



Geospatial Data Analysis Corporation (GDA Corp)

"Monitoring The World, For A Better Tomorrow"

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Landsat-class Regional Mosaics for Improved Visualization, Monitoring, and Analysis

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JACIE 2015

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

**May 4-8, 2015
Tampa, Florida**



GDA Landsat-class Archive ²

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- In support of the USDA analytical efforts, GDA maintains an operational end-to-end fully automated system for rapid, massive download, processing, and publishing of global Landsat and Landsat-class imagery for all major agricultural areas
- GDA collects, calibrates to the surface reflectance, and adds value-added imagery and products to the GDA Satellite Image Archive within 12-24 hours of imagery release by the source

GDA Image Archive -- http://rasta.GDAcorp.com/Image_Archive/

Landsat-class Sensors:
Landsat 8 OLI
Landsat 7 ETM+
Landsat 5 TM
UK-DMC2
Deimos-1
P6-AWiFS
P6-LISS3
Sentinel-2A (coming)
Sentinel-2B (coming)

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Search Results



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GDA Imagery Archive

Traditional

- Imagery is provided as original Digital Number (DN) data and must be calibrated and corrected for atmospheric properties
- Imagery is provided in a ~1GB .tar.gz archive containing multiple individual single-band uncompressed GeoTIFFs which must be unpacked before use (~4GB per scene)

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- Imagery is already calibrated to the true surface reflectance and cross-calibrated to coincident MODIS surface reflectance values
- Imagery is provided in a ~250MB losslessly compressed, non-zipped, JPEG2000 archive
- User can immediately load image into ArcView / ERDAS / etc. for analysis without unpacking / converting / calibrating
- Saves the user 75% download time, 90% local storage space



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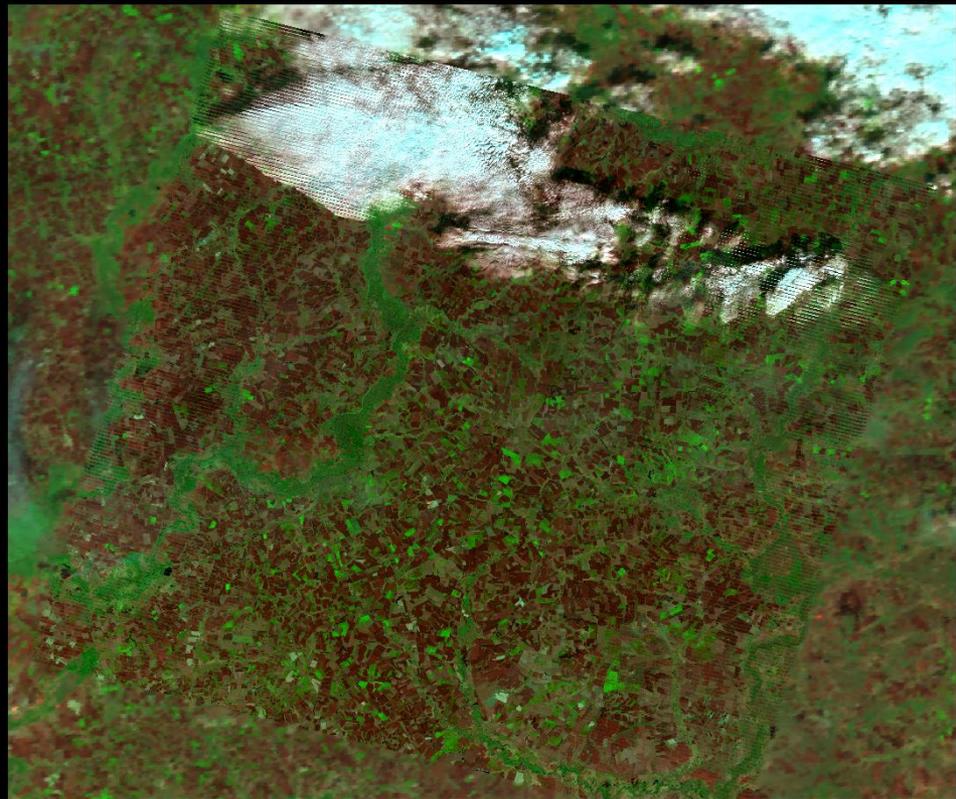
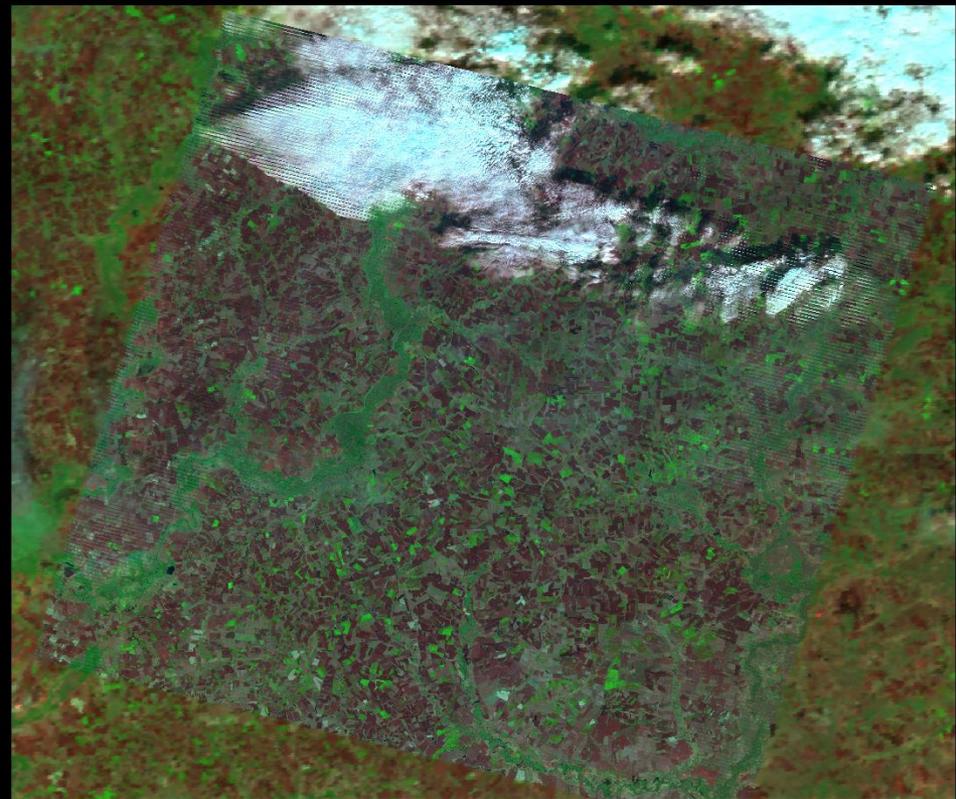
Surface Reflectance Calibrated Imagery ⁴

Imagery

Surface Reflectance vs. TOA Corrected Imagery Draped over Coincident MODIS SR Imagery

TOA Corrected

Surface Reflectance Corrected

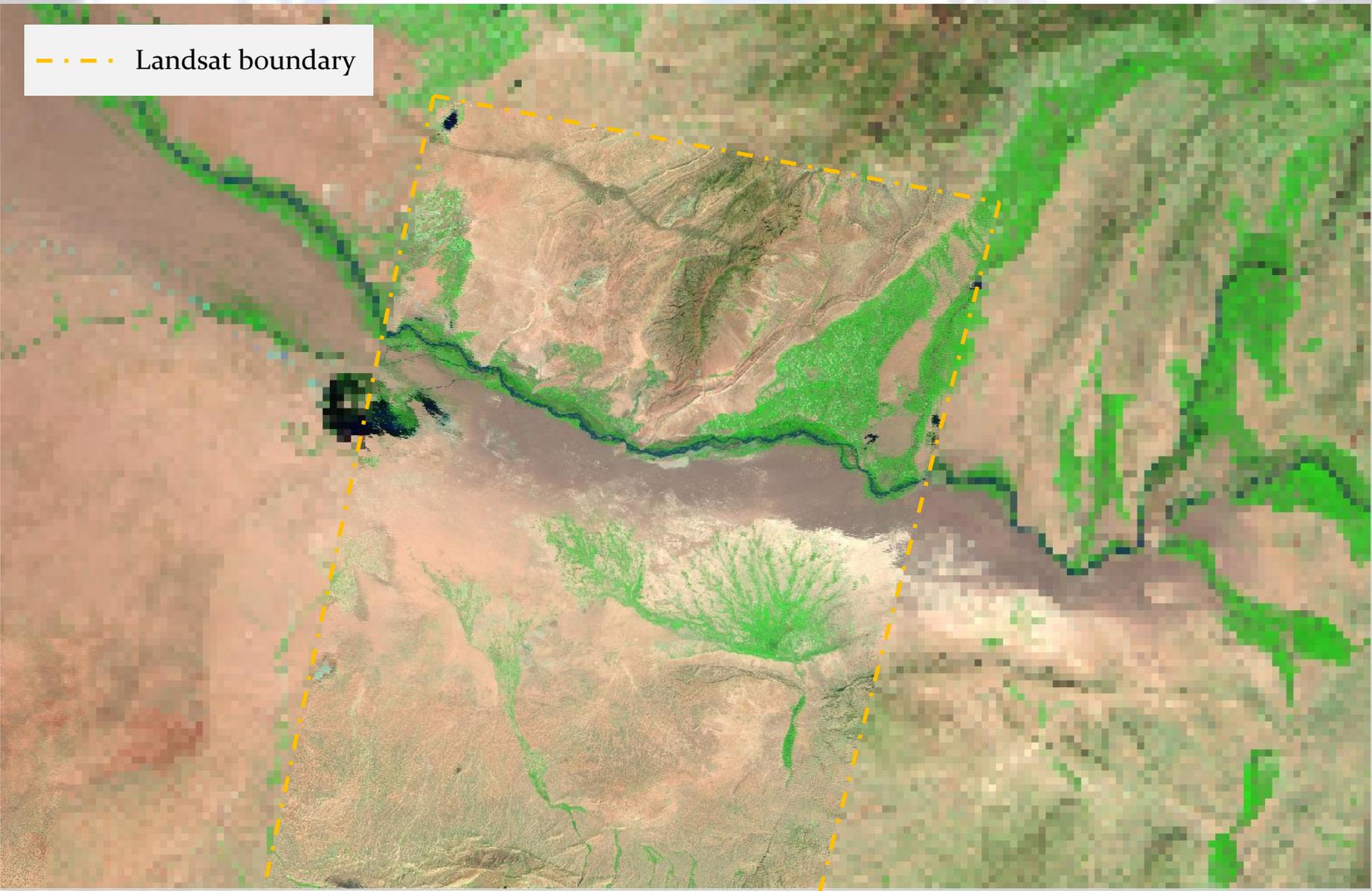




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SR Calibrated LT Draped Over Coincident SR Calibrated MODIS

--- Landsat boundary

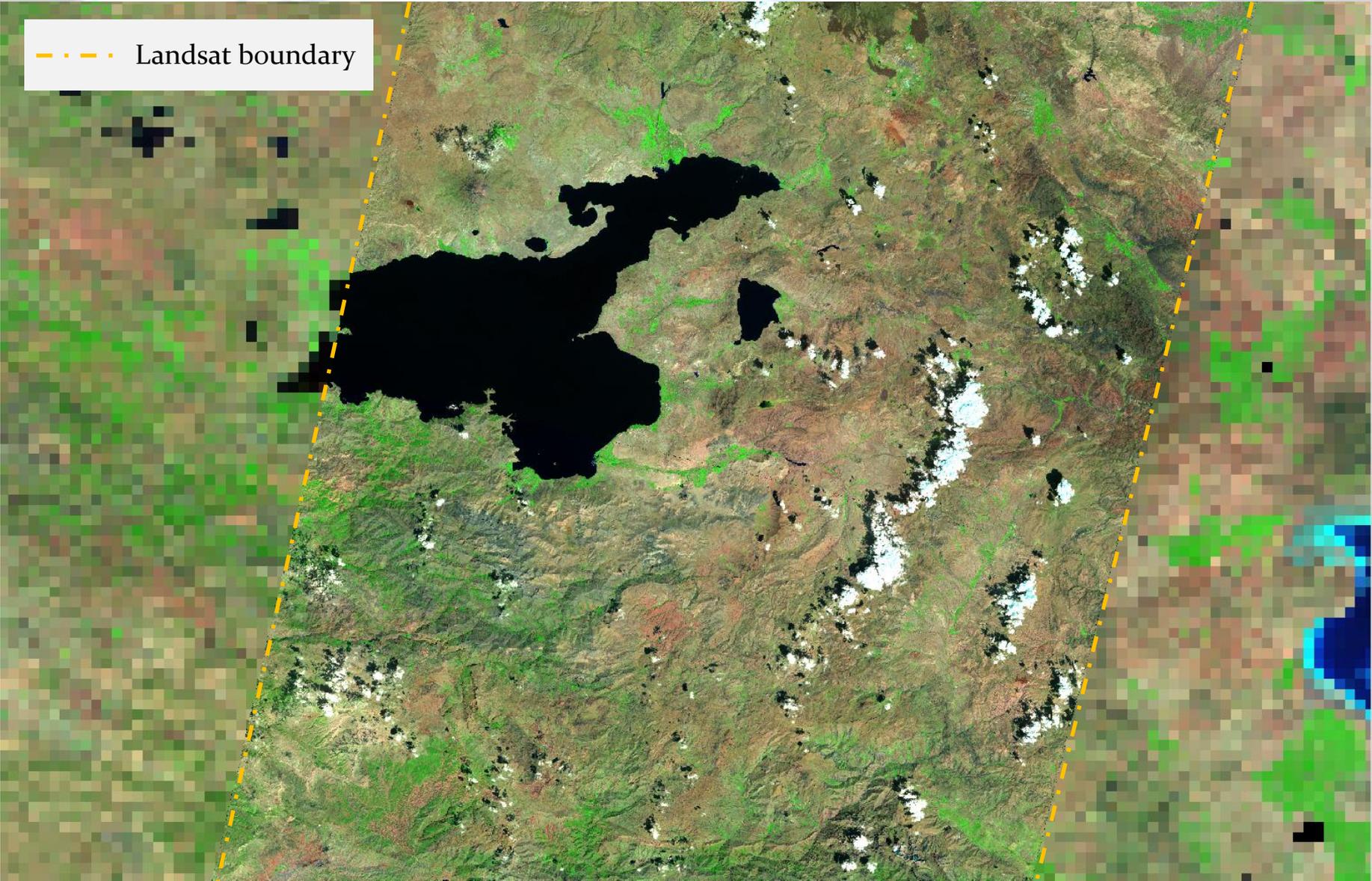




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SR Calibrated LT Draped Over Coincident SR Calibrated MODIS

--- Landsat boundary



Currently:

- Monthly archive addition is ~10,000 scenes
- Daily archive addition is ~350 scenes
- Value added products are generated for each scene (surface reflectance (SR), SR based NDVI, SR based WDRVI, Data Gap masks, *etc*)
- Value added products are available in the archive within 12-24 hours of their release by the source
- GDA global, spinning disk archive of the satellite imagery products is about 120 TB

2015-2016 Plans:

- Landsat Collection: Cover more area and for longer time
- Landsat Collection: Increase cloud cover threshold
- Add Sentinel 2A in 2016 (and Sentinel 2B in 2017)
- Likely to (at least) double the data volume, storage, delivery

Landsat and Landsat-class imagery provide repetitive, reliable, compatible global observations. Once calibrated they can be mosaicked into a time series datasets with a regional or even global coverage.

Mosaic Benefits:

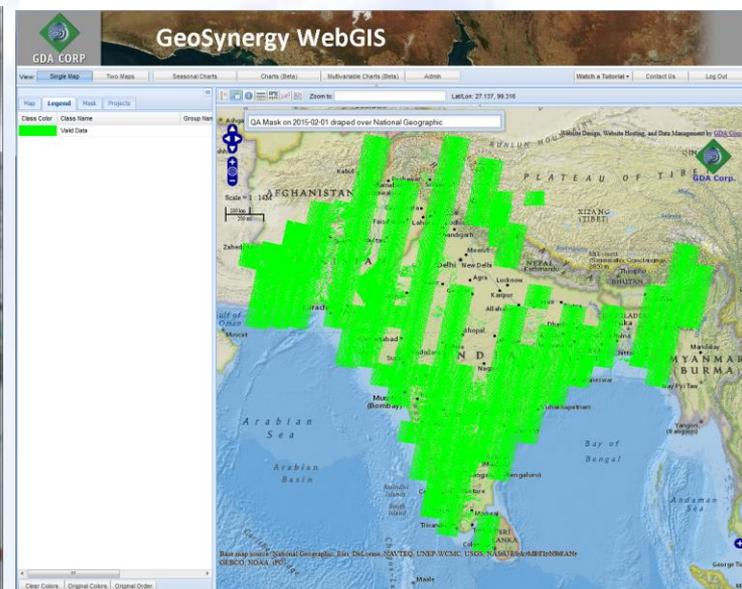
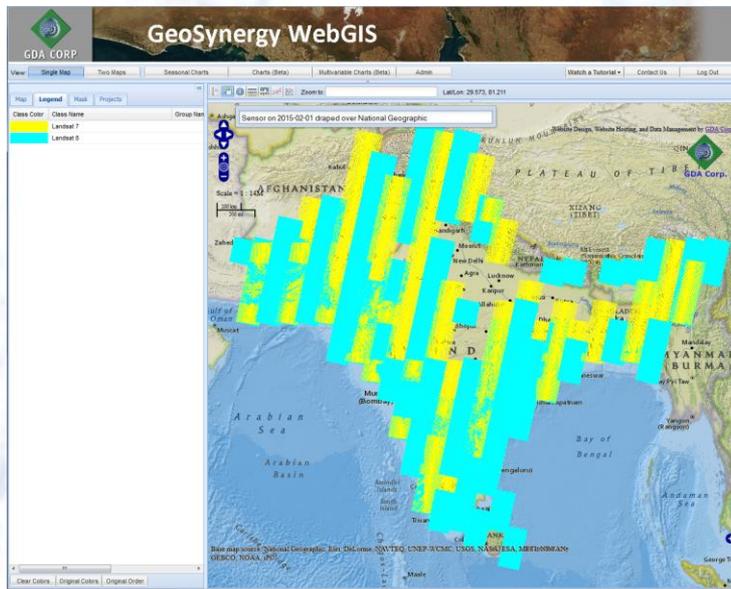
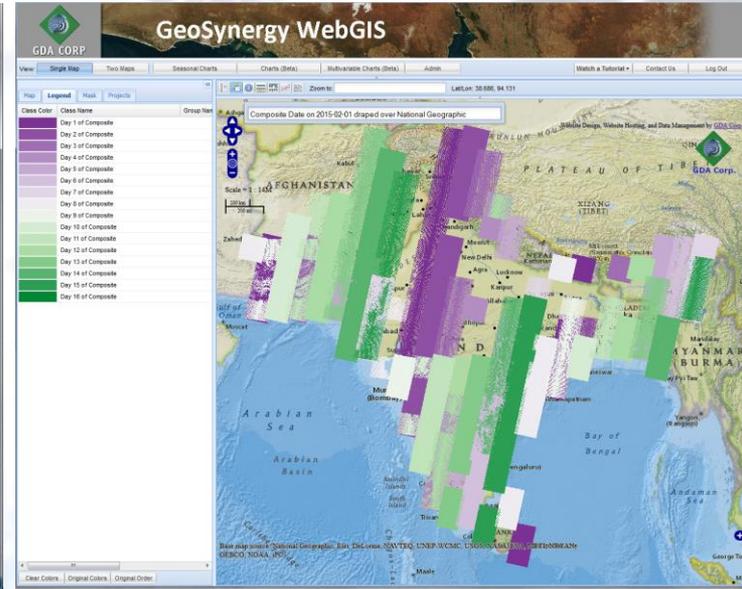
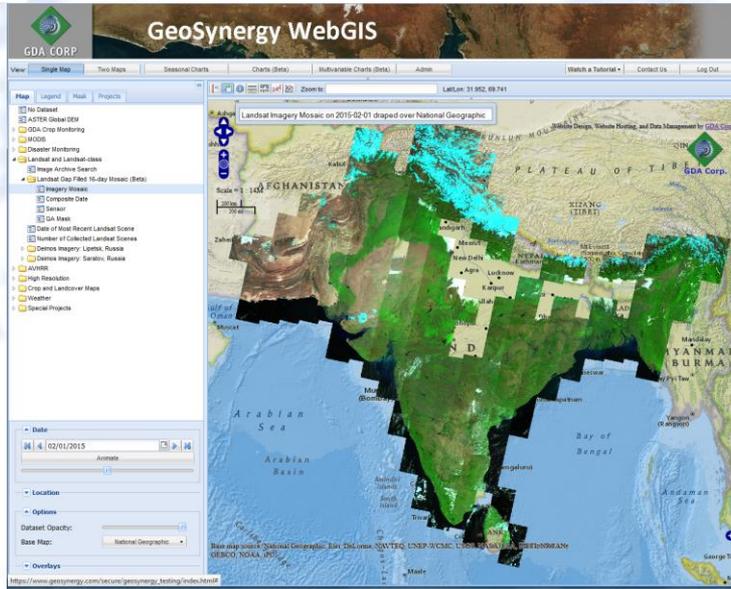
- ✓ Data Volume Reduction
- ✓ Improved Data Storage, Display, Delivery
- ✓ Data Quality Improvements
 - Best pixel selection
 - Data gap suppression
- ✓ Improved Data Analysis
 - At original footprint level
 - Regional analytics
 - Time series analysis

ANALYSIS READY DATA!

Coverage:	Global (<i>all major agricultural areas+</i>)
Source:	GDA Surface Reflectance calibrated Landsat 8 OLI and Landsat 7 ETM+
Dates:	January 01, 2015 - today
Updates:	Hourly
Bands:	6 Multi-Spectral bands, B-G-R-NIR-SWIR ₁ -SWIR ₂
Format:	16-bit; JP2 lossless
Spatial Resolution:	30 meters
Frequency:	16 day compositing
Metadata Spatial Layers (per pixel):	Image Date, Sensor, and Remaining Data Gaps

Mosaic Layers

- Spatial Layers:**
- ✓ Imagery
 - ✓ Image Date
 - ✓ Sensor
 - ✓ Data Gaps





LT Mosaics: Storage Saving

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Landsat and Landsat-class regional-to-global mosaics offer a tremendous data volume reduction and storage savings -- **>80% for each mosaic covering major agricultural areas of the world**

Mosaic: # of Landsat Footprints	800	
Mosaic: Unzipped, JP2 lossless, 6 MS bands, 16bit, 30 meter	160	GB
Source Landsat DN Scenes: Zipped GeoTIFF, 16bit, all bands	~1	TB
Source Landsat SR Scenes: Unzipped GeoTIFF, 16bit, 6 MS bands	~1	TB
Data Volume Reduction / Storage Savings	~84	%



Traditional

- Individually specify and download imagery for all footprints in the target region and date window (Landsat -- ~1GB each)
- Unpack, calibrate, layerstack, clip, and mosaic scenes for viewing in ArcView / ERDAS / etc. (hours of work)

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- Use GeoSynergy website to navigate directly to area of interest, where high-quality cloud-free, calibrated 16-day Landsat composites can be viewed and analyzed online
- No downloading
- No processing
- Constantly updated



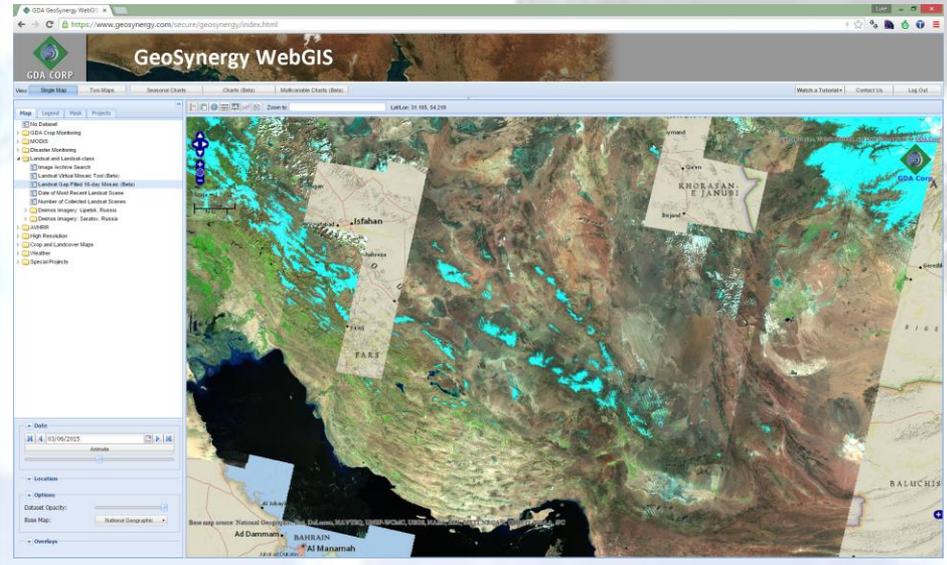
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Regional Visualization & Analysis ¹³

Traditional

- Individually specify and download imagery for all footprints in the target region and date window (Landsat -- ~1GB each)
- Unpack, calibrate, layerstack, clip, and mosaic scenes for viewing in ArcView / ERDAS / etc. (hours of work)

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Traditional

- Individually specify and download Landsat imagery for target area and time period (~1GB for each data point)
- Unpack, calibrate, layerstack and clip scenes to target area
- Create model in ArcView / ERDAS / etc. to extract time series profile

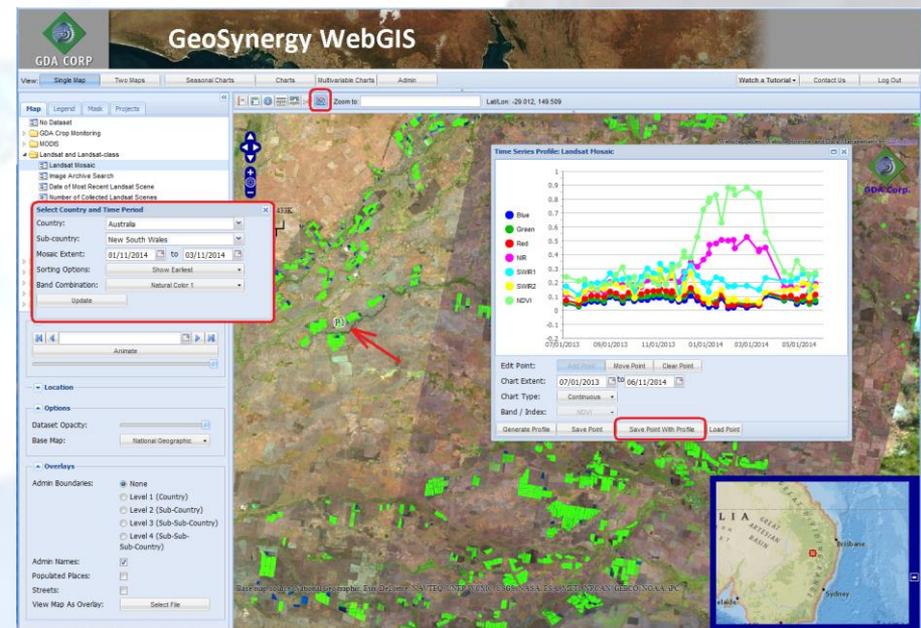
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- Use GeoSynergy website to navigate directly to area of interest
- Use time series profile tool to drop a point and extract time series profile for any location
- Data can also be exported for further analysis using other software tools

Traditional

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- Unpack, calibrate, layerstack and clip scenes to target area
- Create model in ArcView / ERDAS / etc. to extract time series profile

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Traditional

- Individually specify and download Landsat imagery for all footprints in the target region and date window (~1GB each)
- Unpack, calibrate, layerstack, clip, and mosaic scenes for processing
- Generate spectral landcover model using ArcView / ERDAS / etc. to generate landcover map

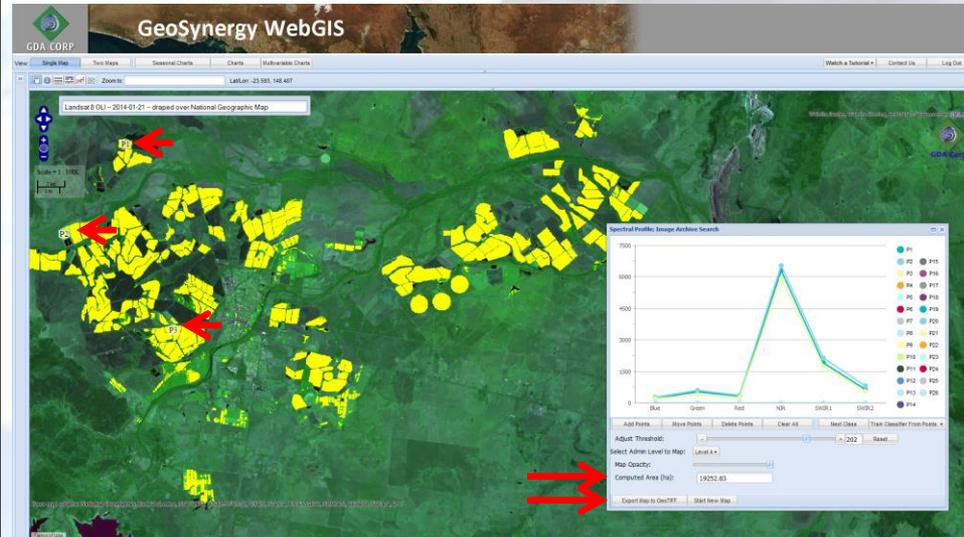
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- Use GeoSynergy website to navigate directly to area of interest
- Use spectral profile tool and analysis ready imagery to identify landcover type(s) of interest
- Use interactive mapping tool to generate landcover map in the browser
- Maps and spectral profiles can be exported for further analysis using other software tools

Traditional

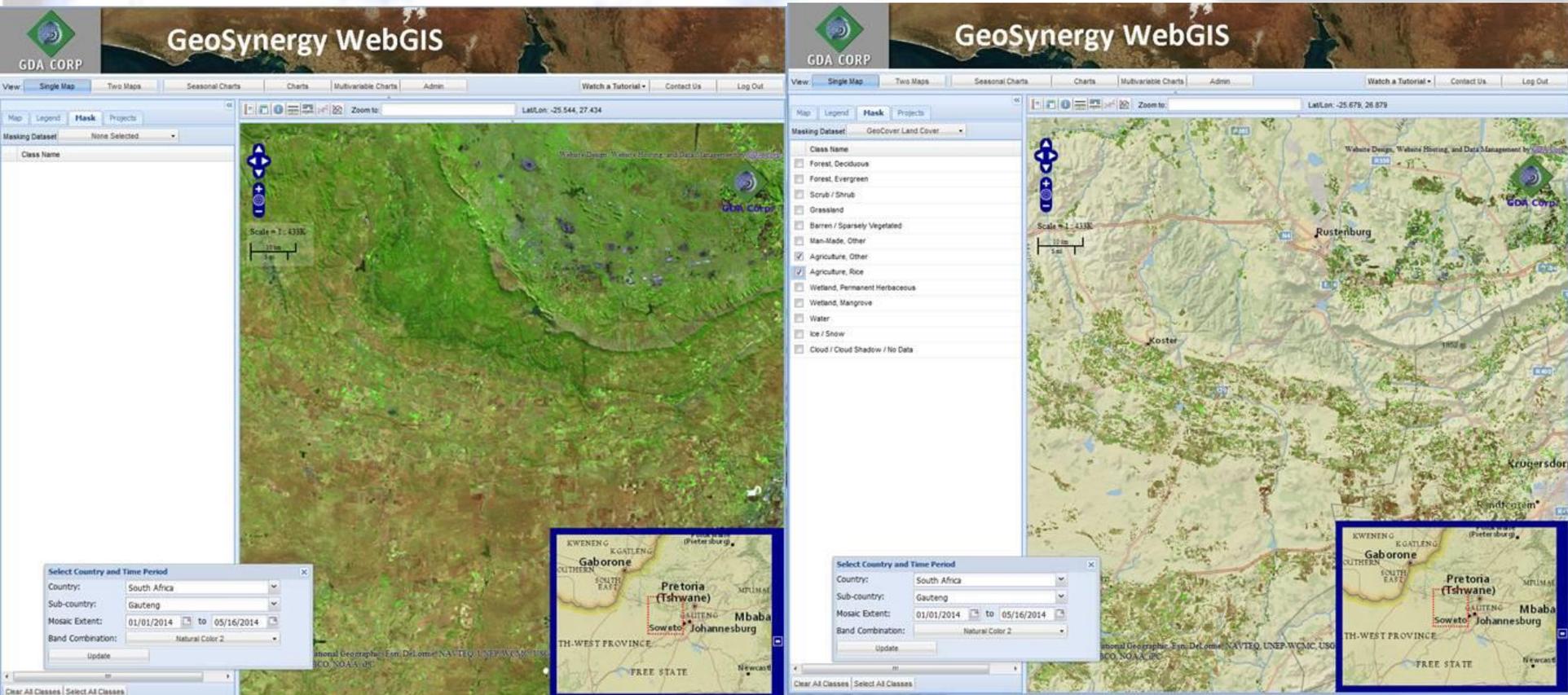
- Individually specify and download Landsat imagery for all footprints in the target region and date window (~1GB each)
- Unpack, calibrate, layerstack, clip, and mosaic scenes for processing
- Generate spectral landcover model using ArcView / ERDAS / etc. to generate landcover map

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Imagery Masking

Ancillary data can be used to focus viewing and analysis on specific AOIs



The image displays two side-by-side screenshots of the GeoSynergy WebGIS interface, demonstrating the process of imagery masking for a specific Area of Interest (AOI) in South Africa.

Left Screenshot: Shows a satellite image of a rural area. The 'Mask' panel on the left is empty, indicating no mask is currently applied. The 'Masking Dataset' is set to 'None Selected'.

Right Screenshot: Shows the same satellite image, but with a mask applied. The 'Masking Dataset' is set to 'GeoCover Land Cover'. The 'Class Name' list on the right shows the following checked items: 'Agriculture, Other' and 'Agriculture, Rice'. Other classes like 'Forest, Deciduous', 'Forest, Evergreen', 'Scrub / Shrub', 'Grassland', 'Barren / Sparsely Vegetated', 'Man-Made, Other', 'Wetland, Permanent Herbaceous', 'Wetland, Mangrove', 'Water', 'Ice / Snow', and 'Cloud / Cloud Shadow / No Data' are unchecked.

Both screenshots include a 'Select Country and Time Period' dialog box with the following settings:

- Country: South Africa
- Sub-country: Gauteng
- Mosaic Extent: 01/01/2014 to 05/16/2014
- Band Combination: Natural Color 2

The dialog box also includes an 'Update' button and a 'Clear All Classes | Select All Classes' option at the bottom.

Example for South African Republic

Summer 2015:

- ✓ Enable on-line, real time manipulation of mosaic band combinations
- ✓ Add NDVI, NDWI, Burn Index to the mosaics
- ✓ Add to the mosaicking imagery with $\leq 65\%$ cloud cover
- ✓ Add mosaics for 2014, 2013, and 2012

2015-2016 Plans:

- ✓ Add Sentinel-2A once available
- ✓ Offer global coverage
- ✓ With S2, change mosaic spatial resolution to 10-15 meters
- ✓ With S2, change mosaic temporal resolution to 5-7 days



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15 m Landsat Mosaics

15 meter Landsat Mosaic

30 meter Landsat Mosaic

GeoSynergy WebGIS

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

Lat/Lon: 36.142, 37.472 Lat/Lon: 36.105, 37.437

Scale = 1 : 27K

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

- Imagery mosaicking dramatically reduces data volume, thus improving data storage, display, and delivery. (When done right) it improves data quality and improves data analysis.
- Massive amounts of analysis ready, full resolution, all bands regional and even global Landsat / Landsat-class mosaics can be presented on-line for viewing, manipulation, and analysis.
- On-line analytics can now include real-time time series drilling and real-time regional mapping with Landsat-class imagery mosaics.
- We should expect an emergence of applications – in a near future -- for real time, regional to global, pixel level monitoring and analysis of land cover types and their change with Landsat-class imagery mosaics. Similarly to now fully automated orthorectification and imagery calibration of Landsat; global mapping and change analysis will eventually become fully automated and routine.



Contact Info

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<http://www.GDAcorp.com>

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<https://www.GeoSynergy.com>

https://rasta.GDAcorp.com/Image_Archive