



**Geospatial Data Analysis Corporation (GDA Corp)**

*“Monitoring The World, For A Better Tomorrow”*

**GDA Corp. U S D A**

# **Open Data Policy for Landsat Imagery: New Opportunities for Regional and Global Crop Mapping**

**Dmitry Varlyguin<sup>1</sup>, Stephanie Hulina<sup>1</sup>, Dath Mita<sup>2</sup>, Paul Provance<sup>2</sup>**

*(1) GDA Corp (Geospatial Data Analysis Corporation)*

*(2) USDA FAS IPAD (USDA Foreign Agricultural Service / International Production Assessment Division)*

**JACIE 2014**

**Civil Commercial Imagery Evaluation Workshop  
the Joint Agency Commercial Imagery Evaluation (JACIE)**

**March 26-28, 2014**

**The Galt House Hotel**

**Louisville, Kentucky**



GDA Corp. U S D A



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

+ NASA Portal  
+ Goddard Homepage

Search NASA:

Keywords



THE LANDSAT PROGRAM



home | search

EDUCATION

+ REFERENCES

# Starting on June 4, 2007, the USGS is offering **Free Orthorectified Landsat data**

## News & Features

- + How Landsat Helps
- + Special Features
- + Science Articles
- + People of Landsat
- + Did You Know?
- + Podcasts & Videos
- Article Archive

## Free Landsat 7 Data Available from USGS

Jun. 4, 2007 • Starting on June 4, 2007, the USGS is offering free orthorectified SLC-off Landsat 7 data of the United States as part of a pilot for the Landsat Data Continuity Mission (LDCM) data policy. Each new U.S. Landsat 7 acquisition will become part of this free archive. Plans also call for Landsat 7 data collected as early as June 2003 to eventually be processed and added to this archive.



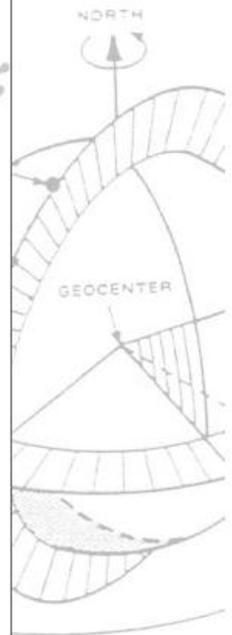
Landsat 7 image of a tornado scar left after a twister touched down in Wisconsin. This June 15, 2007 L7 image was downloaded for free.

The free data are available via download. To see what is available visit the [USGS Global Visualization Viewer](#). Select "Landsat Science" and "SLC-off Std L1T," then click the "View Images" button.

- Further information:
- + visit the [USGS Global Visualization Viewer](#)
  - + [USGS pilot project makes high-quality Landsat data available for download](#)



home | search



- + [ldcm](#)
- + [usgs landsat site](#)
- + [data handbook](#)



Other news.



+ Privacy Policy and Important Notices



NASA Official: James R. Irons  
 Website Curator: Laura Rocchio  
 Site last updated: November 20, 2012



GDA Corp. U S D A

# EARSC

European Association  
of Remote Sensing  
Companies

Home

About Us

Our Mission

News

Contact

## ESA Sentinel-2 -- EU Satellite Data to Roam Free

Jul 07, 2010

In its June 16 2010 resolution on GMES, the European Parliament voted though a resolution that concluded: **“There should be a full and open-access data policy for the Sentinels through a free-of-charge licensing and online access scheme, subject to security aspects.”**

### EU Satellite Data to Roam Free

Date: Jul 07, 2010

Author: [EARSC Executive Secretary](#)

Category: [Programmes](#)

Keywords:

Access to data from Europe's future generation of Sentinel Earth observation satellites is likely to be free after a joint decision by the European Space Agency (ESA) and the European Parliament.

The Global Monitoring for Environment and Security (GMES) project will provide information on how the planet and its climate are changing from data captured from three Sentinel satellites, jointly owned by the nations of the European Union.

It now seems likely that all data from the satellites, with the exception of imagery with a ground resolution sharper than 10 metres, will be accessible to anyone with an internet connection.

*In its June 16 resolution on GMES, the European Parliament voted though a resolution that concluded: "There should be a full and open-access data policy for the Sentinels through a free-of-charge licensing and online access scheme, subject to security aspects."*

<http://earsr.org/news/eu-satellite-data-to-roam-free>



GDA Corp. U S D A



Home About Image Gallery Market Guide Resources Subscribe Advertise

You are here: [Home](#) / [2011](#) / [Jan-Feb](#) / [Departments](#) / [Industry Briefs](#) / [Business](#) / [DMCii's Satellite Imagery Helps Brazil Stamp Out Deforestation](#)

## DMCii's Satellite Imagery Helps Brazil Stamp Out Deforestation

# DMCii's Satellite Imagery Helps Brazil Stamp Out Deforestation

[Email](#)

Jan-Feb 2011

the data covering Brazil will be made **freely available on open license** through the INPE website

1, 2012—Remote sensing solutions provider DMC International Imaging Ltd has entered into a contract with Brazil's National Institute for Space Research (INPE) to deliver near real-time satellite imagery to monitor deforestation, providing information central to Brazil's war on deforestation that has cut deforestation rates by 78% since 2004. The space agency's groundbreaking DETER service uses regular satellite images to detect forest clearance as it happens – rather than surveying the damage afterwards – guiding Brazil's enforcement officers to provide effective forest clearing control. However in recent years, the authorities have discovered that illegal loggers are clearing smaller areas to evade detection by the 250metre-pixel MODIS data that is currently in use.

DMCii's satellite imagery will be made freely available on open licence through the INPE website so the general public can follow progress against deforestation.

A £2.1m contract signed with DMCii will enable INPE to downlink higher resolution 22metre resolution data from the UK-DMC2 satellite to its groundstation at Cuiaba, Brazil. With approximately 130 times as many pixels per hectare as the MODIS images currently in use, the data will detect these smaller clearings and provide detailed maps. The UK-DMC2 satellite will image the entire Amazon basin every two weeks, so that the authorities are alerted as soon as possible after logging is detected. In a unique agreement, the data covering Brazil will be made freely available on open licence through the INPE website so the general public can follow progress against deforestation.

Dr. Gilberto Camara, Director General of INPE said: "With the recent failure of Landsat 5 it became urgent to increase the supply of satellite imagery to operate our forest monitoring system, and DMC data provides a very cost effective tool. The 650km wide swath DMC imagery provides a frequency of coverage and level of detail which enhances the ability of our DETER system to identify deforestation at an early stage. I am particularly pleased that DMCii has agreed to an open licence so that INPE can make the data freely available through its website – an innovation which has enhanced public monitoring of forest management in Brazil."

The contract builds on seven years of cooperation with INPE. Paul Stephens, Director of Sales & Marketing at DMCii commented: "DMCii has a commitment to improved forest governance and management through the provision of timely and reliable information. This is especially important for development of effective REDD+ programmes in tropical forested countries. I am delighted to extend our long standing work with INPE, which is the world leader in the fight against deforestation."

# Why Landsat

Free Landsat imagery offers **global, spatially and temporally consistent analytical data** that is well suited for regional and global crop monitoring and analysis.

Landsat and Landsat class imagery allows **direct and objective** assessments of crop types, distribution, status, progress, and crop expectations.

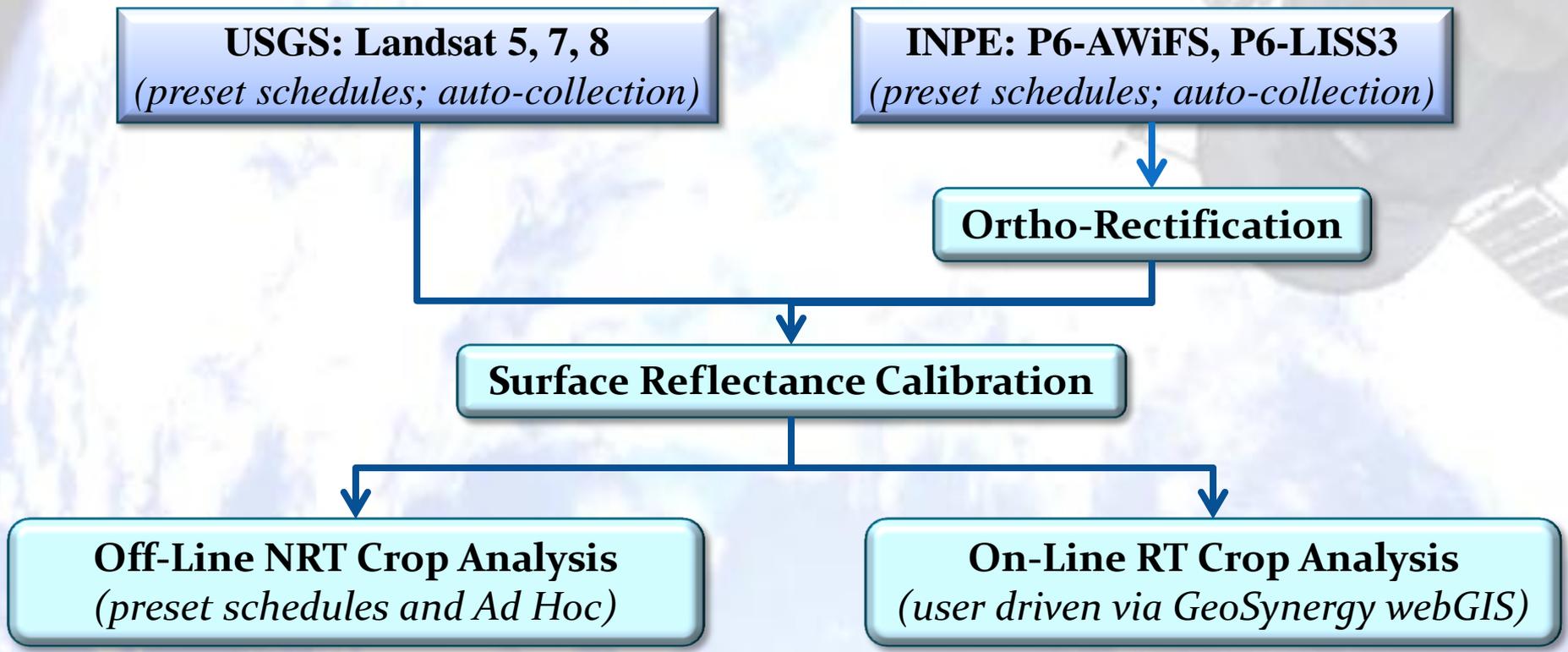
It offers a **repetitive, detailed, timely, and affordable** way to monitor and analyze crops globally and to generate in-season crop maps.

In combination with free MODIS Terra and MODIS Aqua imagery, Landsat can be used in global crop condition assessments and crop yield forecasts.



GDA Corp. U S D A

# Operational Data Flow





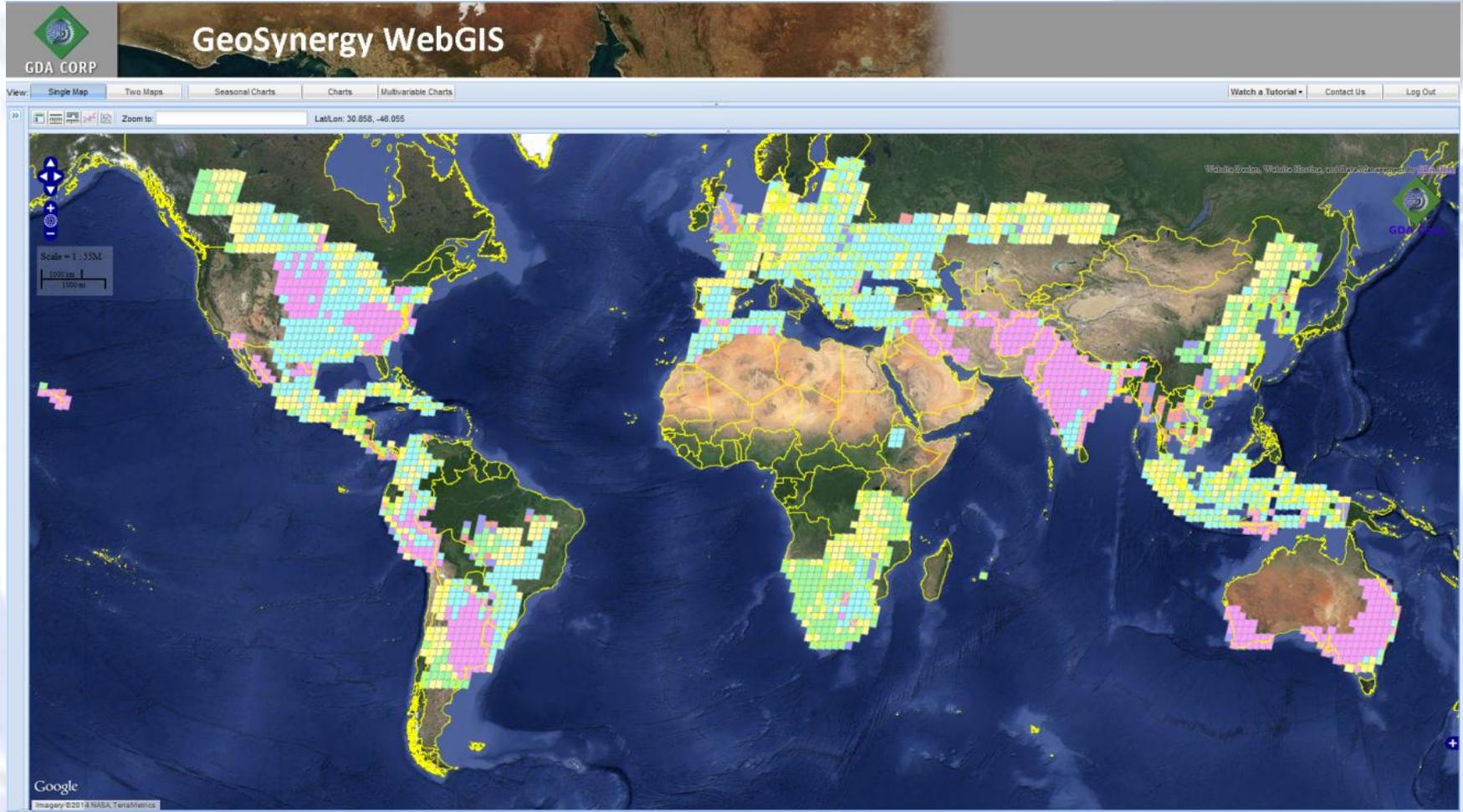
GDA Corp. U S D A

# Landsat for USDA FAS Crop Analytics

## GDA Landsat Imagery: Orthorectified and Surface Reflectance Calibrated

Access via GeoSynergy (<https://www.GeoSynergy.com>) for on-line crop and land cover mapping

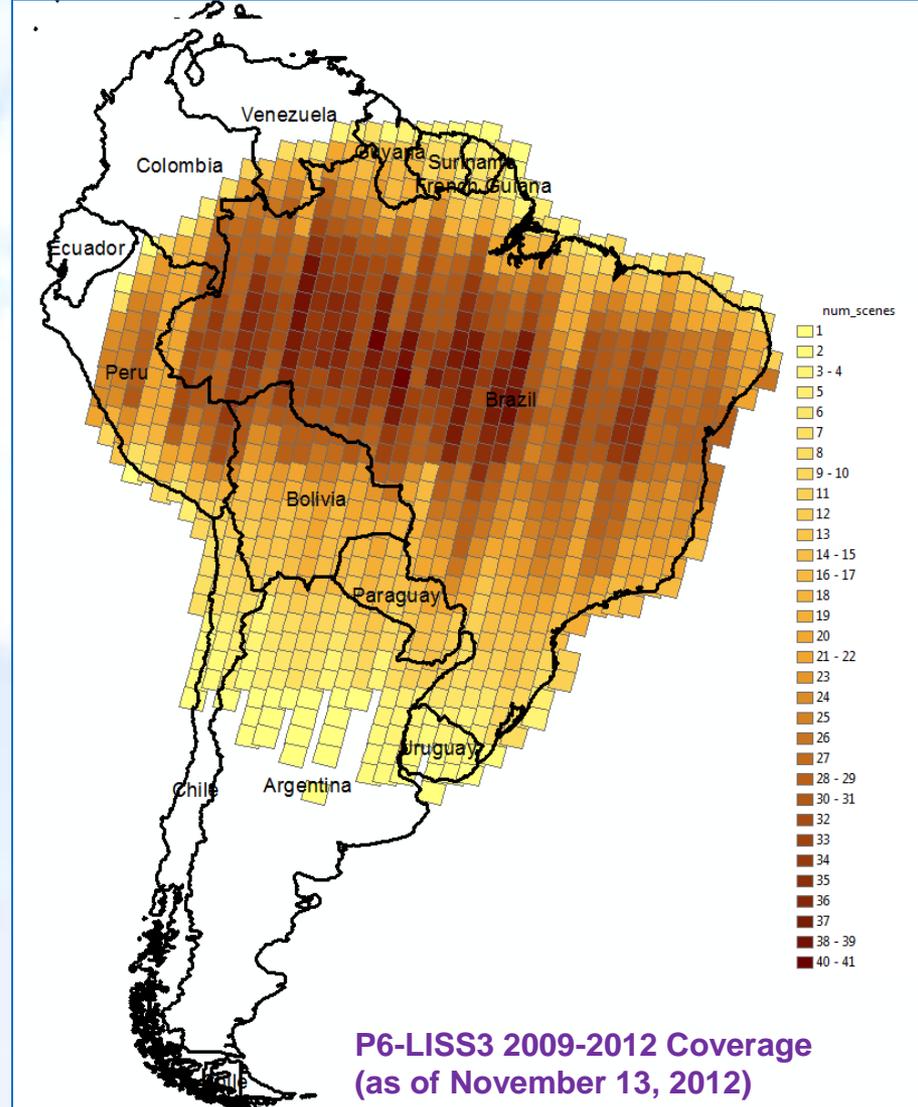
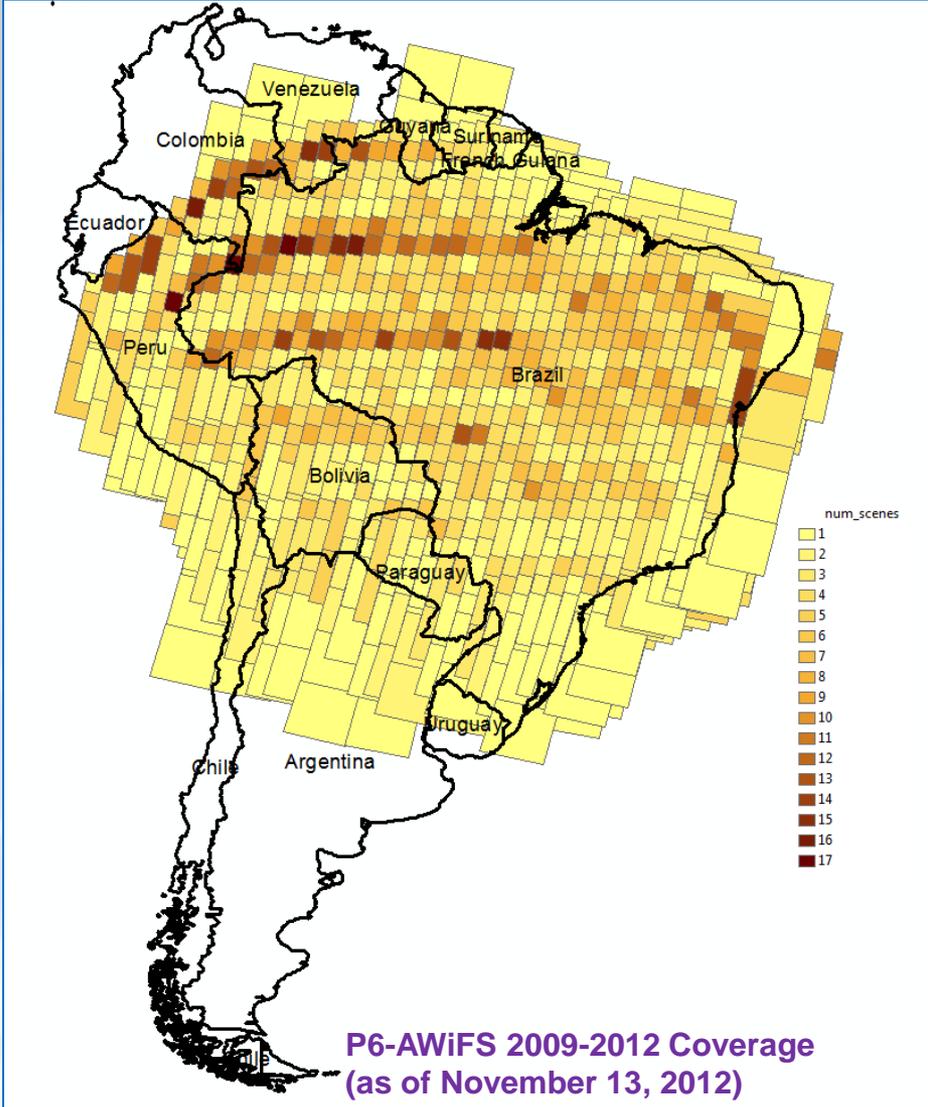
Access via GDA Image Archive ([http://rasta.GDAcorp.com/Image\\_Archive/](http://rasta.GDAcorp.com/Image_Archive/)) for imagery download





GDA Corp. U S D A

# INPE (Brazil) P6-AWiFS & P6-LISS3





# Crop Mapping

## Preset Schedule and Ad Hoc NRT Crop Maps

The maps provide per-pixel information about dominant crop(s) extent within an administrative region. The map focuses on detection of crops that cover a significant -- typically more than 20-25% -- fraction of the total cropland area. Annual and in-season maps are generated.

GDA uses multiple lines of evidence and relies on a weight-of-evidence approach in the crop classification process. The prior and conditional evidences are derived from historical information about crop presence, crop calendar, rotation practices, crop coverage expectations, and a knowledge-base of anticipated crop spectral and temporal signatures.

Maps delivered via GeoSynergy webGIS service.

## On-Line RT Crop Maps

Hands-on Crop Mapping: Analyst driven mapping using Landsat-class imagery and mapping tools via GeoSynergy.



# USA Crop Maps

GDA Corp. U S D A

In-Season, Field Level Crop Mapping for USA: 2006 – 2014. 30 meters. ~Monthly Updates During Crop Season. Mainly an R&D for international crops.

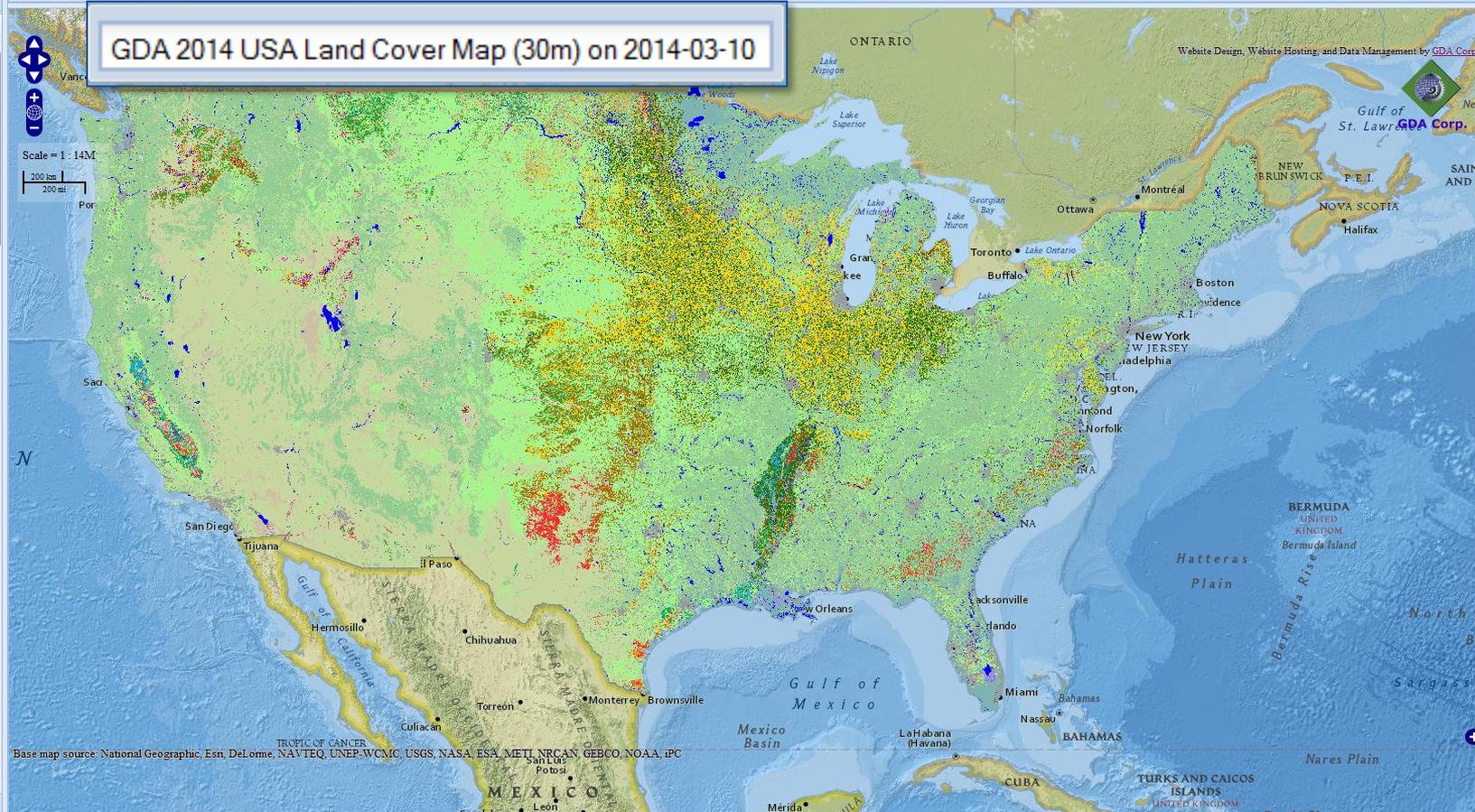
GeoSynergy WebGIS



View: Single Map Two Maps Seasonal Charts Charts Multivariable Charts Admin Watch a Tutorial Contact Us Log Out

Class Color	Class Name
[Red]	Corn
[Orange]	Cotton
[Yellow]	Rice
[Light Green]	Sorghum
[Dark Green]	Soybeans
[Light Yellow]	Sunflower
[Light Green]	Peanuts
[Green]	Tobacco
[Light Green]	Sweet Corn
[Orange]	Pop. or Orn. Corn
[Light Green]	Mint
[Pink]	Barley
[Light Green]	Durum Wheat
[Light Green]	Spring Wheat
[Light Green]	Winter Wheat
[Light Green]	Other Small Grains
[Light Green]	Obt. Crop Win/Wht/Soy
[Purple]	Rye
[Light Green]	Oats
[Light Green]	Millet
[Light Green]	Speltz
[Light Green]	Canola
[Light Green]	Flaxseed
[Light Green]	Safflower
[Light Green]	Rape Seed
[Light Green]	Mustard
[Light Green]	Alfalfa
[Light Green]	Other Hay
[Light Green]	Camelina
[Light Green]	Sugarbeets
[Light Green]	Dry Beans
[Light Green]	Potatoes
[Light Green]	Other Crops
[Light Green]	Sugarcane
[Light Green]	Sweet Potatoes
[Light Green]	Misc. Veggies. & Fruits
[Light Green]	Watermelons
[Light Green]	Onions
[Light Green]	Pickles

GDA 2014 USA Land Cover Map (30m) on 2014-03-10

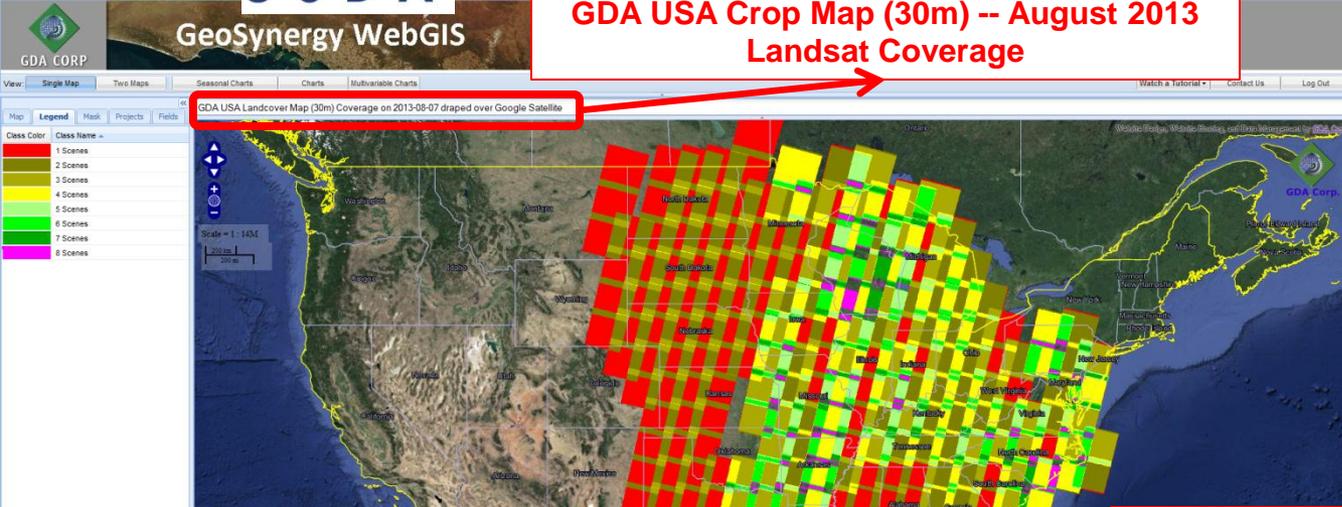


Base map source: National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, IPC

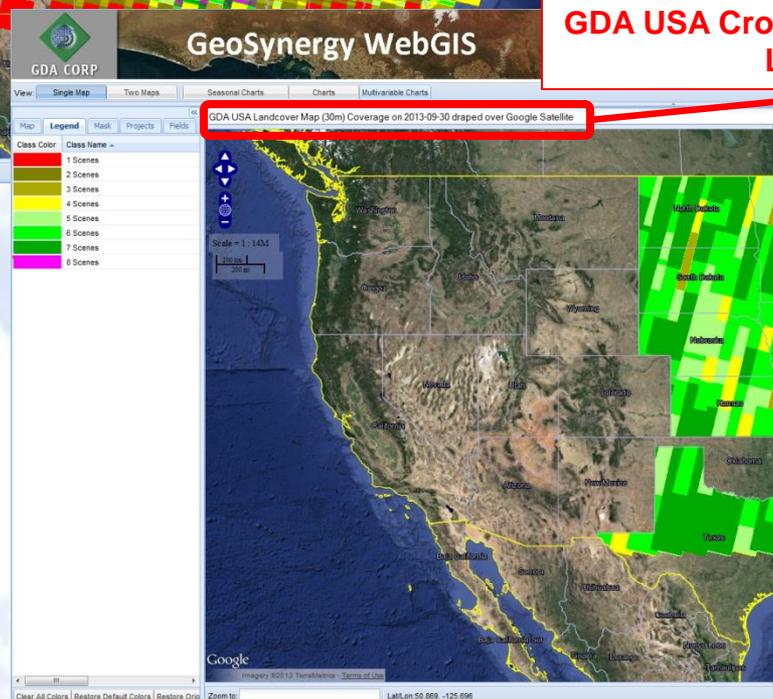


# USA Crop Maps

**GDA USA Crop Map (30m) -- August 2013  
Landsat Coverage**



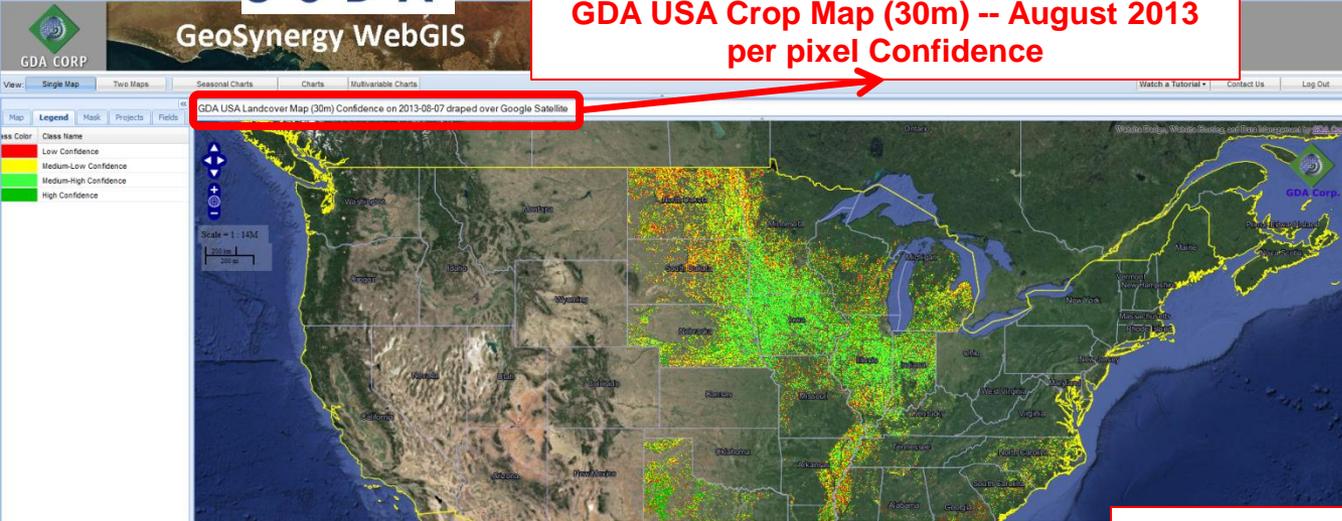
**GDA USA Crop Map (30m) – September 2013  
Landsat Coverage**



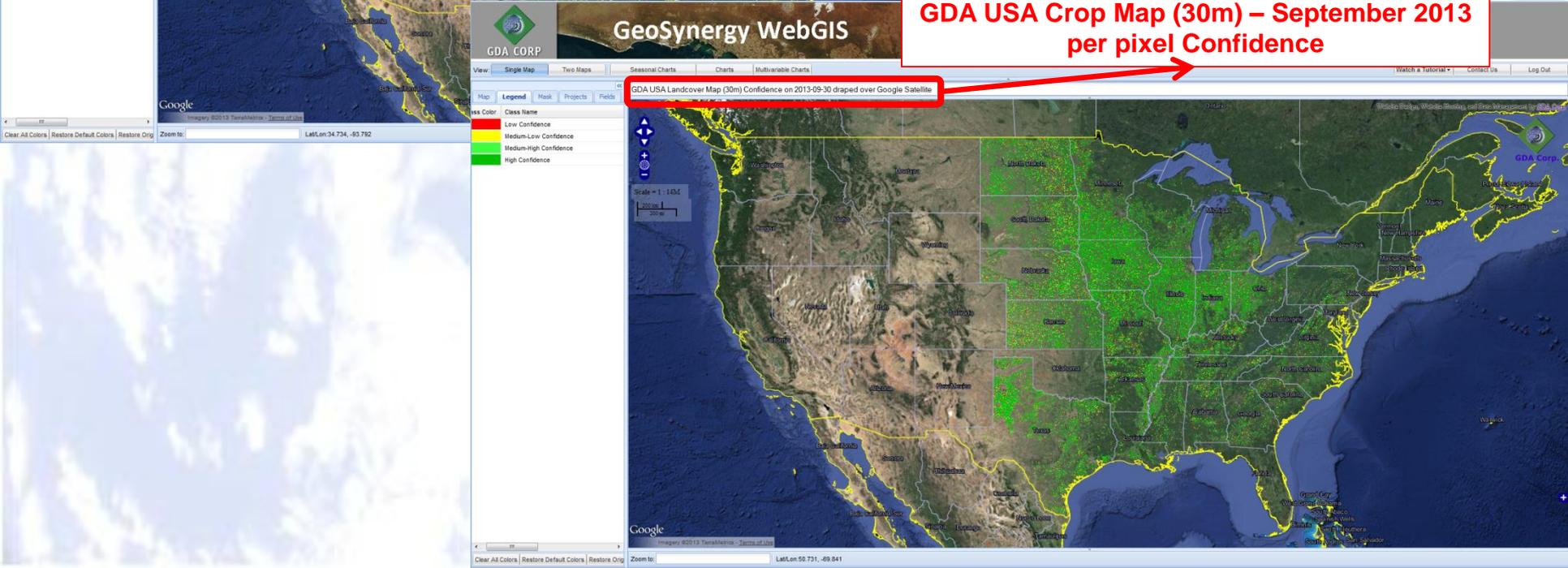


# USA Crop Maps

**GDA USA Crop Map (30m) -- August 2013  
per pixel Confidence**



**GDA USA Crop Map (30m) – September 2013  
per pixel Confidence**

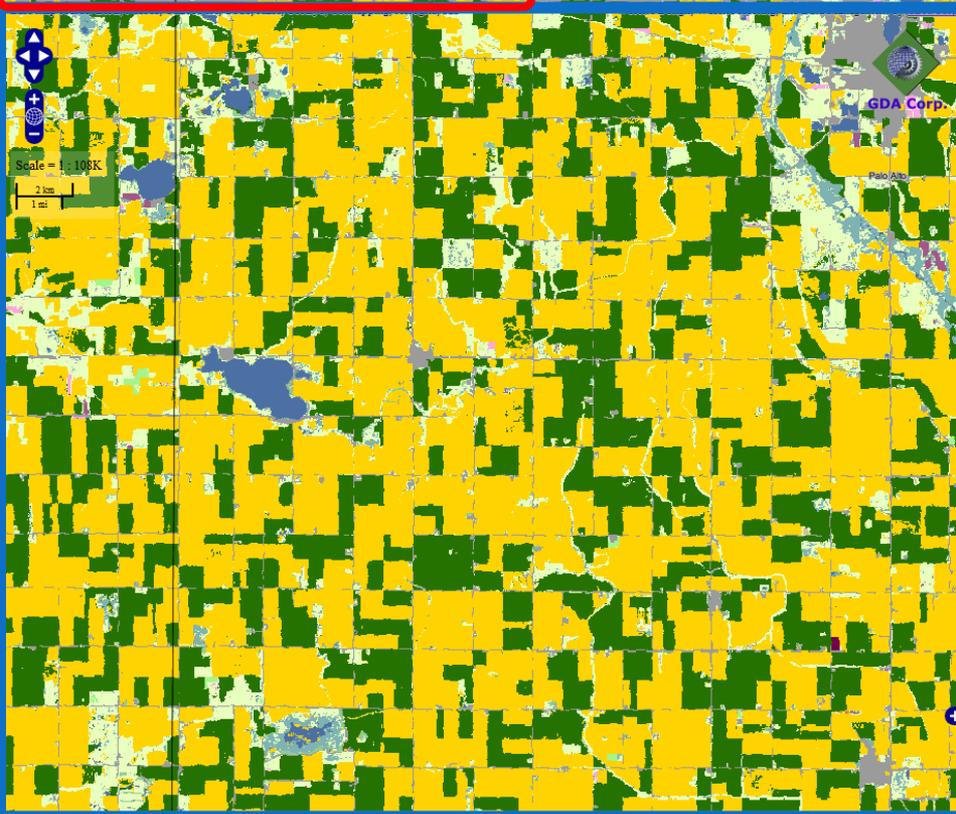


## Comparison to the Truth

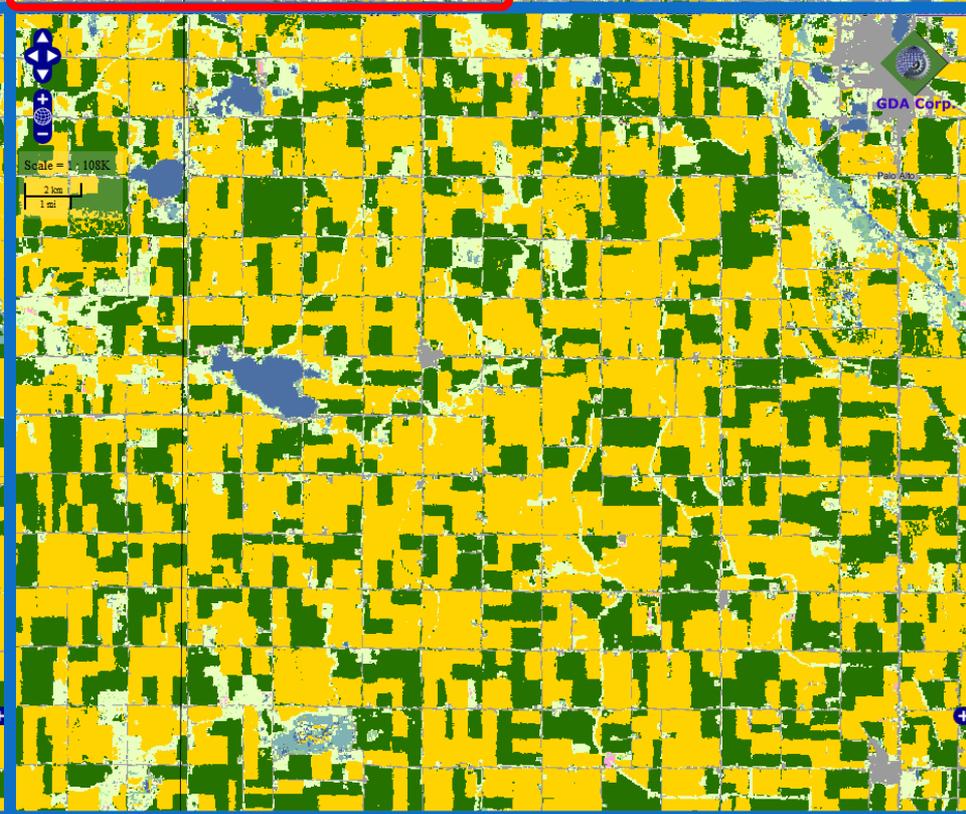
GDA 2012 Crop Map (USA)

USDA 2012 CDL Map

GDA USA Landcover Map (30m) on 2012-12-31 draped over ESRI World Imagery



USDA NASS Cropland Data Layer on 2012-12-31





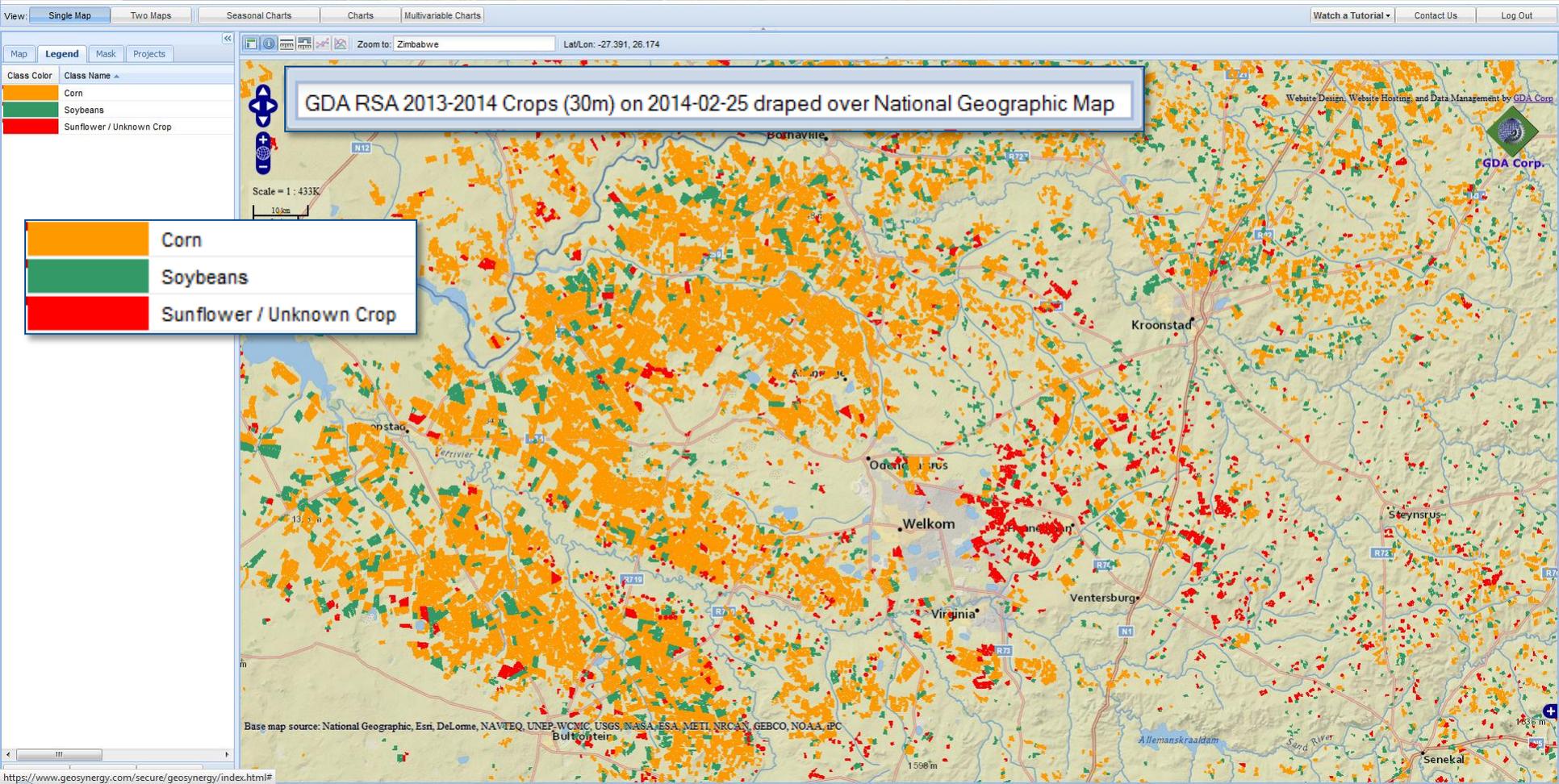
GDA Corp. U S D A

# RSA Crop Maps

## In-Season, Field Level Crop Mapping for South Africa



GeoSynergy WebGIS





# S. American Crop Maps <sup>15</sup>

GDA Corp. U S D A

GeoSynergy WebGIS

GDA S. America 04/05/2013 Crop Map (56m)

View: Single Map Two Maps Seasonal Charts Charts Multivariable Charts Watch a Tutorial Contact Us Log Out

Map Legend Mask Projects Fields

GDA S. America 04/05/2013 Crop map draped over Google Maps

- No Dataset
- GDA Crop Monitoring
  - Crop NDVI Anomaly By Admin Unit
  - Crop NDVI Time Difference By Admin Unit
  - Crop Statistics By Admin Unit
  - GDA USA Landcover Map (30m)
  - GDA USA Landcover Map (30m) Confidence
  - GDA USA Landcover Map (30m) Coverage
  - GDA S. America 04/05/2013 Crop map**
- Crop Maps for YF
- MODIS
- Landsat and Landsat-class
- High Resolution
- Crop and Landcover Maps
- Weather
- Special Projects

Date: [Navigation icons]

Location: [Navigation icons]

Options:
 

- Dataset Opacity: [Slider]
- Base Map: [Dropdown]
- Spectral Profile: [Dropdown]
- Time Series Profile: [Dropdown]

Overlays:
 

- Admin Boundaries:
  - None
  - Level 1 (Country)
  - Level 2 (Sub-Country)
  - Level 3 (Sub-Sub-Country)
  - Level 4 (Sub-Sub-Sub-Country)
- Admin Names:
- Populated Places:
- Streets:

Map Legend

Class Color	Class Name
Yellow	Corn
Dark Green	Soybeans
Cyan	Sugarcane
Olive Green	Coffee
Light Green	Corn 2nd
Dark Olive	Corn / Corn 2nd
Bright Green	Soybeans / Corn 2nd

Scale: 1 : 14M

Map data ©2013 Google, Inav/Geosistemas SRL, MapLink, Mapcity - Terms of Use

Zoom to: [Input] Lat/Lon: -39.234, -53.296

Paraguay	GDA 2012-13 SOY Estimate (ha)
Alto Paraguay	-
Alto Paraná	872,357
Amambay	131,626
Boquerón	-
Caaguazú	390,997
Caazapá	160,662
Canindeyú	564,352
Central	-
Concepción	26,659
Cordillera	-
Guairá	13,925
Itapúa	565,896
Misiones	31,654
Ñeembucú	-
Paraguari	55
Pte Hayes	-
San Pedro	254,450
Asuncion	-
<b>PARAGUAY</b>	<b>3,015,994</b>

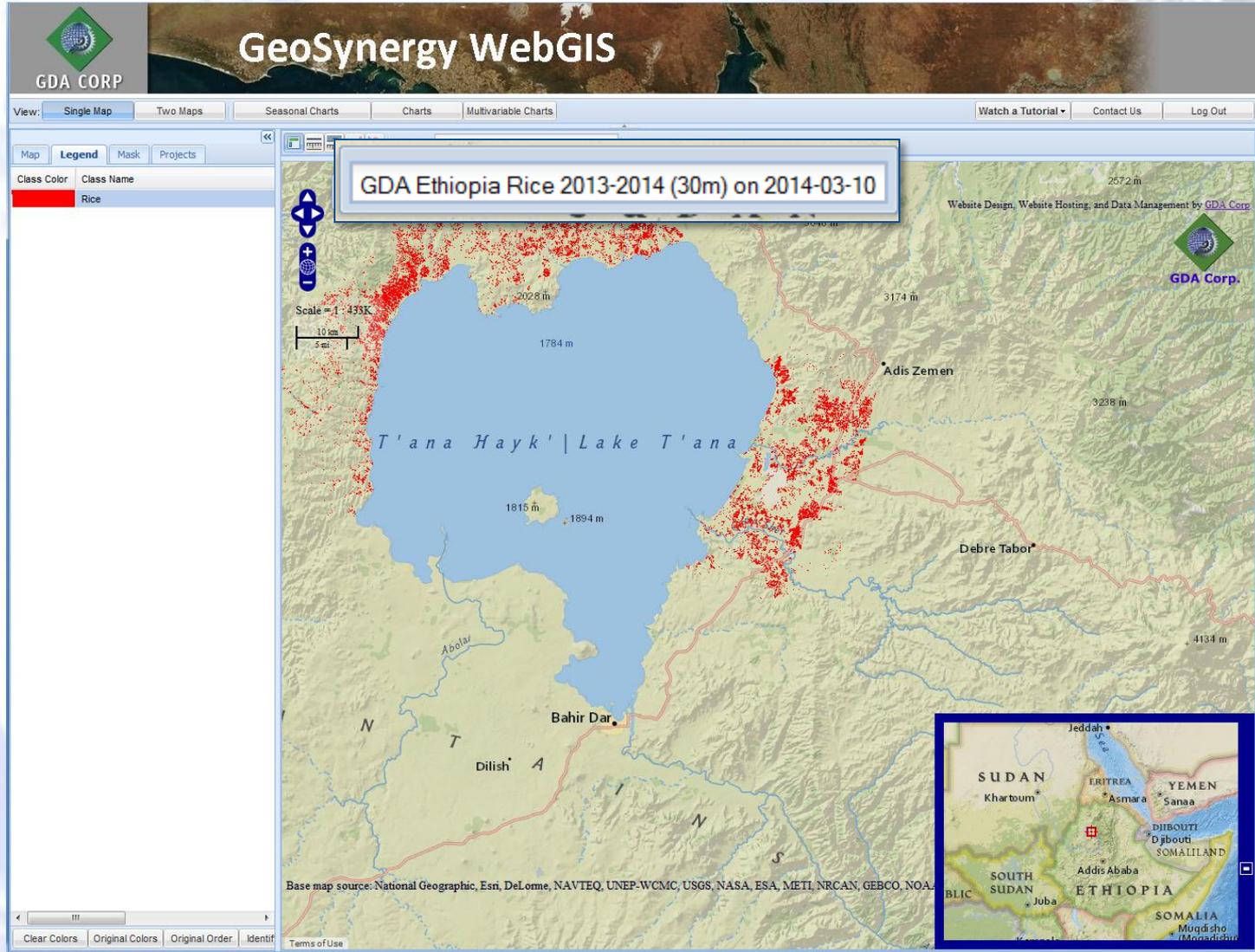
Brazil	GDA 2012-13 CORN (1 <sup>st</sup> harvest) Estimate (ha)
Bahia	472,607
Distrito Federal	48,807
Espirito Santo	25,160
Goiás	347,500
Mato Grosso	95,294
Minas Gerais	1,081,163
Parana	800,470
Rio De Janeiro	15,328
Rio Grande Do Sul	1,103,965
Santa Catarina	503,528
Sao Paulo	647,000
<b>BRAZIL</b>	<b>7,612,382</b>



# Ethiopian Crop Maps <sup>16</sup>

GDA Corp. U S D A

## In-Season Crop Mapping for Ethiopia (Rice)





# Australian Crop Monitoring 17

GDA Corp. U S D A

## Annual Crop Monitoring of Australian Crops. 2006-2014

The screenshot displays the GeoSynergy WebGIS interface. At the top, the title 'GeoSynergy WebGIS' is centered over a satellite image of Australia. Below the title, the GDA Corp. logo is on the left, and navigation links for 'Watch a Tutorial', 'Contact Us', and 'Log Out' are on the right. A 'View:' menu is set to 'Single Map'. The main map area shows 'Australia Sorghum 2012 (planting year) draped over Google Satellite'. The map displays yellow clusters of planting data across various regions of Australia, including Darling Downs, Toowoomba, Brisbane, Ipswich, Logan, Gold Coast, Richmond-Tweed, Northern NSW, North Westem, Hunter, M-G-North Coast, and New South Wales. A legend on the left lists datasets under 'Special Projects for YF', with 'Australia Sorghum' selected. A 'Date' control at the bottom left is set to '12/31/2012'. The bottom of the interface includes Google search links and copyright information for TerraMetrics (2013).

*Empower the Users!*

## **GeoSynergy Offers Most Recent and Historical Landsat and Landsat-class Imagery**

- Perfect imagery for Crop Mapping and Analysis
- Full Resolution, All Multispectral Bands Imagery
- Orthorectified and Surface Reflectance Calibrated
- Generate Virtual Mosaics. Mix and Mash Imagery Datasets
- Mask Imagery by Land Cover Class(es)
- Analyze Image Spectral Properties
- Map Land Cover and Features of Interest in Real Time
- Generate Statistics
- Download Your Maps

GeoSynergy WebGIS

View: [Single Map](#) | [Two Maps](#) | [Seasonal Charts](#) | [Charts](#) | [Multivariable Charts](#) | [Admin](#)
[Watch a Tutorial](#) | [Contact Us](#) | [Log Out](#)

**Map** | Legend | Mask | Projects

- [-] No Dataset
- [-] GDA Crop Monitoring
- [-] MODIS
- [-] Landsat and Landsat-class
  - [+] Landsat Mosaic
  - [+] Image Archive Search
  - [+] Date of Most Recent Landsat Scene
  - [+] Number of Collected Landsat Scenes
- [-] AVHRR
- [-] High Resolution
- [-] Crop and Landcover Maps
- [-] Weather
- [-] Special Projects

**Date**

**Location**

**Options**

Dataset Opacity:

Base Map: National Geographic

**Overlays**

Admin Boundaries:
  None
  Level 1 (Country)
  Level 2 (Sub-Country)
  Level 3 (Sub-Sub-Country)
  Level 4 (Sub-Sub-Sub-Country)

Admin Names:

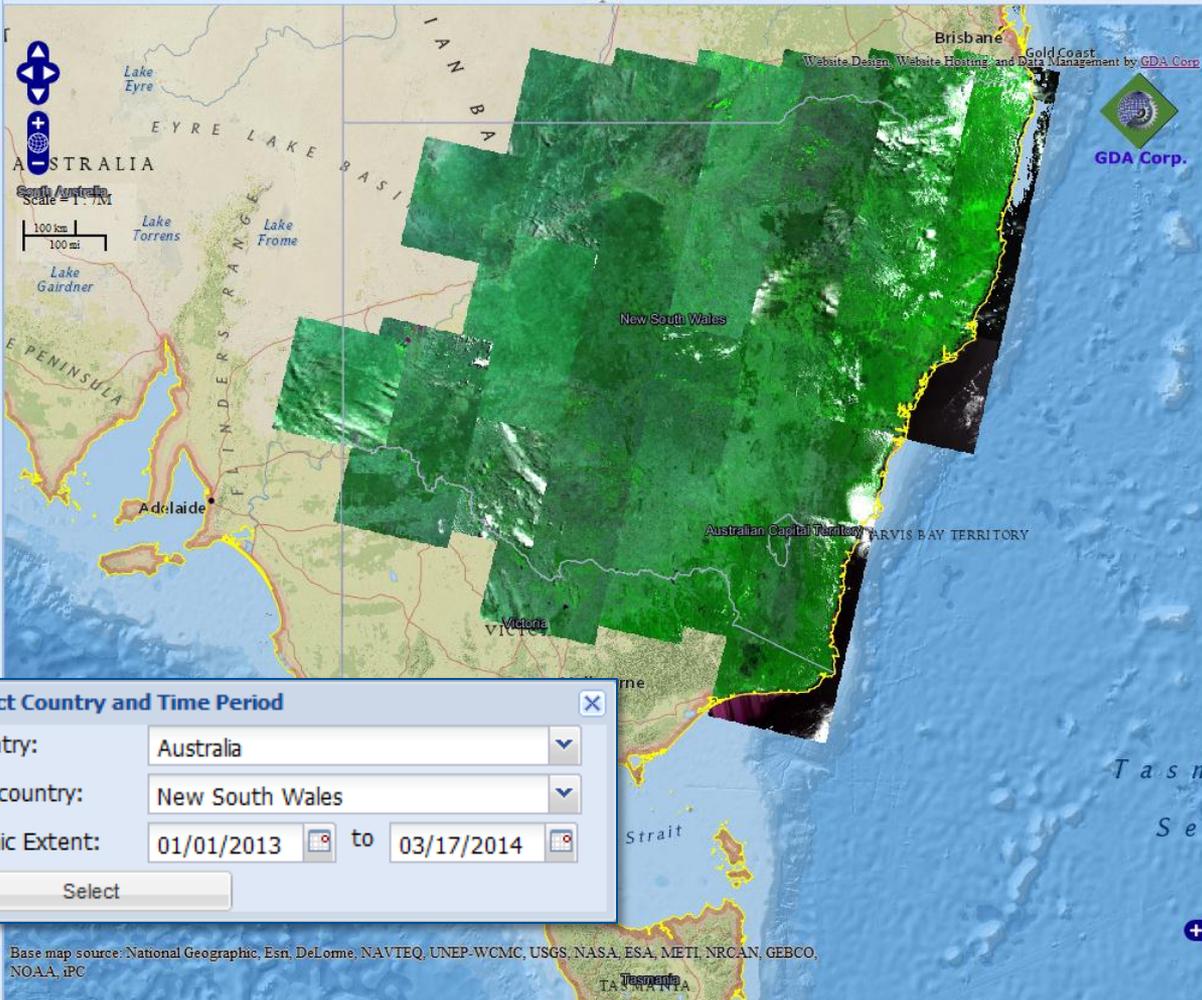
Populated Places:

Streets:

View Map As Overlay: Select File

Zoom to:

Lat/Lon: -30.447, 134.890



**Select Country and Time Period**

Country: Australia

Sub-country: New South Wales

Mosaic Extent: 01/01/2013 to 03/17/2014

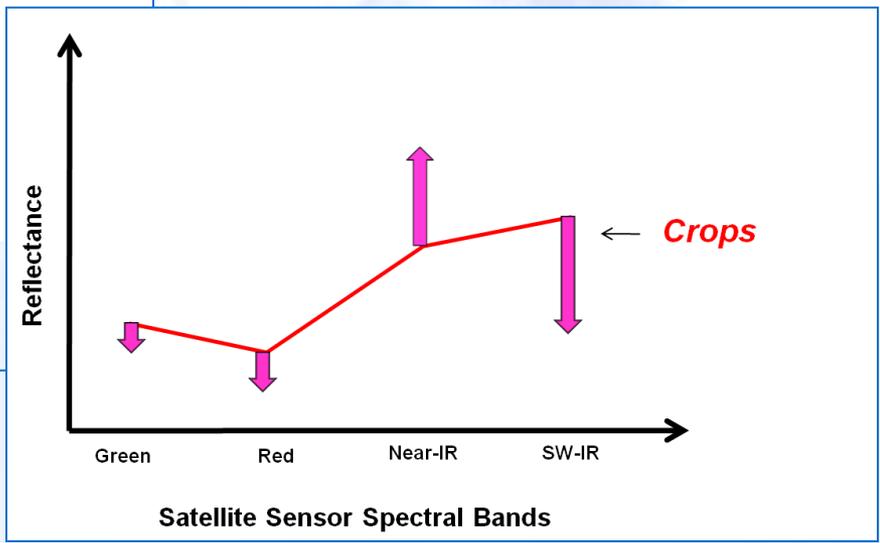
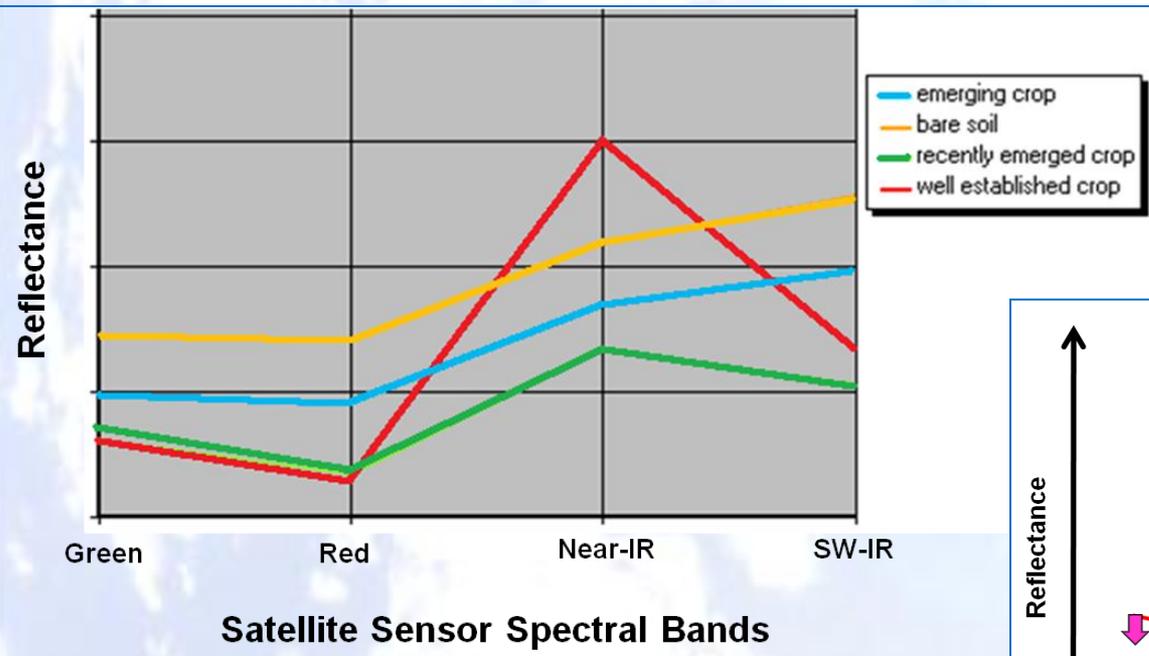
Base map source: National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, iPC



# Crop Spectral Properties

GDA Corp. U S D A

- (1) Individual crop types exhibit *distinctive* spectral signatures
- (2) During key time windows individual crop types exhibit *unique* spectral signatures
- (3) Crop spectral properties predictably change over time







# On-Line Real-Time Mapping

GDA Corp. U S D A

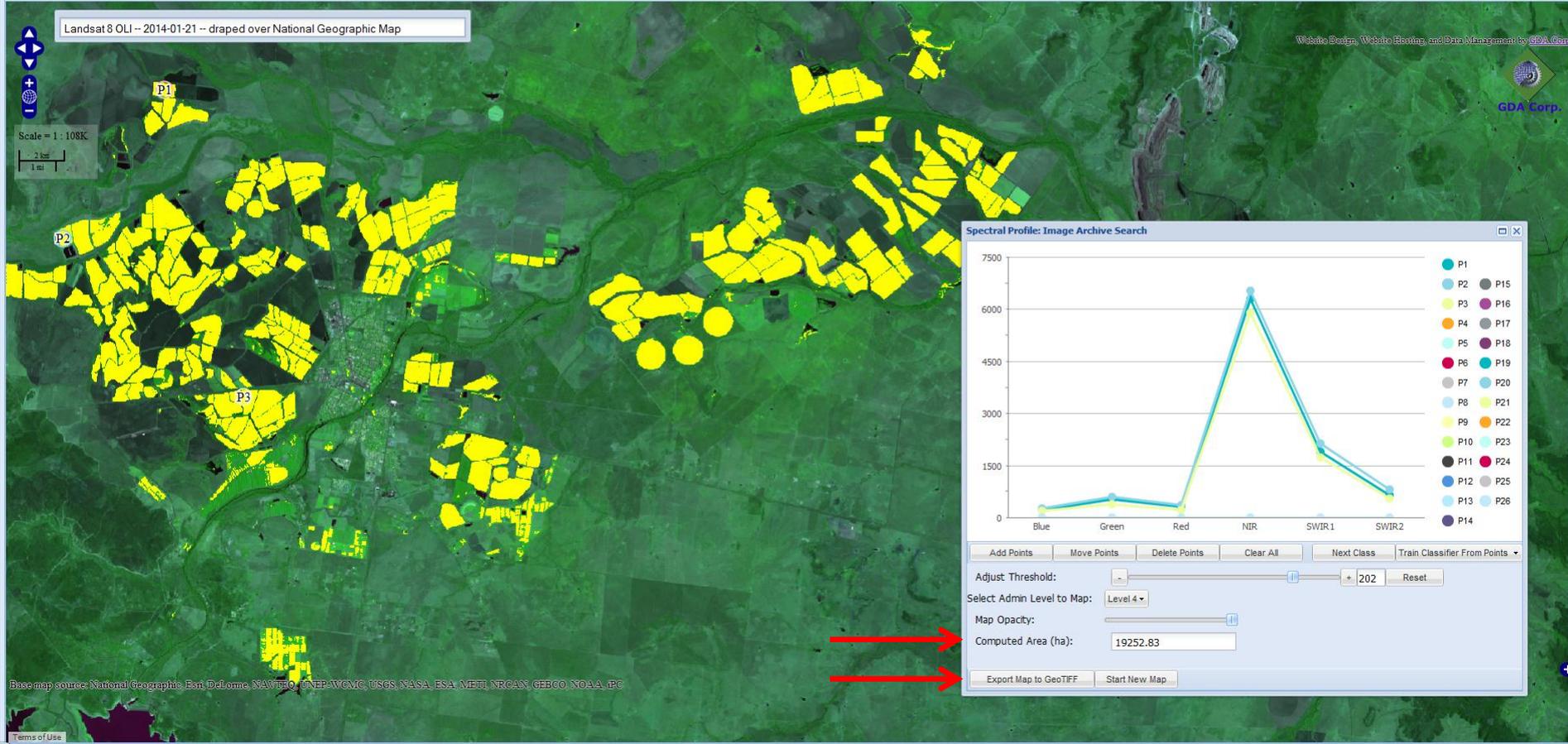
## Save Map and Stats



### GeoSynergy WebGIS

View: Single Map Two Maps Seasonal Charts Charts Multivariable Charts Watch a Tutorial Contact Us Log Out

Zoom to: Lat/Lon: -23.593, 148.407



Base map source: National Geographic, Esri, DeLorme, NAVTEQ, ©NAP-AVCMA, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, IPC

Terms of Use

- Free of charge Landsat imagery -- Great example by USGS!
- Free access to Landsat imagery has created a wealth of new analytical and business opportunities and has had a profound impact on remote sensing applications.
- Free Landsat imagery made it truly possible to move from one date / one footprint mapping to regional and global analysis of land cover.
- Generation of regional crop maps -- annual as well as in-season maps (updated throughout the growing season) – now became possible.

- Combined with recent web tool developments, massive amounts of full resolution, all bands Landsat data can be presented on-line for viewing, manipulation, and analysis.
- On-line analytics can now include real-time Landsat time series drilling and regional mapping with Landsat imagery.
- We can expect an emergence of applications – in a near future -- for mapping global croplands with Landsat imagery in near real time. Similarly to the fully automated orthorectification and imagery calibration of Landsat; global mapping and change analysis will eventually become automated and routine.



GDA Corp. U S D A

# Questions? Comments? Requests?



Source : <http://globalpartnerpro.com>

## GDA Corp

Dmitry L. Varlyguin, Ph.D.

301 Science Park Road, Suite 112, State College, PA 16801

814-237-4060

[dmitry@gdacorp.com](mailto:dmitry@gdacorp.com)

<http://www.GDAcorp.com>

<https://www.CropSignal.com>

<https://www.GeoSynergy.com>

[http://rasta.GDAcorp.com/Image\\_Archive](http://rasta.GDAcorp.com/Image_Archive)