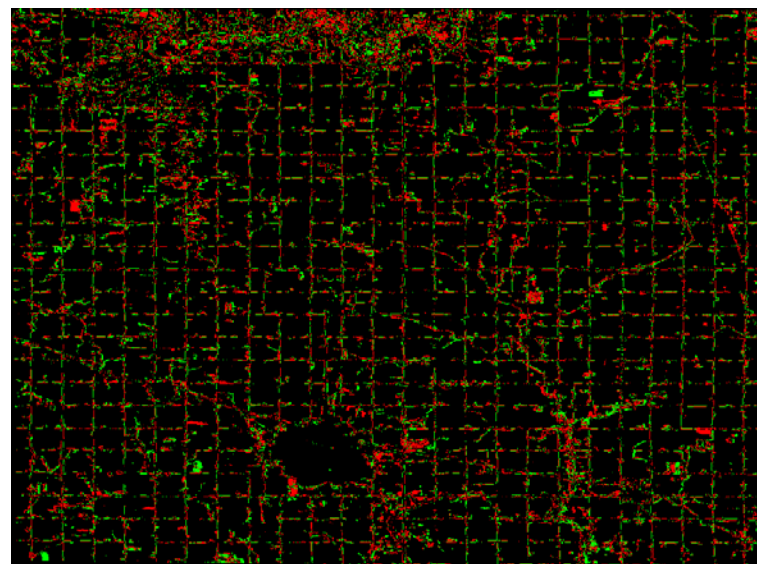
Client Layer

- Openlayers
  - ❑ AJAX-enabled open source Web mapping framework

- ExtJS
  - ❑ Open source Javascript Framework

- Google Earth
  - ❑ KML with CDL display

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CDL Explorer Features

- Ajax Enabled Web Application
- Accessible from any common browser
- OGC and other standards (WFS, WMS, WCS, WPS, GML, JSON) compliant
- Provide customization and download of CDL
- Help users obtain CDL effectively and efficiently
- Drive increased flexibility of CDL related application
- Work best for CDL data exploration and delivery

- Select CDL by state and year
- Visualize CDL
- Zoom in/out
- Pan
- Search the data by county and year
- Subset the data by state, county, and year
- Subset the data for any area of interest by polygon
- Reproject data to map projection specified by the user
  Support common map projections (e.g., Lat/Long, UTM)
- Download the CDL subset in the original projection and GeoTiff format
- Export a selected CDL subset to Google Earth (in KML)

CDL Explorer Demo Links

- CDL Explorer Demo:

  http://129.174.131.228/NASSDownloadDemo/

- CDL Web Service Example:

  http://129.174.131.228/NASSDownloadDemo/GetCDL

  for example:

  http://129.174.131.228/NASSDownloadDemo/GetCDL?year=2006&fips=19015

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Demo – Main User Interface

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Demo – State/County Selection

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Demo - Query

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Demo - Customization

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Demo – Preview

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Demo – Google Eaeth

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Demo – AOI Definition

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Demo – AOI Preview

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Future Works

- Resample to specified spatial resolution (WCS)
- Reformat to format specified by the user (WCS)
  - ❑ Support all common raster formats offered by Geospatial Data Abstraction Library (GDAL)
- Overlay CDL data with other GIS layers (e.g. NASS Statistics Data)
- Online pixel count based crop acreage for state, county, or any AOI
- Online crop acreage statistics graphing/charting for state, county, or any AOI
- Multi-year crop acreage change statistics and graphs for state, county, or any AOI
- Maps showing the change of crop types for state, county, or any AOI between any two years

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Conclusion

- NASS CDL data access, querying, visualization, and dissemination could be offered in an effective and efficient way through Web services

- SOA works well and the web-based interactive mapping enabled capabilities greatly enhance geospatially data access, navigation, query, visualization, and dissemination.

- OGC compliant Web services facilitate interoperability and automatic data delivery, and the open GIS technology is robust and has better performance.

- Online interactive mapping system/capabilities greatly improve user experiences and NASS data dissemination.

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Thank you!

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