



National Aeronautics and
Space Administration



ARSET

Applied Remote Sensing Training

<http://arset.gsfc.nasa.gov>

Creating and Using Normalized Difference Vegetation Index (NDVI) from Satellite Imagery

Instructors: Cindy Schmidt and Amber McCullum

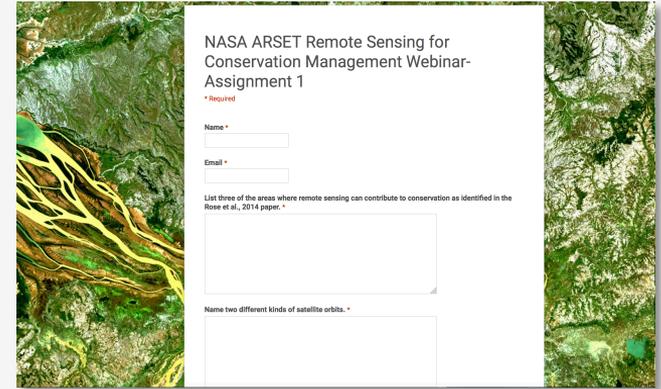
Week 3

Course Structure

- One lecture per week – every Wednesday from February 10 to March 2 at 12:00-1:00pm EST (-05:00 UTC)
 - Lectures
 - In-class exercise
 - Q&A
 - Homework exercises
- Webinar recordings, PowerPoint presentations, in-class exercises, and homework assignments can be found after each session at:
 - <http://arset.gsfc.nasa.gov/ecoforecasting/webinars/advanced-webinar-creating-and-using-normalized-difference-vegetation-index>
- Q&A: Following each lecture and/or by email (cynthia.l.schmidt@nasa.gov)

Homework and Certificates

- Homework
 - Hands-on exercise each week
 - Answers must be submitted via Google Form
- Certificate of Completion:
 - Attend all 4 webinars
 - Complete all 4 homework assignments by the deadline (access from ARSET website)
 - **Week 3 Deadline: Wednesday March 9th**
 - You will receive certificates approximately 2 months after the completion of the course from: marines.martins@ssaihq.com



NASA ARSET Remote Sensing for Conservation Management Webinar-Assignment 1

*** Required**

Name *

Email *

List three of the areas where remote sensing can contribute to conservation as identified in the Rose et al., 2014 paper. *

Name two different kinds of satellite orbits. *

Accessing Course Materials

- <http://arset.gsfc.nasa.gov/ecoforecasting/webinars/advanced-webinar-creating-and-using-normalized-difference-vegetation-index>

The screenshot shows the ARSET website header with navigation tabs for Earth Sciences Division, Applied Sciences, and ASP Water Resources. The main content area features a sidebar with 'Eco Forecasting' and 'Fundamentals of Remote Sensing' sections. The central content displays the title 'Advanced Webinar: Creating and Using Normalized Difference Vegetation Index (NDVI) from Satellite Imagery' with a date range of 02/10/2016 to 03/02/2016. Below the title is a world map showing NDVI data from October 2015. The text indicates the webinar is held on Wednesdays from 12:00PM-1:00PM EST (UTC -05:00) on February 10, 17, 24, and March 2, 2016. A course description at the bottom states: 'In this advanced webinar, participants will learn how to acquire, use, and derive'.

Course Materials

Week	Date	Title	Presentation	Data and Exercise	Recording	Homework
1	February 10, 2016	Introduction to NDVI and QGIS	Week 1 Presentation Week 1 Presentation (Spanish)	Week 1 Data Week 1 Exercise	View Week 1 Recording	Homework 1 Exercise Homework 1 Submission
2	February 17, 2016	Deriving NDVI from Landsat	Week 2 Presentation Week 2 Presentation (Spanish)	Week 2 Data Week 2 Exercise	View Week 2 Recording	Homework 2 Exercise Homework 2 Submission
3	February 24, 2016	MODIS NDVI Time Series	Week 3 Presentation Week 3 Presentation (Spanish)	Week 3 Data Week 3 Exercise	View Week 3 Recording	Homework 3 Exercise Homework 3 Submission
4	March 2, 2016	MODIS NDVI Anomalies	Week 4 Presentation Week 4 Presentation (Spanish)	Week 4 Data Week 4 Exercise	View Week 4 Recording	Homework 4 Exercise Homework 4 Submission

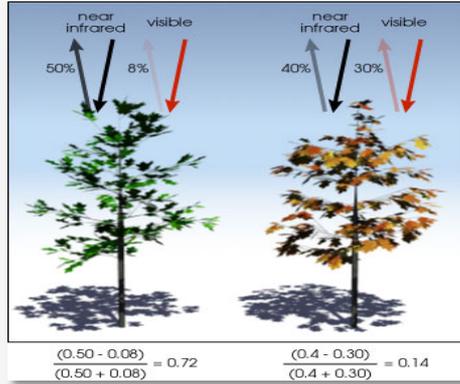
*Please note that you must register to view all recordings. This includes the requirement to re-register for each separate recording for live webinar participants.

Course materials are provided here using each specified link and will be active after each week

Course Outline

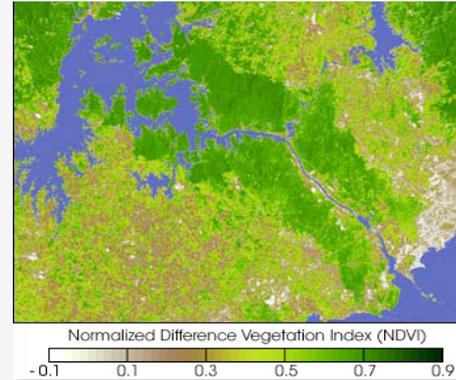
Week 1

Overview of
NDVI and
QGIS



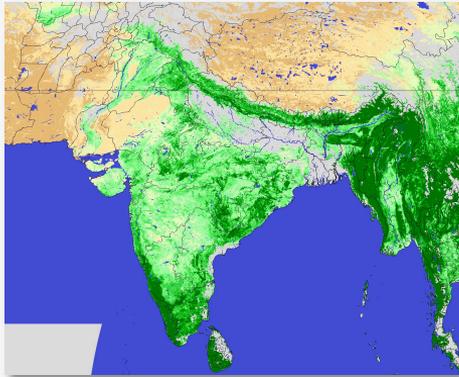
Week 2

NDVI with
Landsat



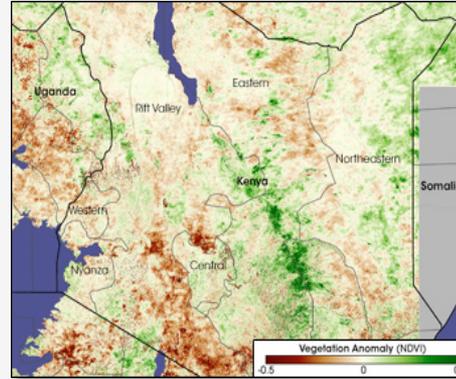
Week 3

MODIS
NDVI Time
Series



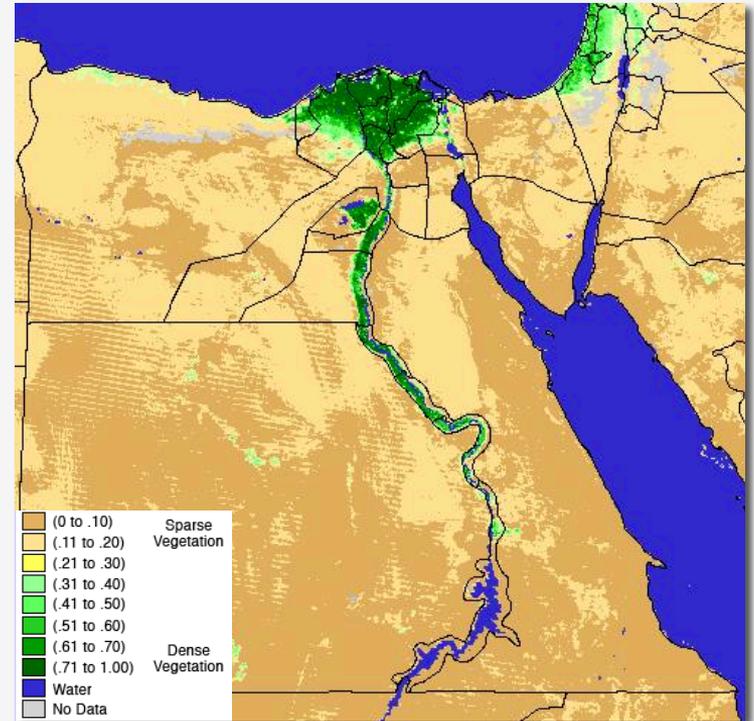
Week 4

MODIS
NDVI
Anomaly
Mapping



Week 3 Agenda

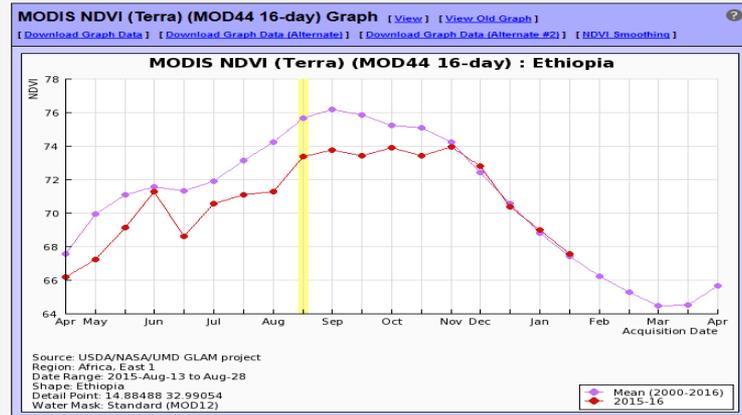
- Overview of MODIS Imagery
- Live Demos: Global Agricultural Monitoring (GLAM) Project
 - MODIS/NDVI Time Series Database
 - GIMMS MODIS system
- Q&A



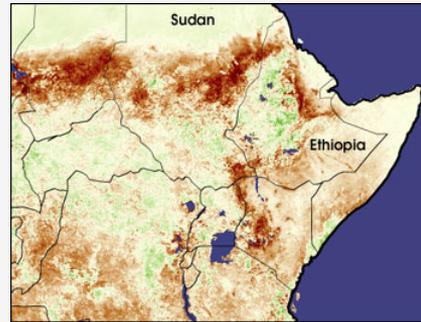
MODIS NDVI of Nile River Basin from GLAM

NDVI Time Series and Anomalies

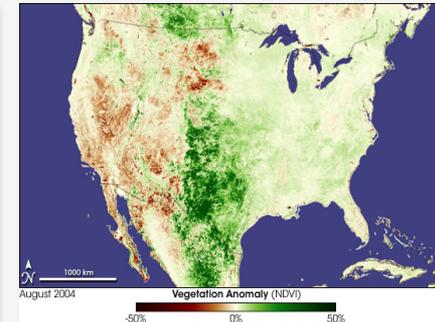
- Can be used to identify
 - Changes in vegetation health
 - Land degradation
 - Decreased/increased precipitation
 - Changes in phenology (green-up timing)



NDVI time series for 2015, Ethiopia



NDVI anomaly, August 1984, Ethiopia



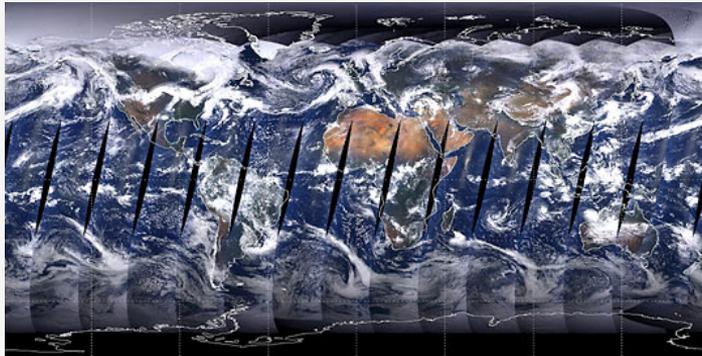
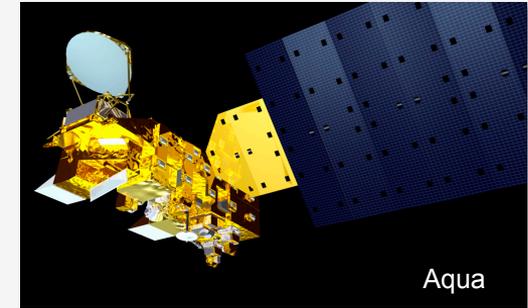
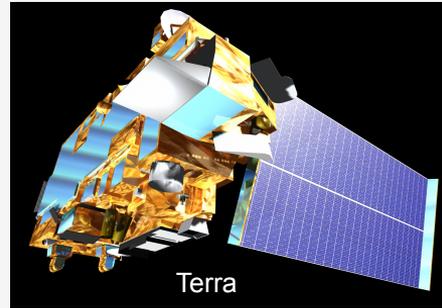
NDVI anomaly, August 2004, USA

A satellite image of a river delta, likely the Amazon, showing a complex network of channels and floodplains. A semi-transparent rectangular box is overlaid on the center of the image, containing the text 'MODIS Review' and a horizontal line below it. The background shows various shades of green, brown, and blue, representing different land and water features.

MODIS Review

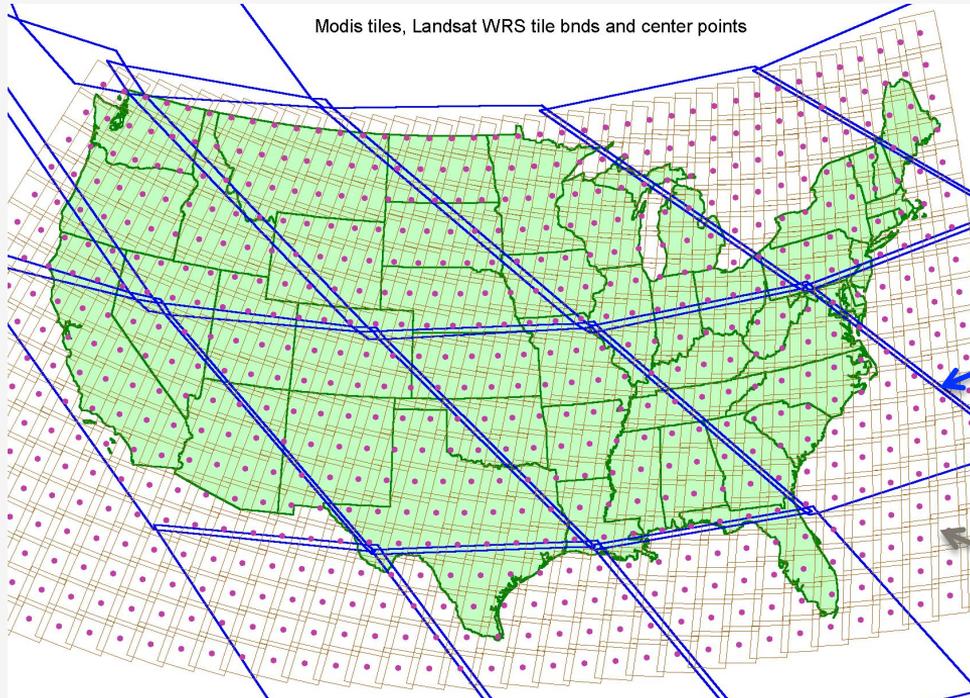
MODIS Characteristics

- Spatial Resolution
 - 250m, 500m, 1km
- Temporal Resolution
 - Daily, 8-day, 16-day, monthly, quarterly, yearly
 - 2000-present
- Data Format
 - Hierarchical data format



- Spectral Coverage
 - 36 bands (major bands include Red, Blue, IR, NIR, MIR)
 - Bands 1-2: 250m
 - Bands 3-7: 500m
 - Bands 8-36: 1000m
- Orbital gaps

MODIS Tiles vs. Landsat



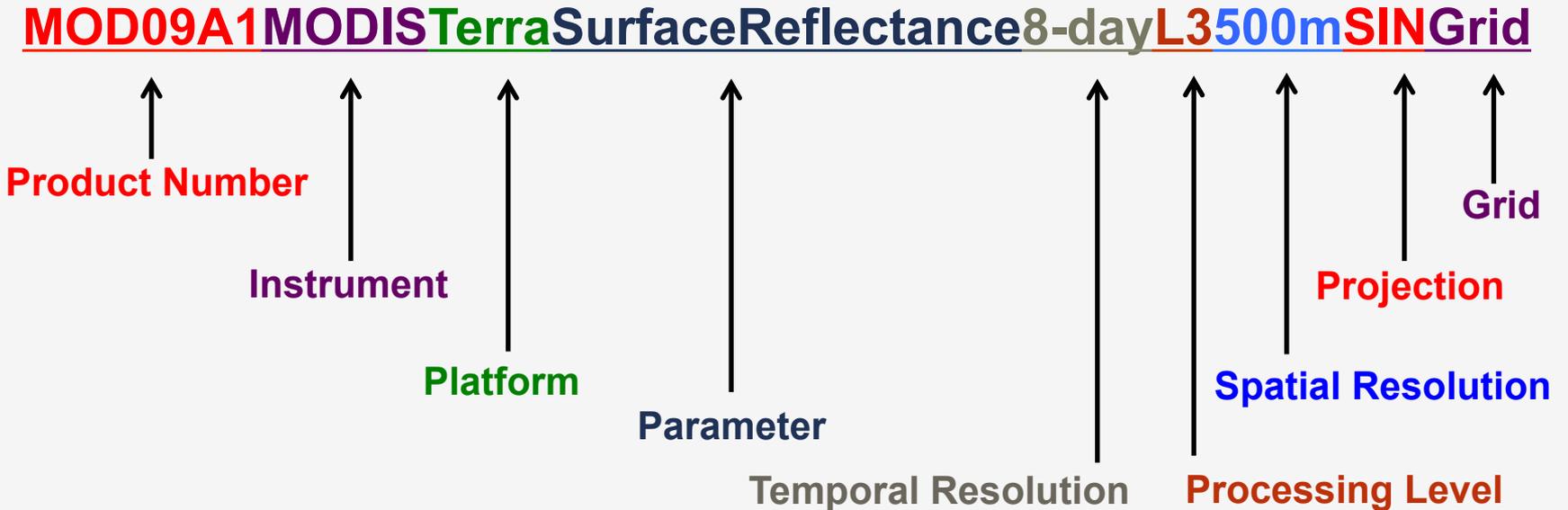
Large swaths!

MODIS tiles
in blue

Landsat tiles
in brown

MODIS Naming Convention

MODIS filenames follow a naming convention which gives useful information regarding the specific product. For Example:



****NOTE: MOD – Terra; MYD – Aqua; MCD - Combined**

MODIS Land Products

MODIS Name	Product Name <i>Short name</i>	Spatial Resolution (m)	Temporal
MOD 09	Surface Reflectance	500	8-day
MOD 11	Land Surface Temperature	1000	Daily, 8-day
MOD 12	Land Cover/Change	500	8-day, Yearly
MOD 13	Vegetation Indices	250-1000	16 day, monthly
MOD 14	Thermal Anomalies/Fire	1000	Daily, 8-day
MOD 15	Leaf Area Index/Fraction of Absorbed Photosynthetically Active Radiation (FPAR)	1000	4-day, 8-day
MOD 16	Evapotranspiration		
MOD 17	Primary Production	1000	8-day, yearly
MOD 43	Bidirectional reflectance distribution function (BRDF)/Albedo	500-1000	16-day
MOD 44	Vegetation Continuous Fields	250	yearly
MOD 45	Burned Area	500	monthly

All MODIS Land Products are available at processing Level 3

Where to Obtain MODIS Land Products

- Land Processes Distributed Active Archive (LP DAAC)

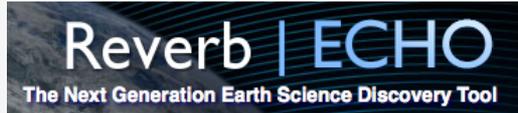
https://lpdaac.usgs.gov/dataset_discovery/modis/modis_products_table

- Earth Observing System Data and Information System (EOSDIS):

<http://Earthdata.nasa.gov>

The screenshot displays the Earthdata website interface. At the top, there are six circular icons representing different Earth system components: ATMOSPHERE, CALIBRATED RADIANCE AND SOLAR RADIANCE, CRYOSPHERE, HUMAN DIMENSIONS, LAND, and OCEAN. Below these icons are three main content sections: 'Earthdata News Feeds', 'EOSDIS News', and 'Sensing Our Planet'. The 'Earthdata News Feeds' section lists various data centers: GES-DISC, GHRC, LaRC ASDC, LP DAAC, NSIDC DAAC, ORNL DAAC, PO DAAC, SEDAC, GCMD, and ESIP Federation. The 'EOSDIS News' section features several news items, including 'Making the Most of Earth Science Data: The 2nd Gregory G. Leptoukh Online Giovanni Workshop', 'NASA FIRMS Helps Fight Wildland Fires in Near Real-Time', 'Status of Rapid Response servers', 'Webinar - Know Your Landsat: Understanding and Accessing Landsat Data', 'New Products in the Global Imagery Browse Services', and 'Toolsets for Airborne Data (TAD)'. The 'Sensing Our Planet' section is currently empty.

Where to Obtain MODIS Land Products



ECHO Reverb: <http://reverb.echo.nasa.gov>



Data Subsetting and Visualization: Oakridge National Lab DAAC (ORNL DAAC): <http://daac.ornl.gov>



GLCF: <http://www.landcover.org/data/lc>



GLOVIS: <http://glovis.usgs.gov>



Fire Information for Resource Management System (FIRMS): <https://earthdata.nasa.gov/data/near-real-time-data/firms>

Where to Obtain MODIS Land Products



Worldview (Fires, Land Surface Temperature and Snow Cover): <https://earthdata.nasa.gov/labs/worldview>



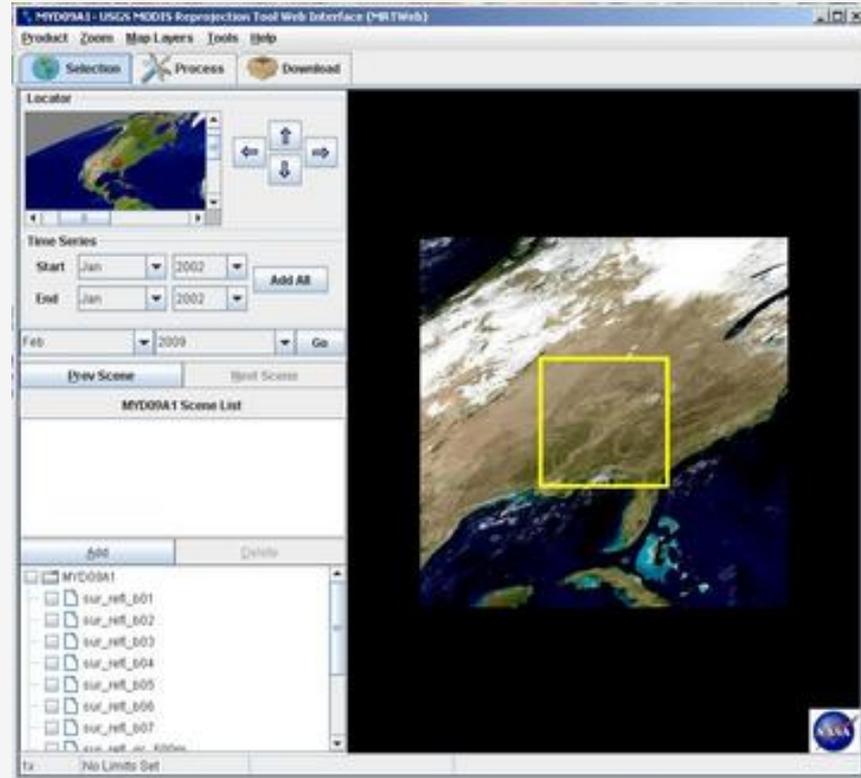
Visualization, SERVIR:
<https://www.servirglobal.net/Global/MapsData/InteractiveMapper.aspx>



MRTWeb: <http://mrtweb.cr.usgs.gov>

MRTWeb

- MRTWeb enables you to:
 - Visualize
 - Select
 - Mosaic
 - Subset
 - Reproject
 - Reformat



What is EVI?

- Enhanced Vegetation Index (MOD13Q1) – standard product from MODIS
 - More sensitive to changes in areas having high biomass
 - Reduces the influence of atmospheric conditions on vegetation index values
 - Corrects for canopy background signals

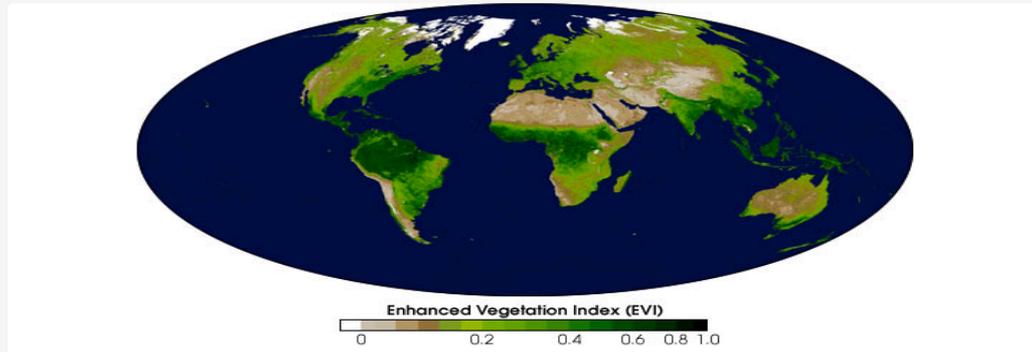


Image credit: NASA Earth Observatory

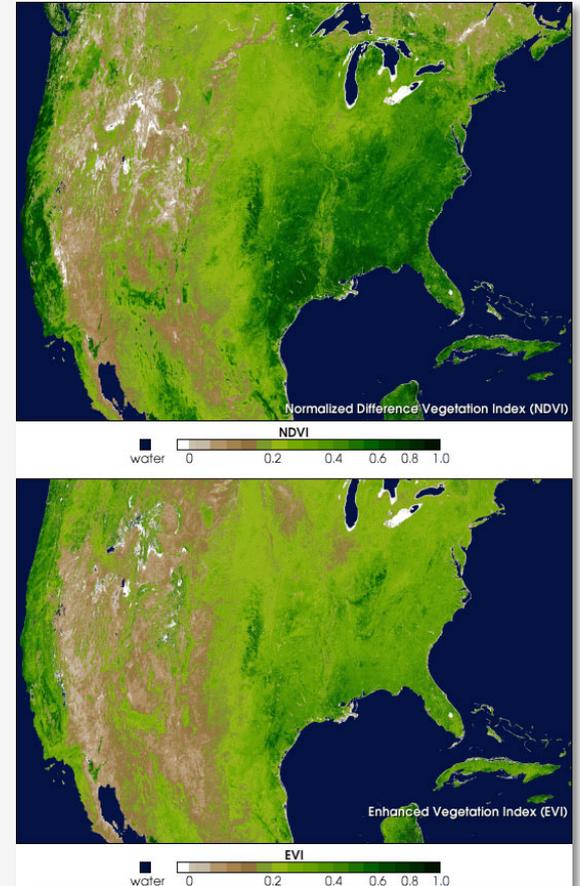
What is EVI?

- EVI is calculated as:

$$EVI = G * (NIR - RED) / NIR + C1 * RED - C2 * BLUE + L$$

- Red and Blue bands must be atmospherically corrected
- G is a scaling factor. $G = 2.5$
- C_1 , C_2 and L are coefficients to correct for atmospheric condition. For MODIS and Landsat $C_1=6$, $C_2 = 7.5$ and $L = 1$

*Comparison between MODIS NDVI and EVI in North America
March 2000*



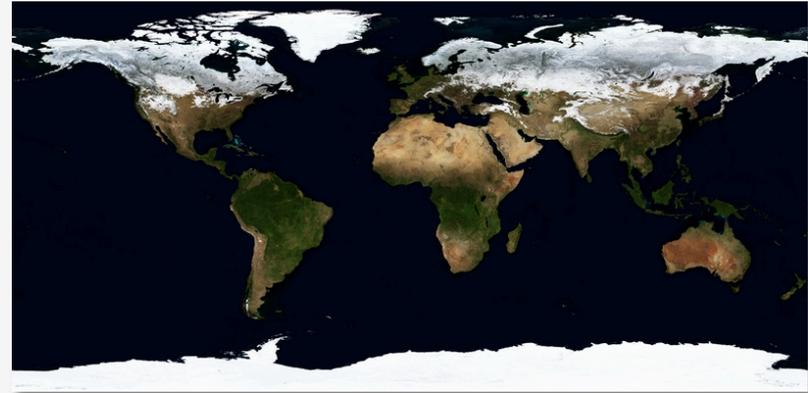
Source: earthobservatory.nasa.gov

An aerial satellite image of a river valley, showing a winding river and surrounding green fields. A semi-transparent white rectangular box is overlaid on the center of the image, containing the text 'Live Demos: Global Agriculture Monitoring (GLAM) Project'. Below the text is a horizontal black line.

Live Demos: Global Agriculture Monitoring (GLAM) Project

Global Agriculture Monitoring (GLAM) Project

- Global 16-day 250 m NDVI time series database
- USDA and NASA collaboration
 - Integrates remote sensing into USDA monitoring system
- Web-interface
 - Plot time series graphs over crop season
 - Monitor current conditions
 - Spatially view NDVI anomalies
 - Plot histograms of current and historical NDVI data

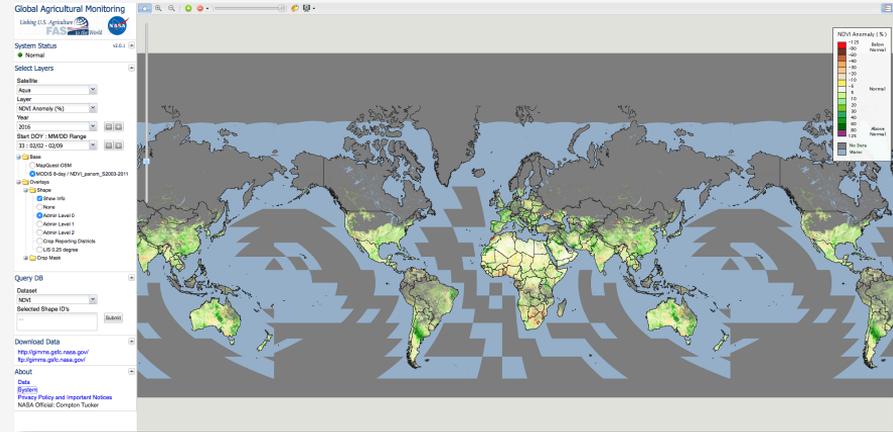


Website:

<http://pekko.geog.umd.edu/usda/test/>

Global Agriculture Monitoring (GLAM) Project

- Global Inventory Modeling and Mapping Studies (GIMMS) MODIS monitoring system
- USDA and NASA collaboration
 - Integrates remote sensing into USDA monitoring system
- Web-interface
 - Global NDVI distribution datasets in online viewer
 - Download GeoTIFF imagery
 - Spatially view NDVI and NDVI anomalies



Website:

<http://glam1.gsfc.nasa.gov>

Contacts

- ARSET Land Management and Wildfire Contacts
 - Cynthia Schmidt: Cynthia.L.Schmidt@nasa.gov
 - Amber McCullum: AmberJean.Mccullum@nasa.gov
- General ARSET Inquiries
 - Ana Prados: aprados@umbc.edu
- ARSET Website:
 - <http://arset.gsfc.nasa.gov/>



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ARSET
Applied Remote Sensing Training
<http://arset.gsfc.nasa.gov>

Thank You

Next Week:
MODIS NDVI Anomalies