

## ARSET

Applied Remote Sensing Training

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

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

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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](mailto: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](mailto:marines.martins@ssaihq.com)



# Accessing Course Materials

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

NASA ARSET  
Applied Remote Sensing Training

Earth Sciences Division Applied Sciences ASP Water Resources

DISASTERS ECO FORECASTING HEALTH & AIR QUALITY WATER RESOURCES

Eco Forecasting  
► Eco Webinars  
Eco Personnel

Fundamentals of Remote Sensing  
On-Demand Training in Fundamentals of Remote Sensing

Upcoming Training  
Ecoforecasting  
Advanced Webinar:  
Creating and Using  
Normalized Difference  
Vegetation Index (NDVI)  
from Satellite Imagery  
02/16/2016 to 02/24/2016

Advanced Webinar: Creating and Using Normalized Difference Vegetation Index (NDVI) from Satellite Imagery  
02/16/2016 to 02/24/2016

October 2015 NDVI

Wednesdays 12:00PM-1:00PM EST (UTC -05:00)  
February 16, February 17, February 24, March 2  
Registration closes on February 8, 2016

Course Description: In this advanced webinar, participants will learn how to acquire, use, and derive

Course Materials

Week	Date	Title	Presentation	Date and Exercise	Recording	Homework
1	February 16, 2016	Introduction to NDVI and QGIS	Week 1 Presentation Week 1 Presentation (Spanish)	Week 1 Date 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 Date Week 2 Exercise	View Week 2 Recording	Homework 2 Exercise Homework 2 Submission
2	February 24, 2016	MODIS NDVI Time Series	Week 3 Presentation Week 3 Presentation (Spanish)	Week 3 Date 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 Date Week 4 Exercise	View Week 4 Recording	Homework 4 Exercise Homework 4 Submission

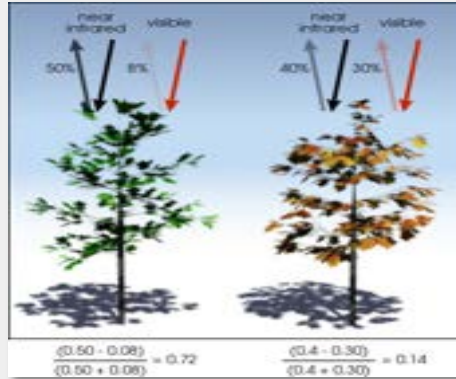
\*Please note that you must register to view all recordings. This includes the requirement to re-register for each separate recording for live webinar participants.

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

# Course Outline

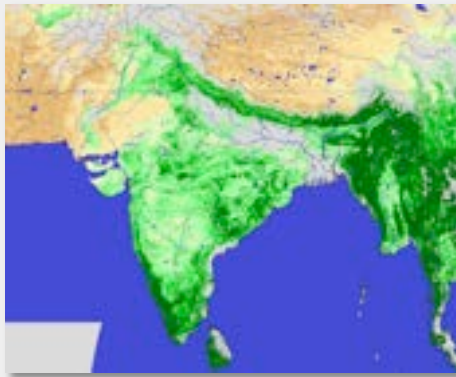
## Week 1

Overview of  
NDVI and  
QGIS



## Week 3

MODIS  
NDVI Time  
Series



## Week 2

NDVI with  
Landsat



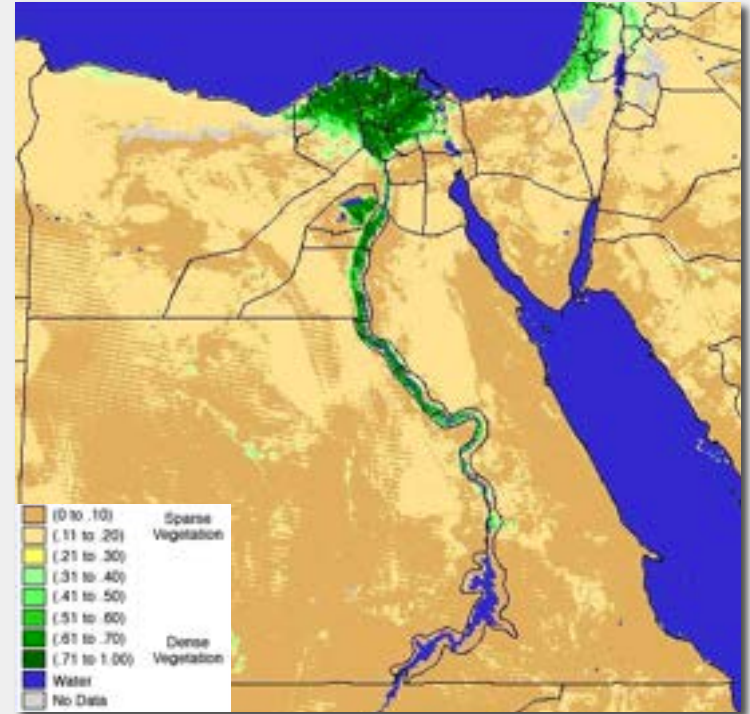
## Week 4

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

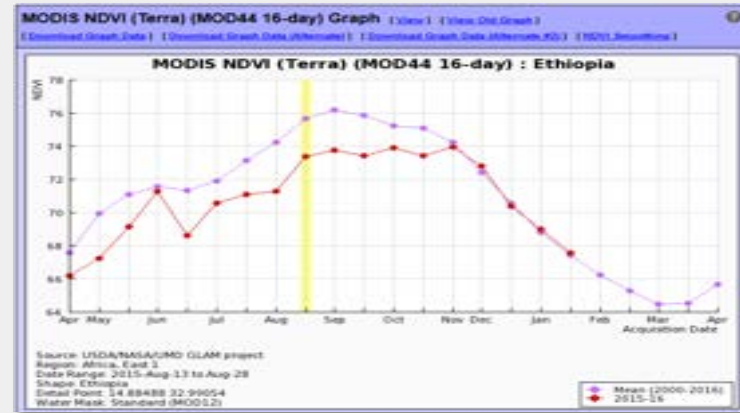


MODIS NDVI of Nile River Basin from GLAM



# NDVI Time Series and Anomalies

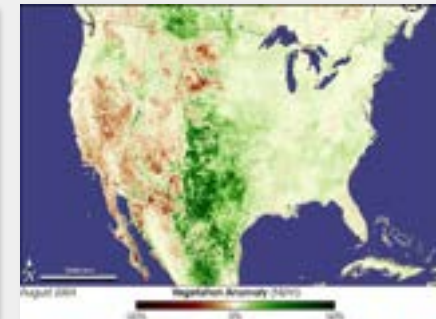
- Can be used to identify
  - Changes in vegetation health
  - Land degradation
  - Decreased/increased precipitation
  - Changes in phenology (green-up timing)



*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'.

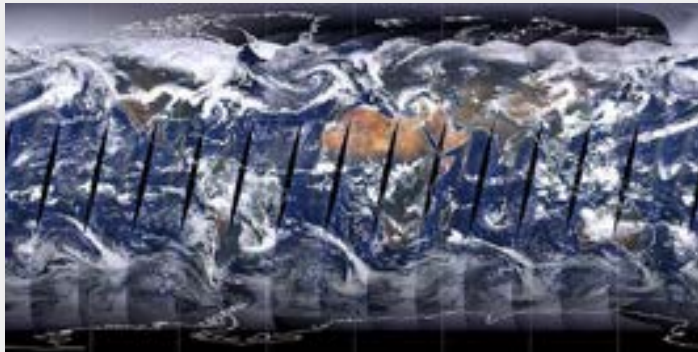
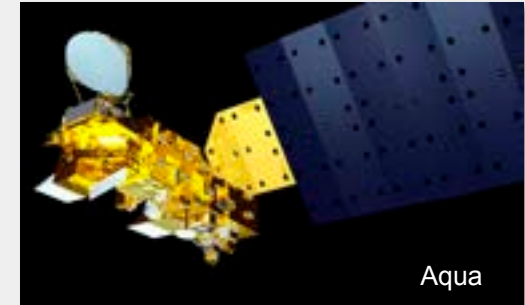
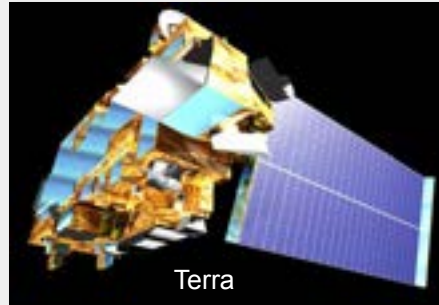
# MODIS Review

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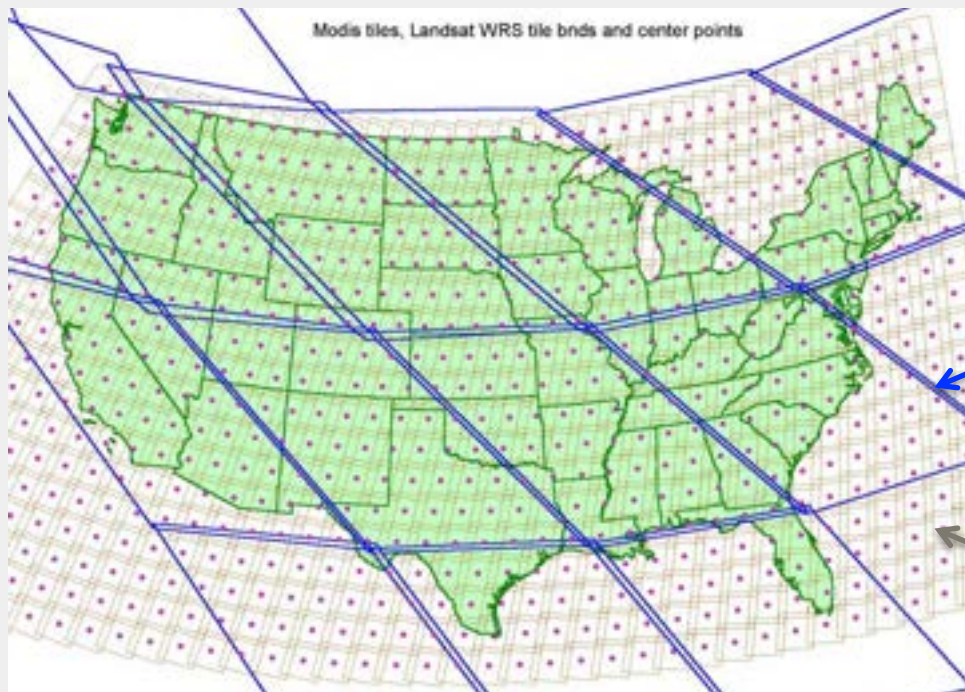
# MODIS Characteristics

- 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



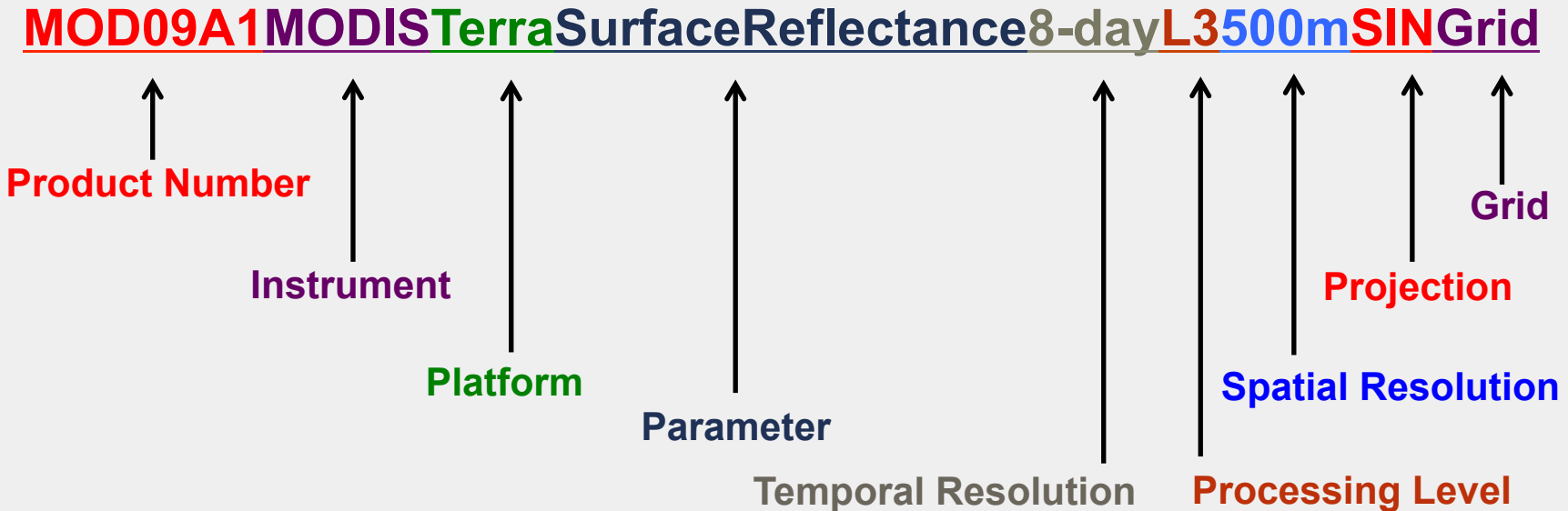
Large swaths!

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 <b>Short name</b>	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**

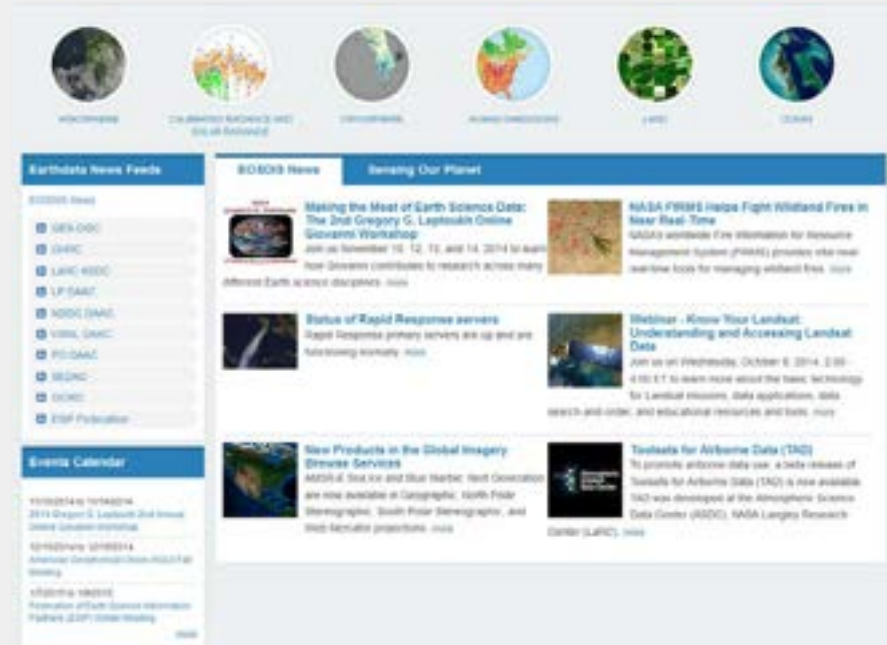
# Where to Obtain MODIS Land Products

- Land Processes Distributed Active Archive (LP DAAC)

[https://lpdaac.usgs.gov/dataset\\_discovery/modis/modis\\_products\\_table](https://lpdaac.usgs.gov/dataset_discovery/modis/modis_products_table)

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

<http://Earthdata.nasa.gov>





# 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>



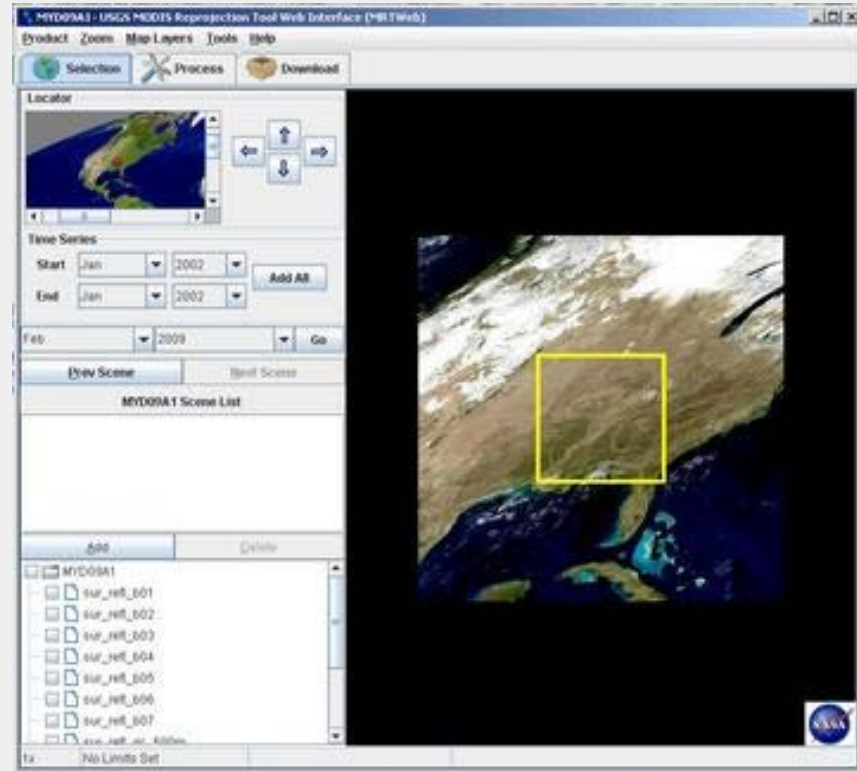
Visualization, SERVIR:  
<https://www.servirglobal.net/Global/MapsData/InteractiveMapper.aspx>



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

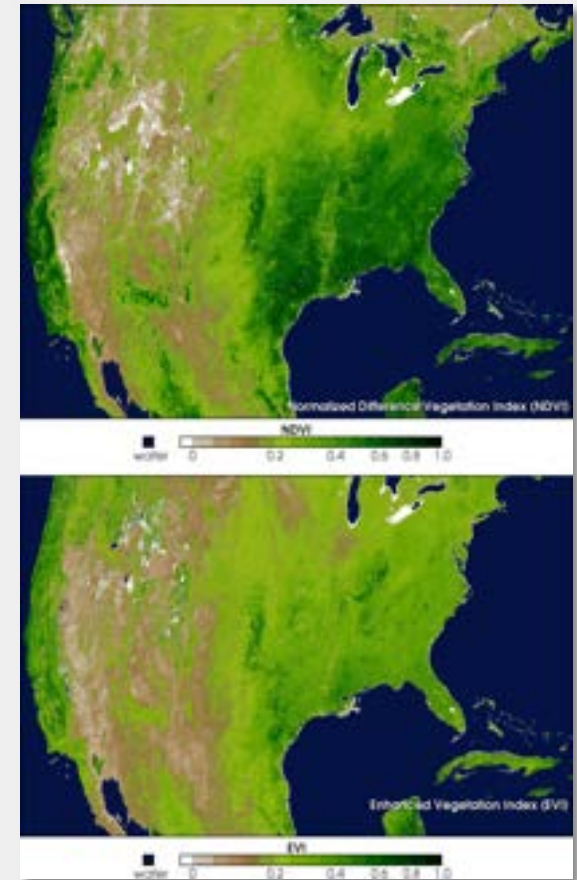
# What is EVI?

- 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](http://earthobservatory.nasa.gov)



A satellite image of a river delta, likely the Amazon, showing a complex network of waterways and green land. A semi-transparent rectangular box is overlaid on the center of the image, containing the title text.

# Live Demos: Global Agriculture Monitoring (GLAM) Project

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# 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

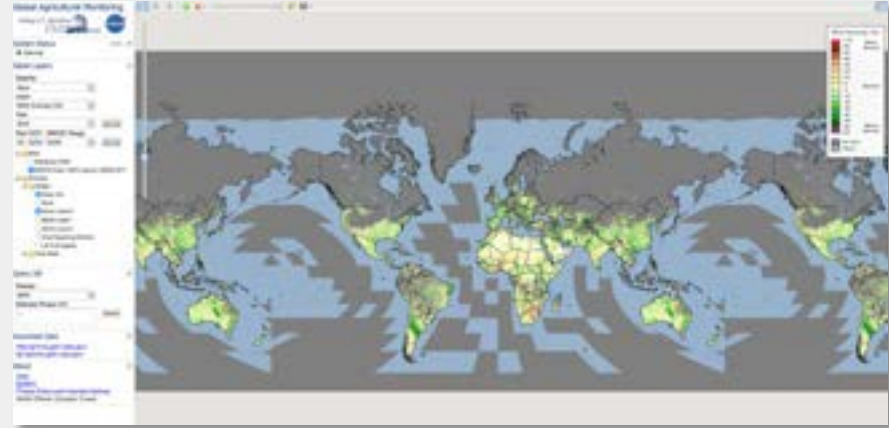


Website:

<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](mailto:Cynthia.L.Schmidt@nasa.gov)
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- General ARSET Inquiries
  - Ana Prados: [aprados@umbc.edu](mailto:aprados@umbc.edu)
- ARSET Website:
  - <http://arset.gsfc.nasa.gov/>



## ARSET

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# Thank You

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**Next Week:**

***MODIS NDVI Anomalies***