

NASA Programmatic Perspective to LCLUC science in South Asia

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Frascati, Italy – March, 2010

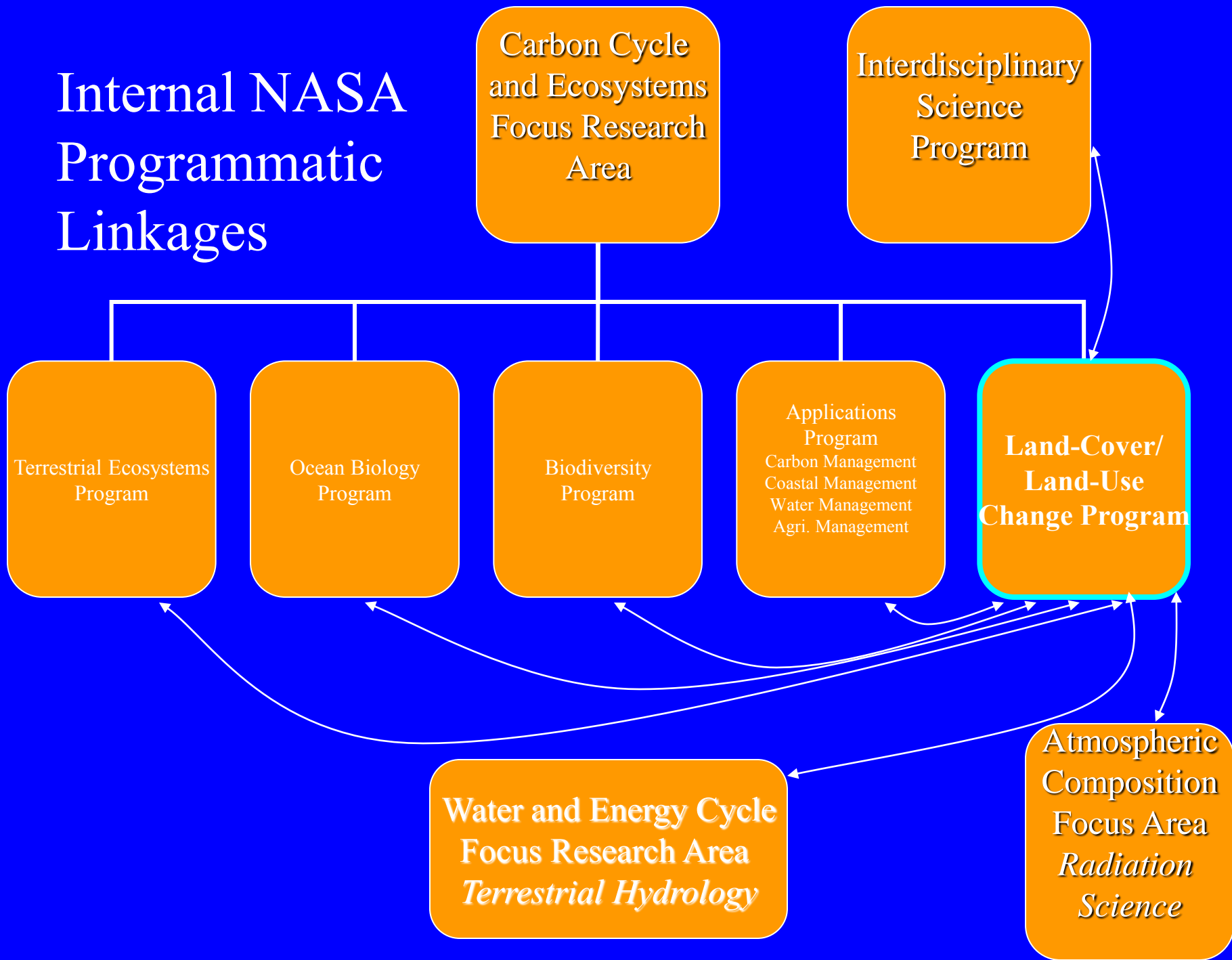


Land-Cover/Land-Use Change Program



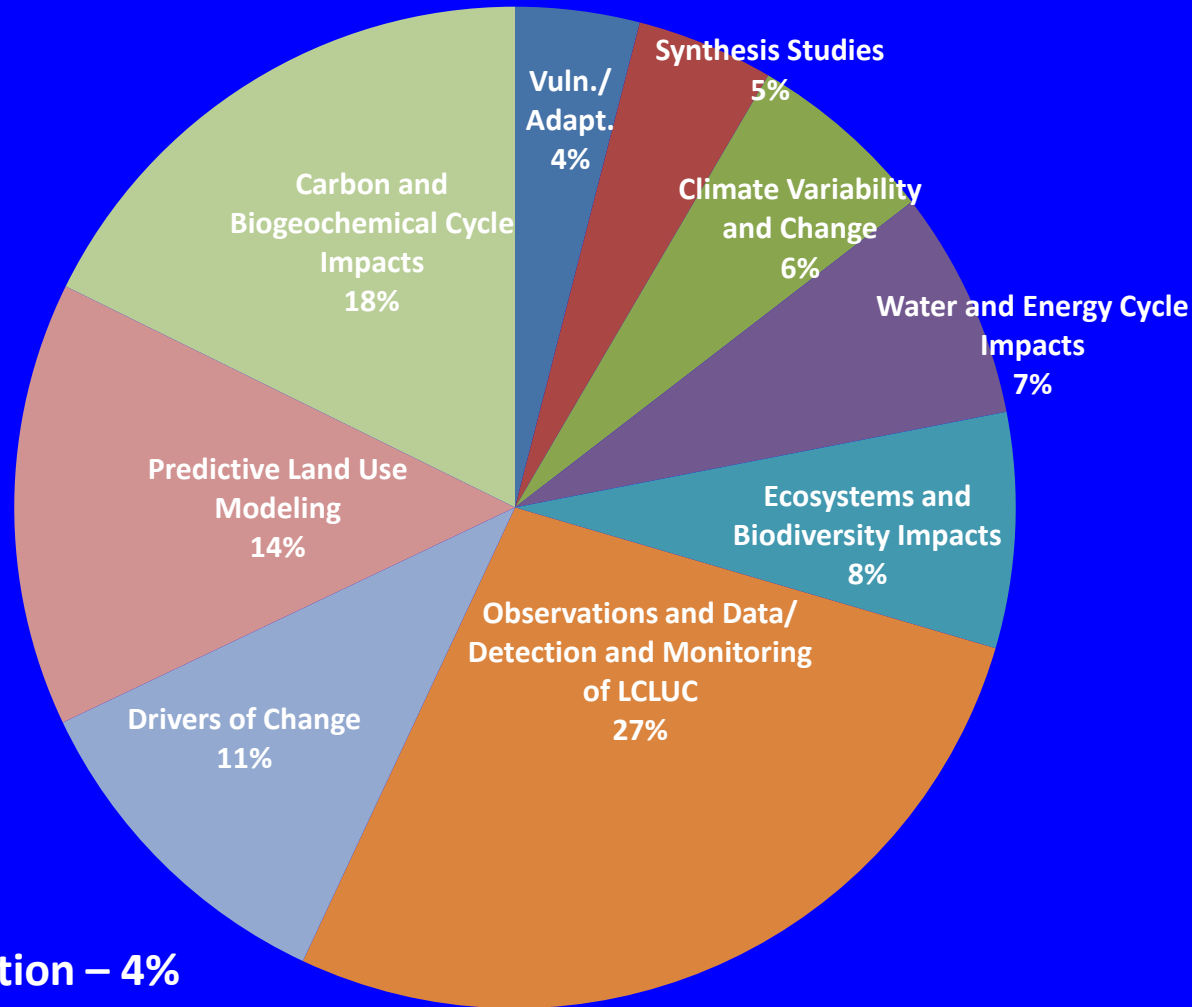
- LCLUC is an interdisciplinary scientific theme within NASA's Earth Science program. The ultimate vision of this program is *to develop the capability for periodic global inventories of land use and land cover from space, to develop the scientific understanding and models necessary to simulate the processes taking place, and to evaluate the consequences of observed and predicted changes*
- <http://lcluc.hq.nasa.gov/>

Internal NASA Programmatic Linkages



LCLUC Program: First 15 years 1997-2011

~ 200 projects
during 15 years
~30-40 per year
~200 researchers
per year



Impacts - 33%
Drivers - 11%
Monitoring - 27%
LU Modeling - 14%
LU <-> Climate - 6%
Synthesis - 5%
Vulnerability/Adaptation - 4%

NASA LCLUC Support of Regional Initiatives

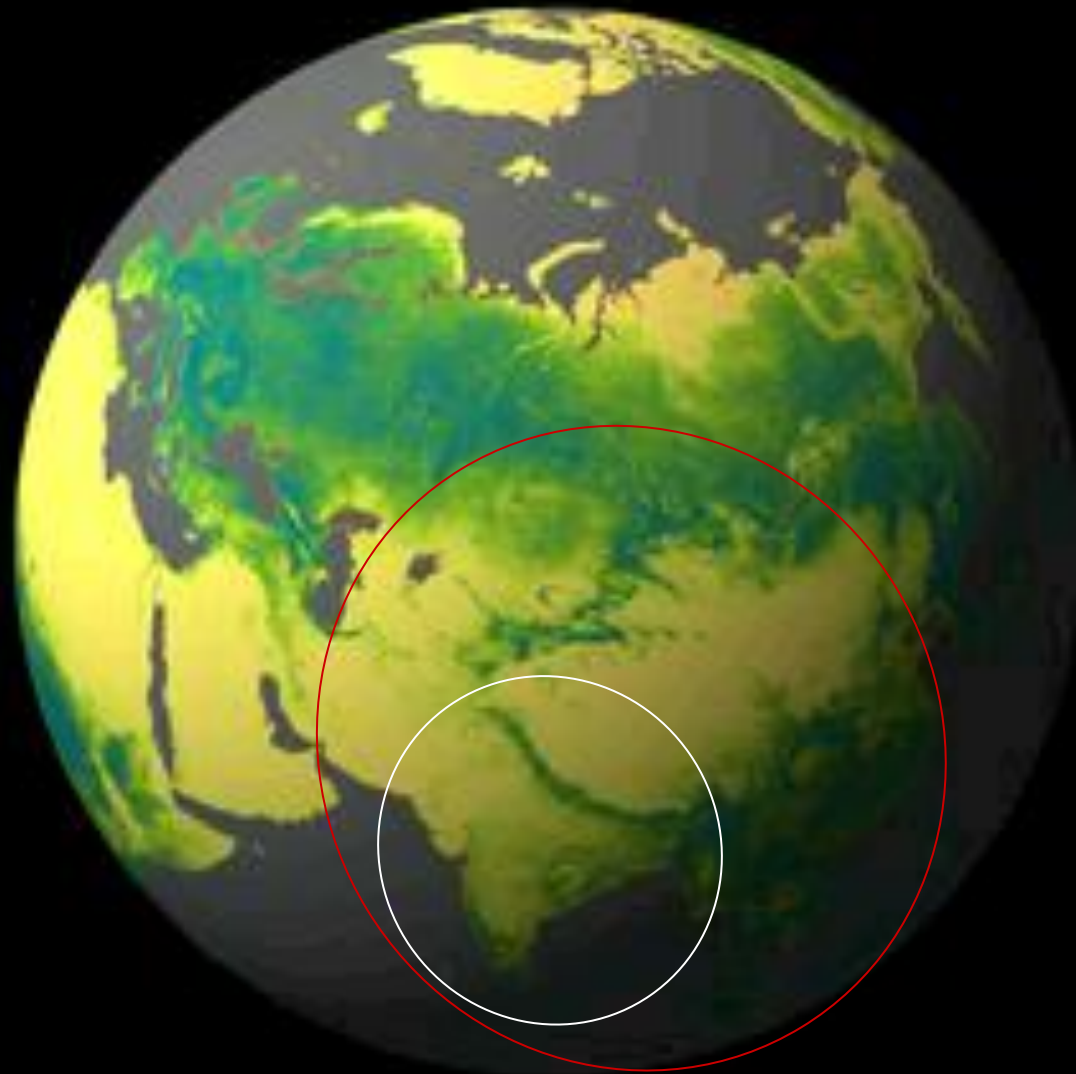
- LBA: Regional Field Campaign in Amazon
- CARPE: Central African Regional Project on the Environment in Congo Basin (with US AID)
- NEESPI: Northern Eurasia program
- MAIRS: Monsoon Area program

Monsoon Asia Integrated Regional Study (MAIRS) Science Themes

- Four research themes
 - Rapid transformation of land and marine resources in Coastal Zones
 - Multiple stresses on ecosystems and biophysical resources in high Mountain Zones
 - Vulnerability of ecosystems in Semi-arid Zones due to changing climate and land use
 - Changes in resource use and emissions due to rapid urbanization in Urban Zones



Focus on Southern Asia





Six cross-cutting issues
of environmental change:

- Water
- Energy
- Food Security
- Air quality and Health
- Natural Disasters
- Biodiversity

LCLUC Research in South Asia and Relevant Global Scale Projects

Agriculture	Forests	Urban	Atmosphere	Sensors
<p>Quantifying Changes in Agricultural Intensification and Expansion in Monsoon Asia during 2000-2010.</p> <p>Xiao, Xiaming Oklahoma University</p>	<p>Mapping Three Decades of Global Forest Cover Change using the Global Land Survey Landsat Datasets</p> <p>Townshend, John University of Maryland College Park, USA</p>	<p>Using Landsat Global Land Survey Data to Measure and Monitor Worldwide Urbanization</p> <p>Brown de Colstoun, Eric NASA Goddard Space Flight Center</p>	<p>Land Use–Ecosystem–Climate Interactions in Monsoon Asia: Evaluating the Impacts of Current and Projected LCLUC on Climate, Water and Carbon Cycling in the First Half of 21st Century</p> <p>Tian, Hanquin Auburn University</p>	<p>Cross Calibration of Current LANDSAT Sensors with Foreign Landsat-Class Sensors for Long-Term Monitoring and Land-Surface Processes</p> <p>Chander, Gyanesh EROS data Center, USA</p>
<p>Multi-sensor Fusion to Determine Climate Sensitivity of Agriculture Intensification in South Asia</p> <p>DeFries, Ruth Columbia University</p>	<p>Enhancing Global Scale Observations and Information on Tropical Forest Change Using Landsat Global Data Remote Sensing</p> <p>Skole, David Michigan State University, USA</p>	<p>Multi-Scale and multi-sensor analysis of Urban cluster development and Agricultural land loss in China and India</p> <p>Seto, Karen Yale University</p>	<p>Land Cover And Land Use Change And Its Effects On Carbon Dynamics In Monsoon Asian Region</p>	<p>Sentinel-3 Science Products: A US contribution</p>
<p>Advancing methods for Global Crop Area Estimation</p> <p>Matthew, Hansen University of Maryland College Park</p>	<p>Global Tropical Mangrove Mapping</p> <p>Giri, Chandra, USGS EROS Data Center, USA</p>	<p>Understanding and Simulating Global Urban Expansion in the Context of Climate Change</p> <p>Zhou, Yuyu Joint Global Change Research Institute</p>	<p>Land Cover And Land Use Change And Its Effects On Carbon Dynamics In Monsoon Asian Region</p> <p>Jain, Atul University of Illinois at Urbana Champaign</p>	<p>Masek, Jeff NASA GSFC</p> <p>Justice, Chris University of Maryland College Park</p>

LCLUC International Science Team Meetings

Fall-Winter

2007: Drylands (NEESPI/MAIRS)

Urumqi, China

2009/1: Tropics (MAIRS)

Kohn Kaen, Thailand

2009/9: Drylands (NEESPI/MAIRS)

Almaty, Kazakhstan

2010: Boreal/Temperate (NEESPI)

Tartu, Estonia

2011: Tropics (MAIRS)

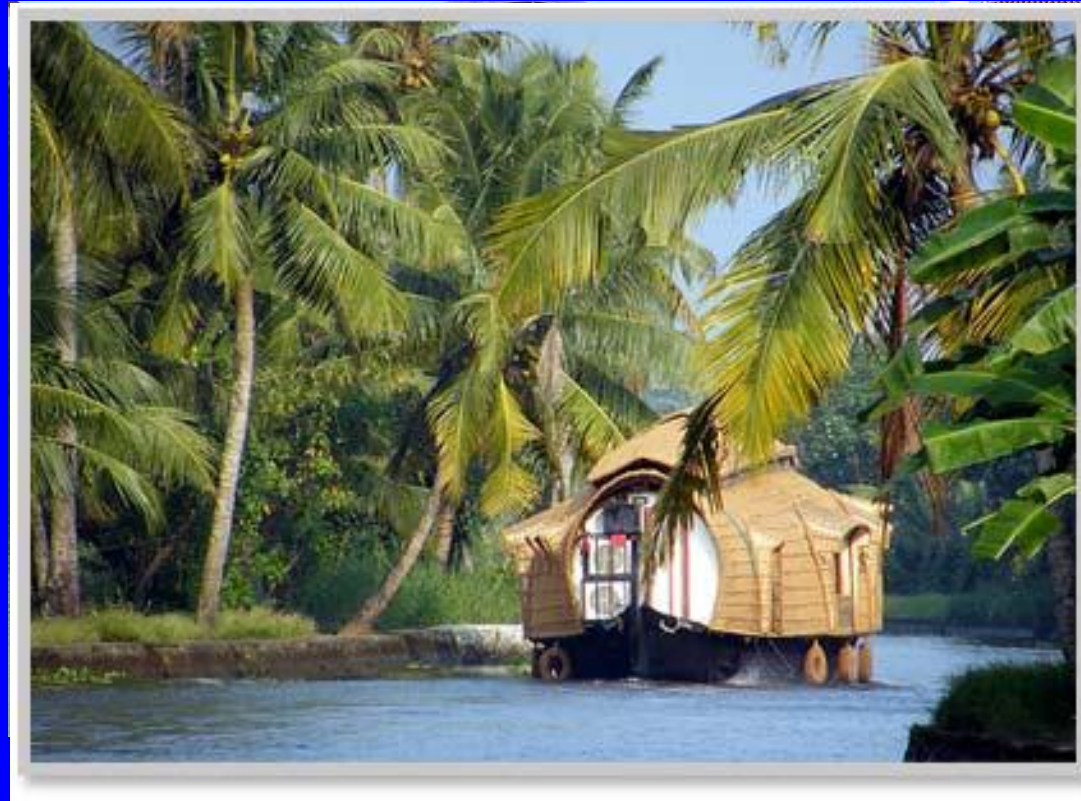
Hanoi, Vietnam

2013/1: Tropics (MAIRS)

Coimbatore, India

2013/11: Tashkent, Uzbekistan

2014: TBD



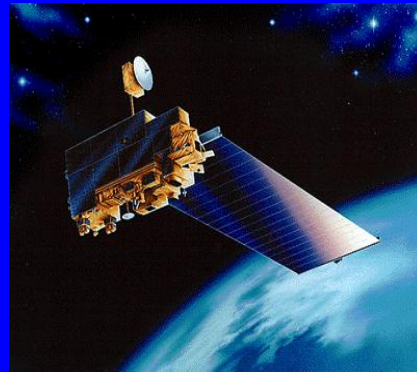
NASA LCLUC-relevant Missions

Systematic Missions - Observation of Key Earth System Interactions



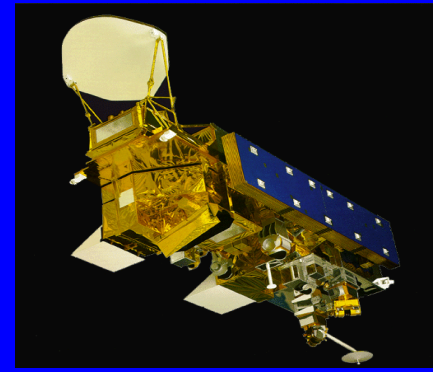
Landsat 7

4/15/99



Terra

12/18/99



Aqua

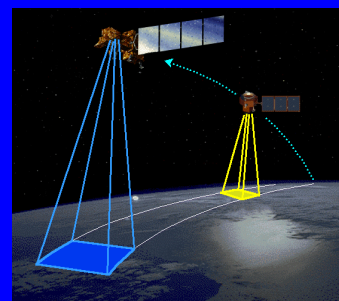
5/3/02

Exploratory Missions - Exploration of Specific Earth System Processes and Parameters and Demonstration of Technologies



SRTM

2/11/00



EO-1

11/21/00

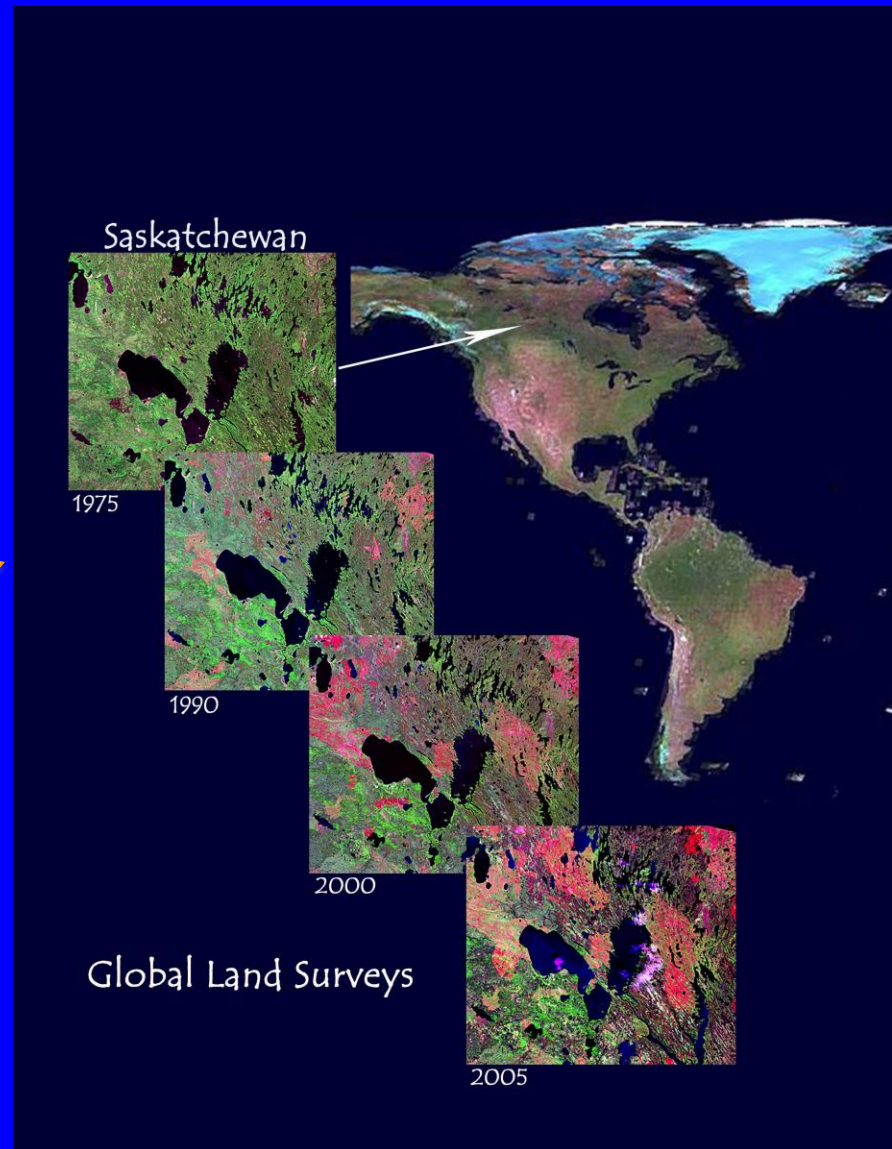
Land Monitoring at Moderate Resolution

- Landsat data are accessible free of charge at USGS
- LDCM (Landsat-8) to be launched Feb 11, 2013
- Landsat observations insufficient
- International cooperation is needed
- Land Surface Imaging Constellation under CEOS
- IRS data availability issues

Global Land Survey Data Sets

Global cloud-free, geocorrected Landsat datasets centered on 1975, 1990, 2000, 2005, and 2010

- 30-m global mosaics of 1 selected scene per “epoch” at the peak of vegetation
- For global assessments of land-cover change on a decadal scale
- Paper describing GLS-2005 published in P&RS Journal
- GLS datasets are complete and available for download via GLOVIS/EarthExplorer at USGS free of charge
- Paper with assessment of GLS datasets is under revision for publication in RSE Journal

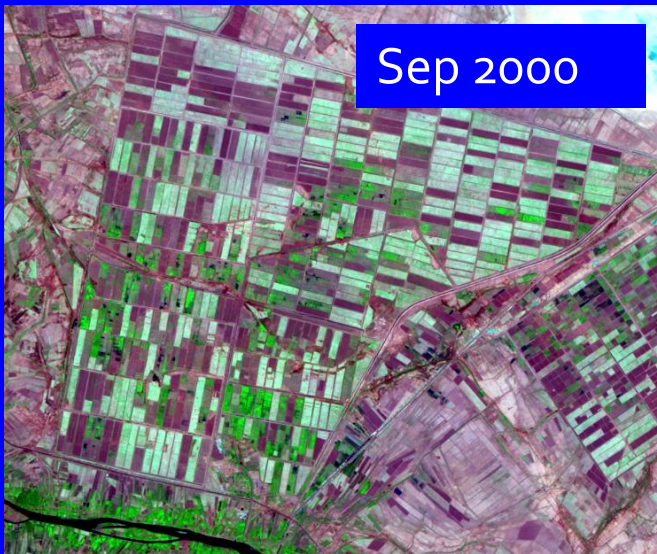


Progression of fires scars in central Canada

Advanced Use of Optical Moderate Resolution Data

- Fusing coarse- and mid-resolution data
- Fusing data from different moderate resolution sensors
- Using ALL cloud-free pixels in the imagery

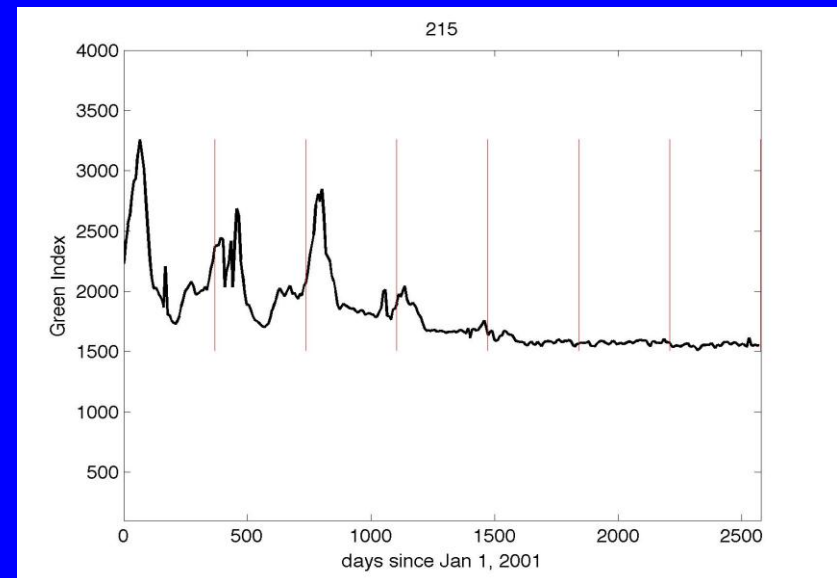
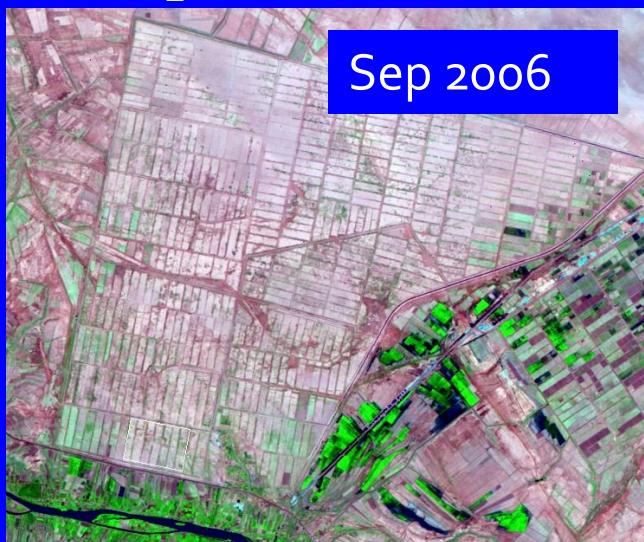
Changes in Land Use: Fusing Moderate and Coarse Resolutions



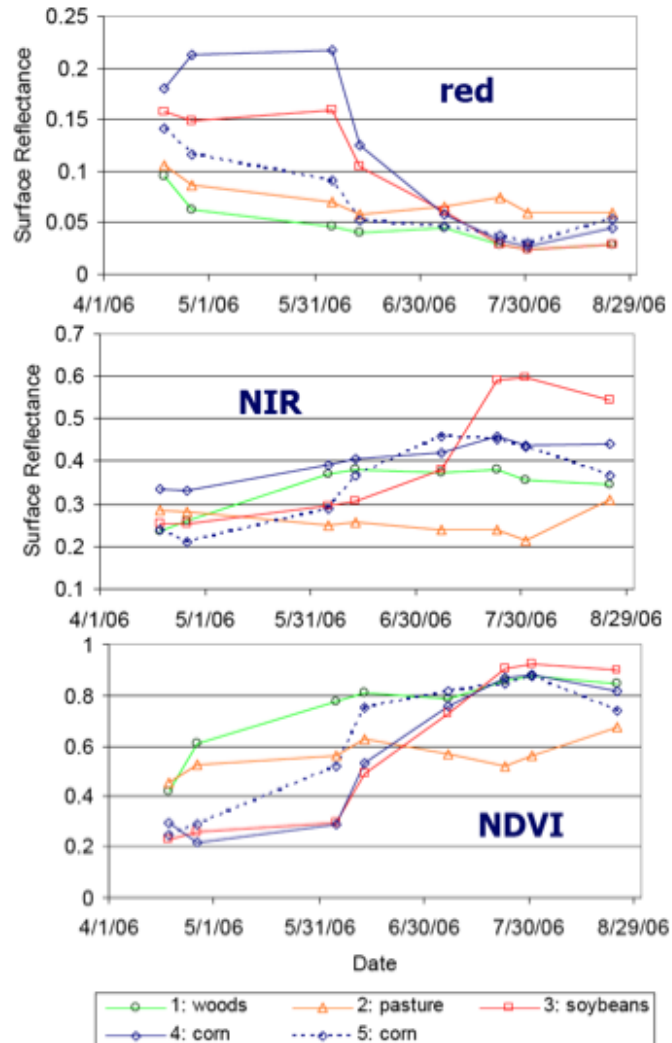
Landsat images over an area in Iraq 6 years apart (like in GLS)

MODIS time series of Green Index for an abandoned irrigated area

Iraq



Fusing Data From Moderate Resolution Sensors: Land-Cover Phenology at 30 m



- Red reflectance, near-infrared (NIR) reflectance, and NDVI values for individual fields from central Illinois during the first half of the 2006 growing season
- Data are combined from Landsat-5, -7, ASTER, and IRS

Using All Clear Pixels by Compositing

Landsat Missions - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://landsat.usgs.gov/WELD.php

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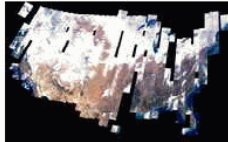
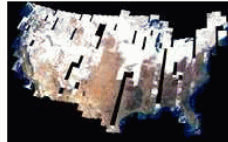

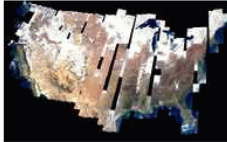
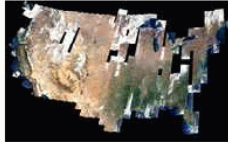
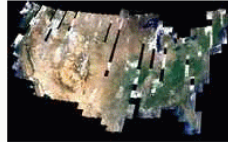
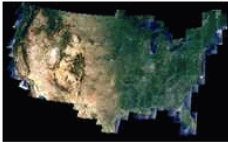

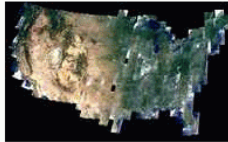
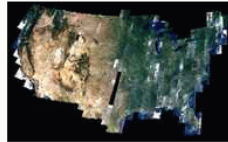

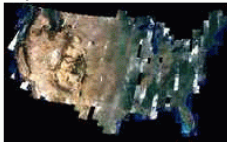
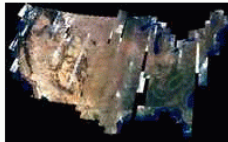
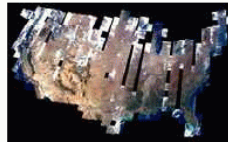
Web-enabled Landsat data (WELD) Project

The WELD project is systematically generating 30 m composited Landsat ETM+ mosaics at weekly, monthly, seasonal and annual time periods for the conterminous USA (CONUS) and Alaska. The composited mosaics are designed to provide consistent Landsat data that can be used to derive land cover and geo physical and bio physical products for regional assessment of surface dynamics and to study Earth system functioning.

Version 1.3 of the WELD monthly, seasonal and annual products generated from Landsat ETM+ terrain corrected (Level 1T) data with cloud cover $\leq 80\%$ sensed December 2007 to November 2008 are available here.

WELD Browse Imagery

The thumbnail images below illustrate the currently available Version 1.3 WELD data products, please click on them to see a higher resolution version. These true color browse images show the Landsat ETM+ red, green and blue wavelength bands at approximately 500 m resolution.

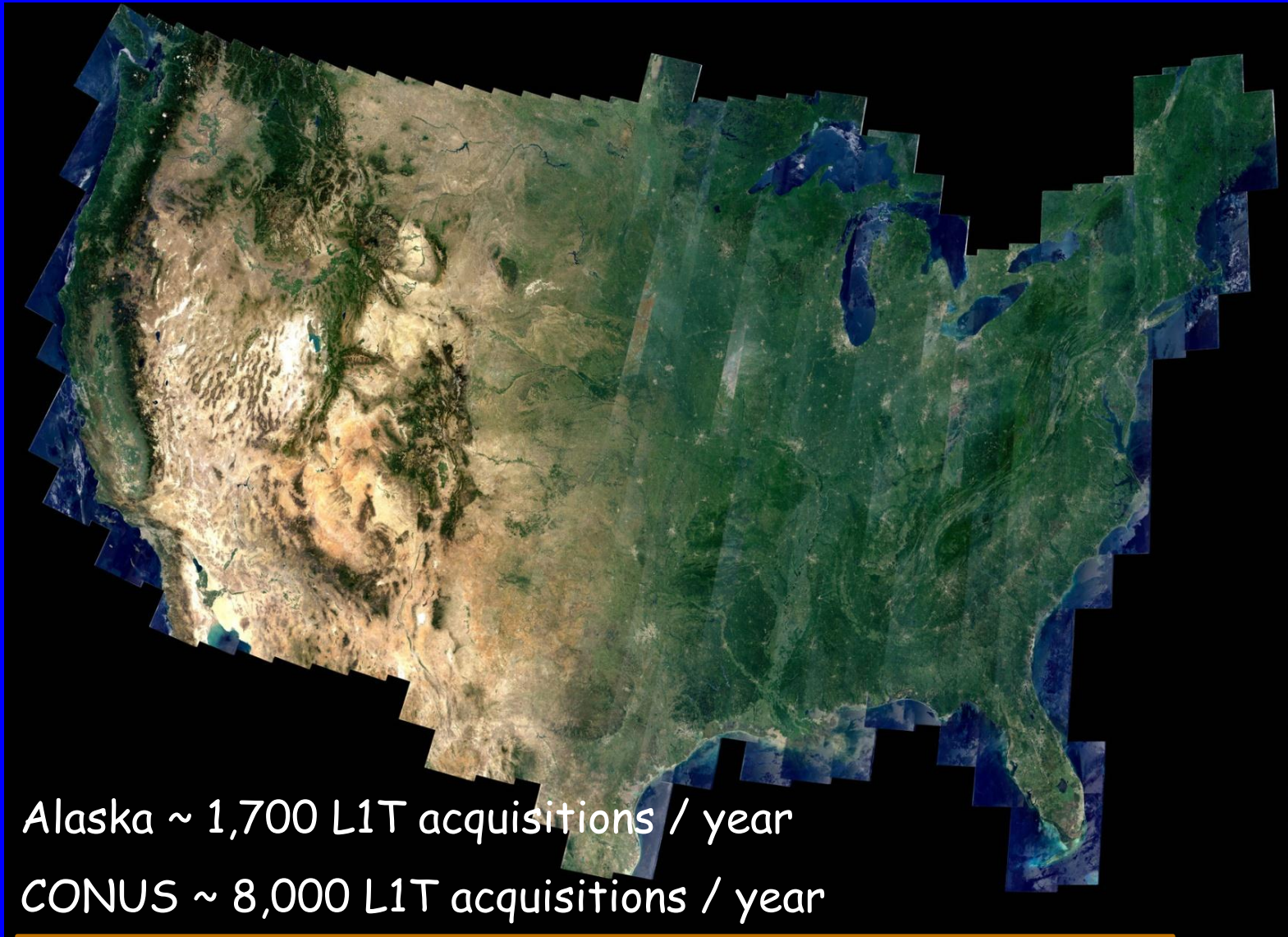
CONUS Annual 	Winter 	December 2007 	January 2008 	February 2008 
	Spring 	March 2008 	April 2008 	May 2008 
	Summer 	June 2008 	July 2008 	August 2008 
	Autumn 	September 2008 	October 2008 	November 2008 

2008

<http://landsat.usgs.gov/WELD.php>

Done

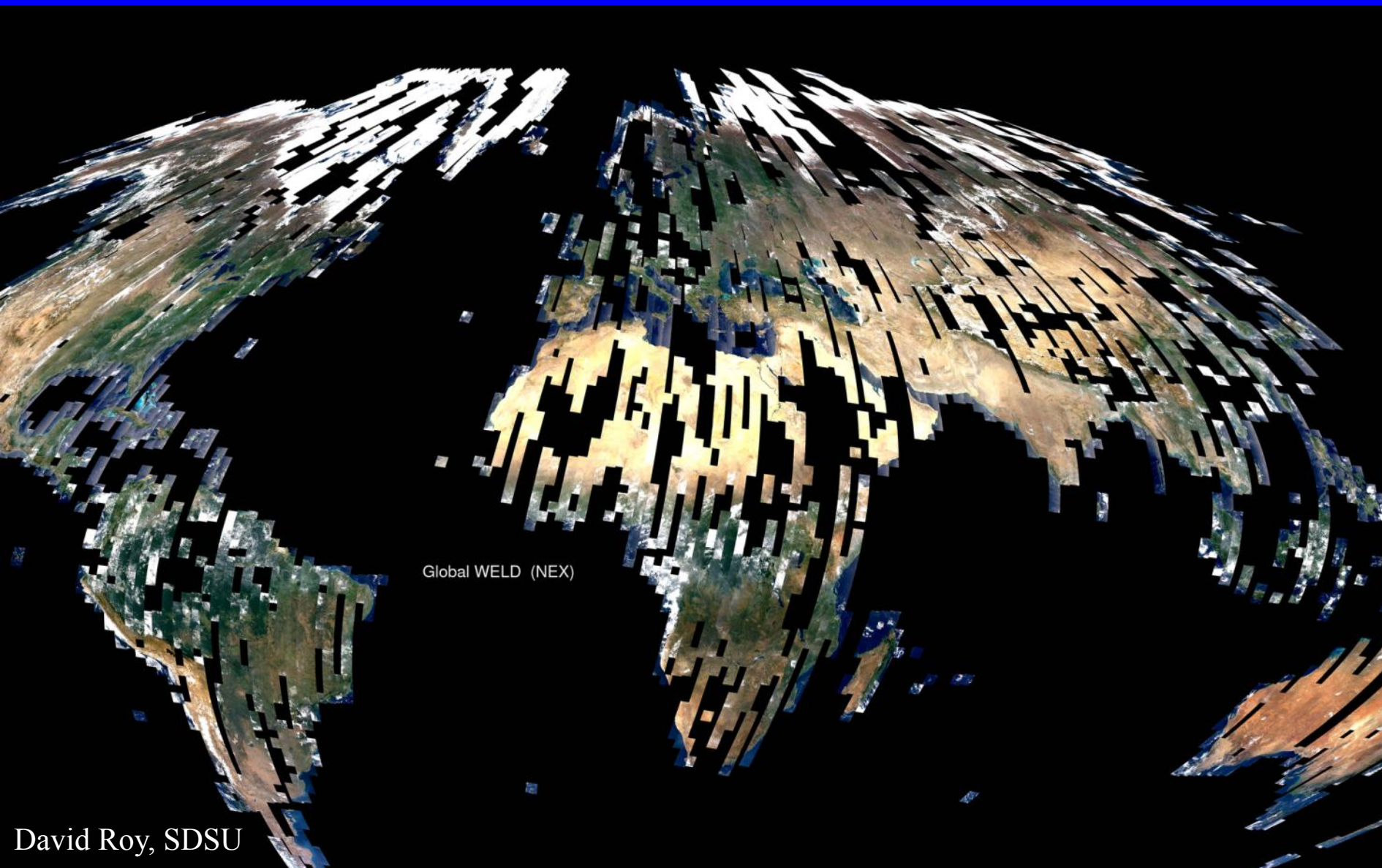
Web-Enabled Landsat Data (WELD). Year: 2009



**New tools and methods to process
large data volumes from Landsat**

Roy SDSU

Global Landsat Processing Using High Performance Computing (7,281 input images, Monthly Composite May 2010)



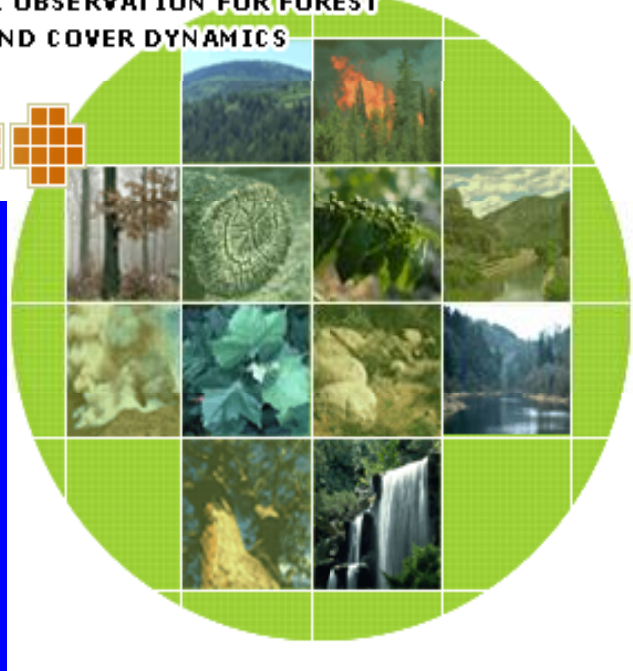
David Roy, SDSU

1.8km TOA true color browse, each pixel generated from 60 x 60 30m Landsat ETM+ pixels

MODIS Land Sinusoidal Projection

GOFC-GOLD

GLOBAL OBSERVATION FOR FOREST
AND LAND COVER DYNAMICS



GTOS

A science
panel of the
Global
Terrestrial
Observing
System

- Forum for users of satellite data to discuss their needs and for producers to respond through improvements to their programs
- Regional and global datasets with info on:
 - Location of different forest types
 - Major changes in forest cover
 - Biological functioning of forests (quantifying absorption and emission of greenhouse gases)

- GOFC-GOLD is a coordinated program of space-based and on-the-ground observations of forest and land cover for global monitoring of terrestrial resources and the study of global change

- Globally consistent data processing and interpretation methods
- International networks for data access, data sharing, and international collaboration
- Production of improved products

Regional Networks

a critical component of the implementation of GOFC-GOLD

Providing the interface between the Implementation Teams and data users in the regions

NERIN – Northern Eurasia

SEARIN - South East Asia

OSFAC - Central Africa

Miombo - Southern Africa

SAFNET – Southern Africa

RedLatiF – South America

WARN – West Africa

CARIN – Central Asia

SCERIN – South/Central Eastern Europe

SARIN for Southern Asia?

GOFC-GOLD Networks In Southern Eurasia

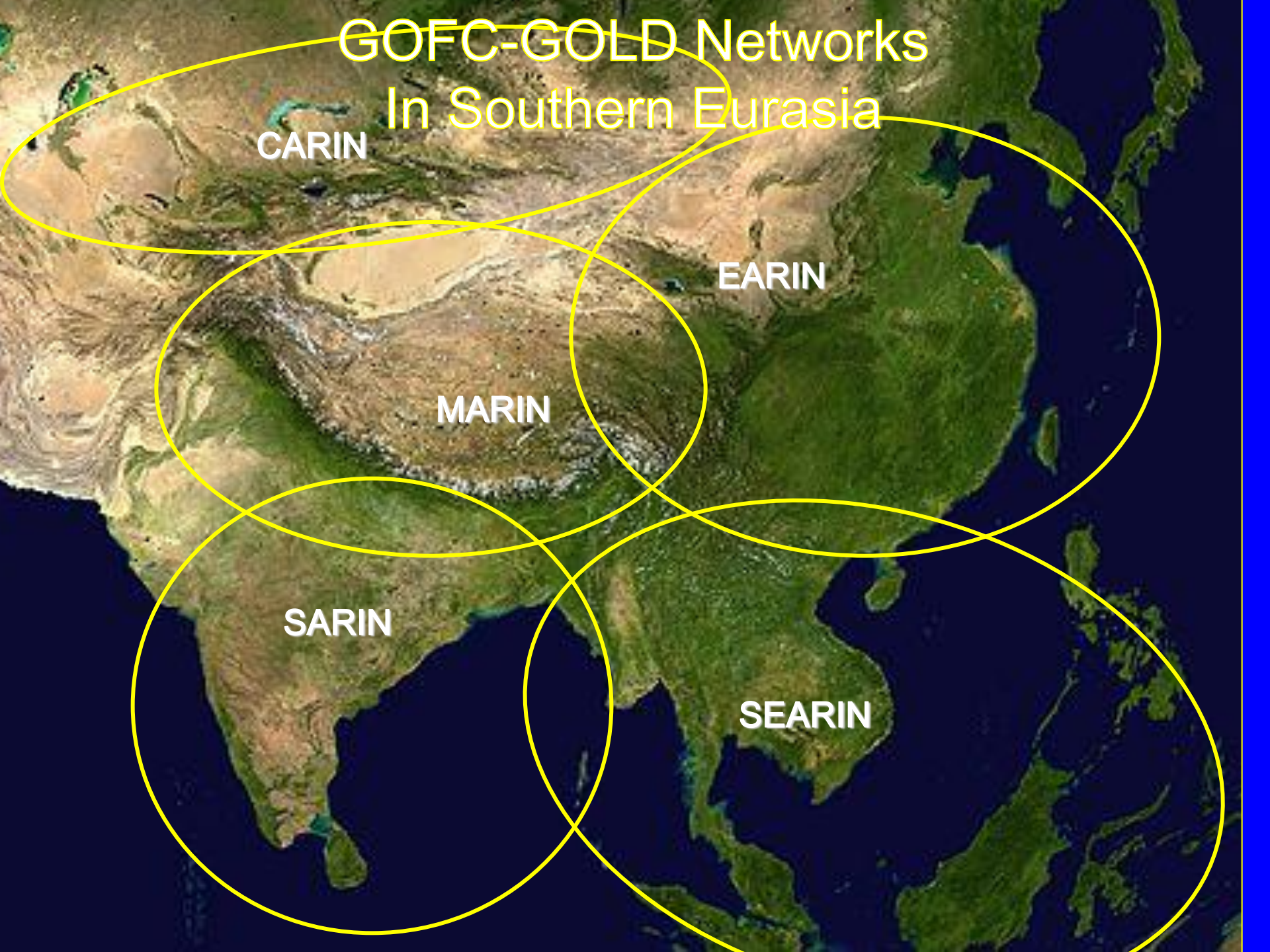
CARIN

EARIN

MARIN

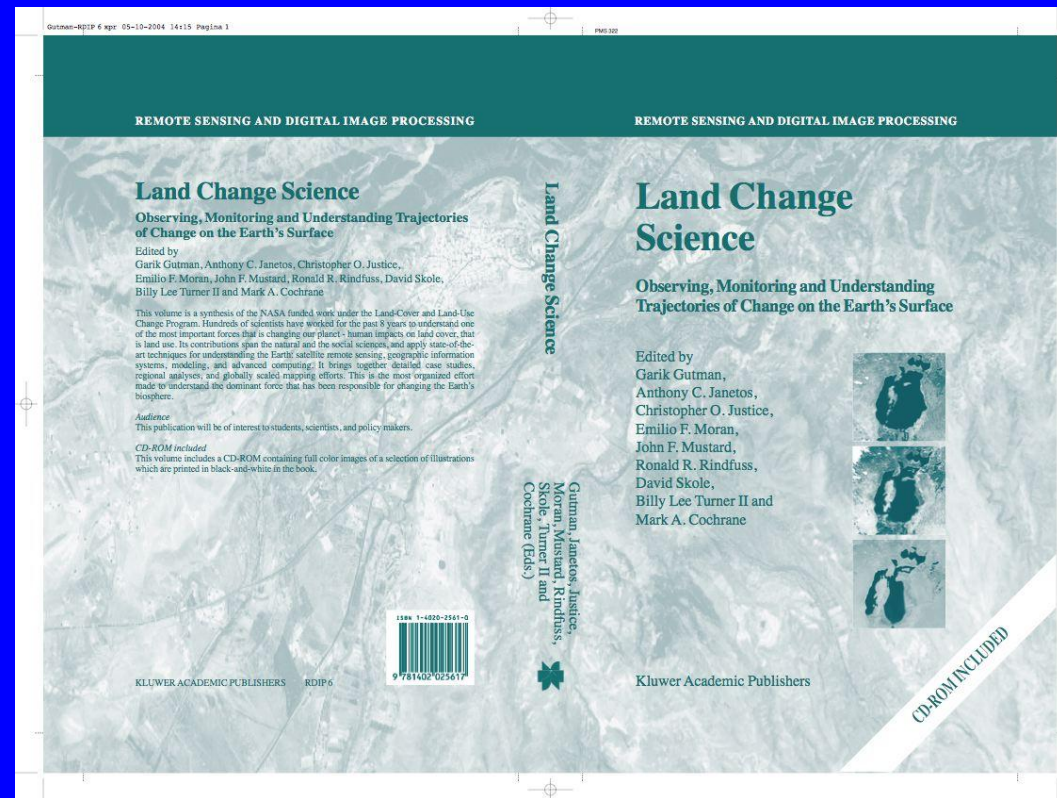
SARIN

SEARIN



After 17 years of NASA LCLUC : Towards Synthesis

- First 10 years: Mostly Case studies
- Various areas of the world
- Patterns to processes
- Disturbances and feedbacks
- Trajectories and projections
- Ongoing synthesis for Eastern Europe and Russia
- Expected more on Central Asia and South East Asia



Thank you शुक्रिया

