

Global Land Survey Activities and Land Cover Analysis from Landsat



Shannon Franks, SGT/NASA
Jeffrey G. Masek, NASA GSFC
Garik Gutman, NASA HQ
Rachel Headley, USGS

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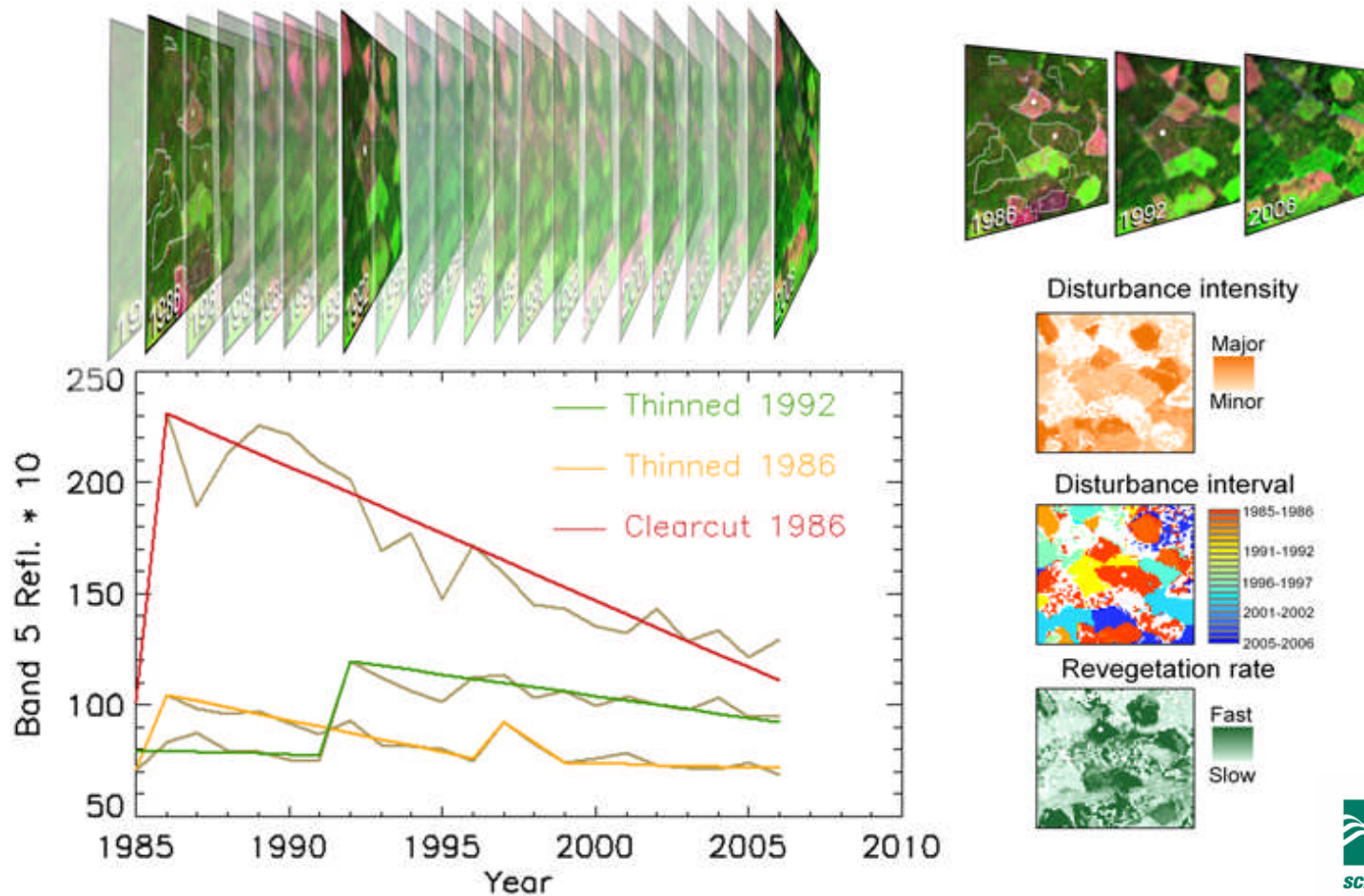
Background – the Landsat Legacy

- ▶ Landsat has acquired moderate-resolution land imagery since 1972 (30m resolution since 1982) – our longest, continuous record of land transformation from space
- ▶ Historically Landsat applications have been limited by
 - ▶ Cost of the data (\$4000/scene in 1990's; \$600/scene in 2000's)
 - ▶ Computational technology (1 scene = 0.3 GB)
- ▶ Two transforming developments:
 - ▶ **Free data:** In 2008 USGS opened the US Landsat archive for free distribution
 - ▶ **Global datasets:** The Global Land Survey (GLS) has produced pre-processed data for ~5 year epochs for assessing global land cover change



Impact of Free Data

LandTrendr: Landsat-based Detection of Trends in Disturbance and Recovery – Kennedy and Cohen, Landsat Science Team - 2010



Global Land Survey (GLS) History

- ▶ Since the 1990's, NASA and USGS have supported development of global land-cover datasets by creating the “GeoCover” series.
- ▶ Was renamed GLS to reflect reprocessed architecture and to establish a consistent naming convention for all Landsat Global datasets.
- ▶ Datasets centered around 1975, 1990, 2000, 2005, and 2010.
- ▶ Collectively, these datasets provide consistent observations of global, orthorectified, leaf-on, “cloud free” data.
- ▶ Data is freely available from USGS sites Glovis and Earth Explorer.

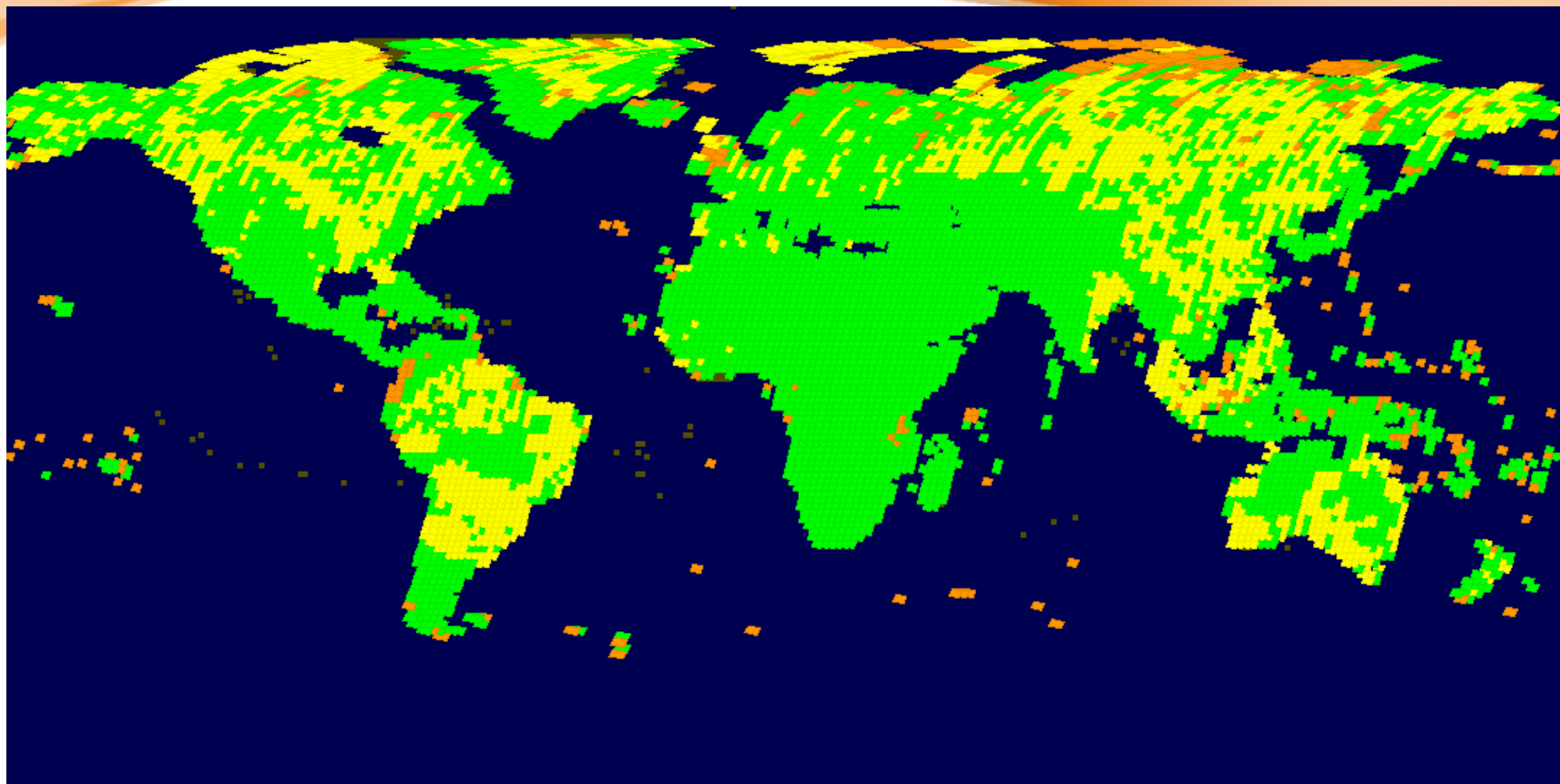


GLS2005 stats

- ▶ Landsat scenes:
 - ▶ 5764 ETM+ path/rows
 - ▶ 4,702 gap-filled
 - ▶ 1,062 assigned multiple scenes (non gap-filled)
 - ▶ 2,425 TM path/rows
 - ▶ 67% from IC, Campaign Station acquisitions
- ▶ EO-I scenes: 555 (islands and reefs)



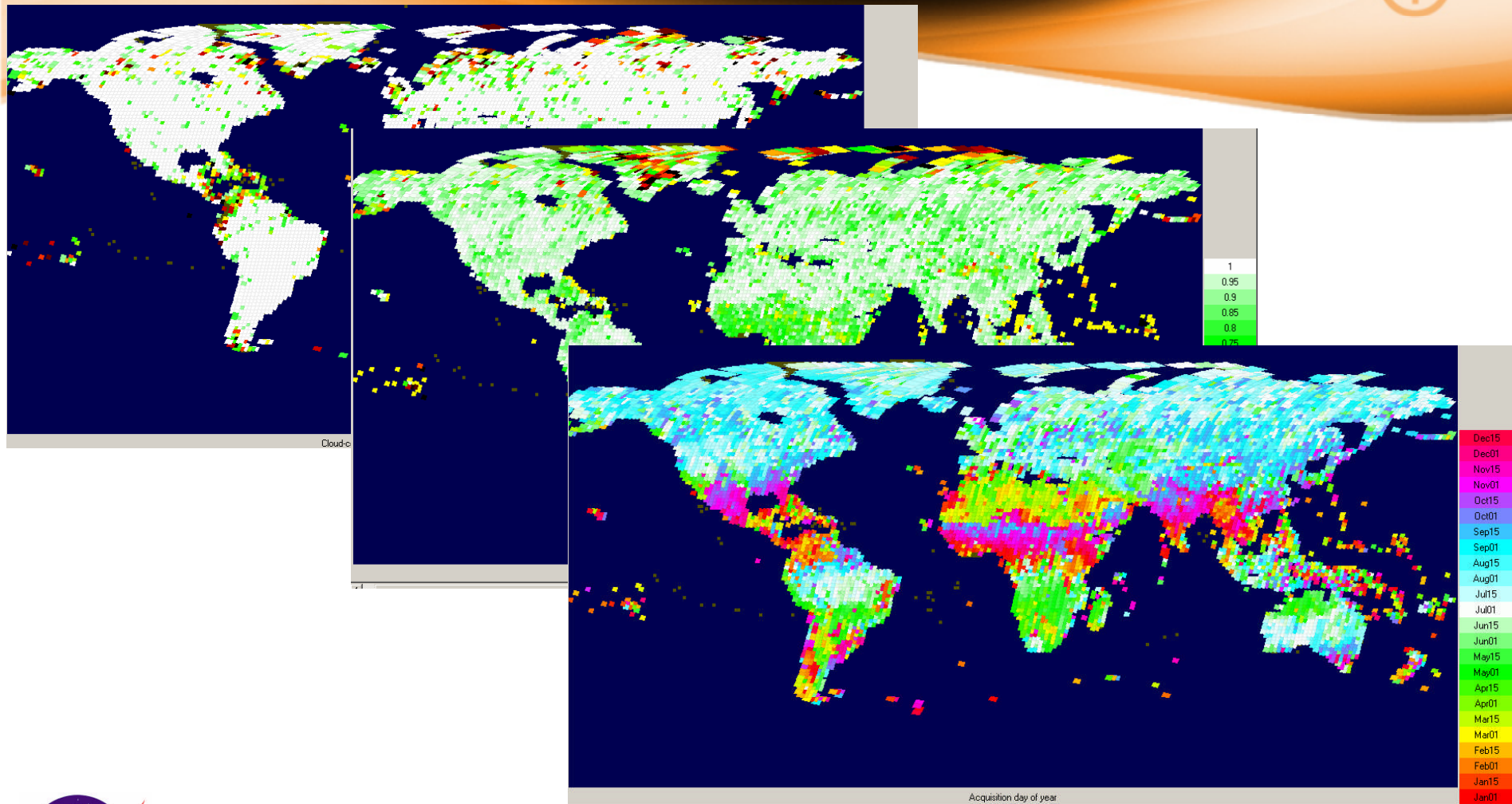
Sensor Selection



Landsat 7 ETM+ or Landsat 5 TM



Cloud Cover, NDVI, Time of Year



GLS2010 Value Proposition

Why assemble **GLS2010** when the archive is now open?

- ▶ Incorporates international L5 data otherwise not available (or not freely available)
- ▶ Gap-filled L7 products otherwise unavailable
- ▶ relieves users from having to search metadata and assemble “best” data set for land cover research



GLS2010 Status

2009-2010 Acquisition Window

- ▶ - combination of Landsat-5, Landsat-7, ALI
- ▶ - International Cooperator Participation + 8 Campaign Stations

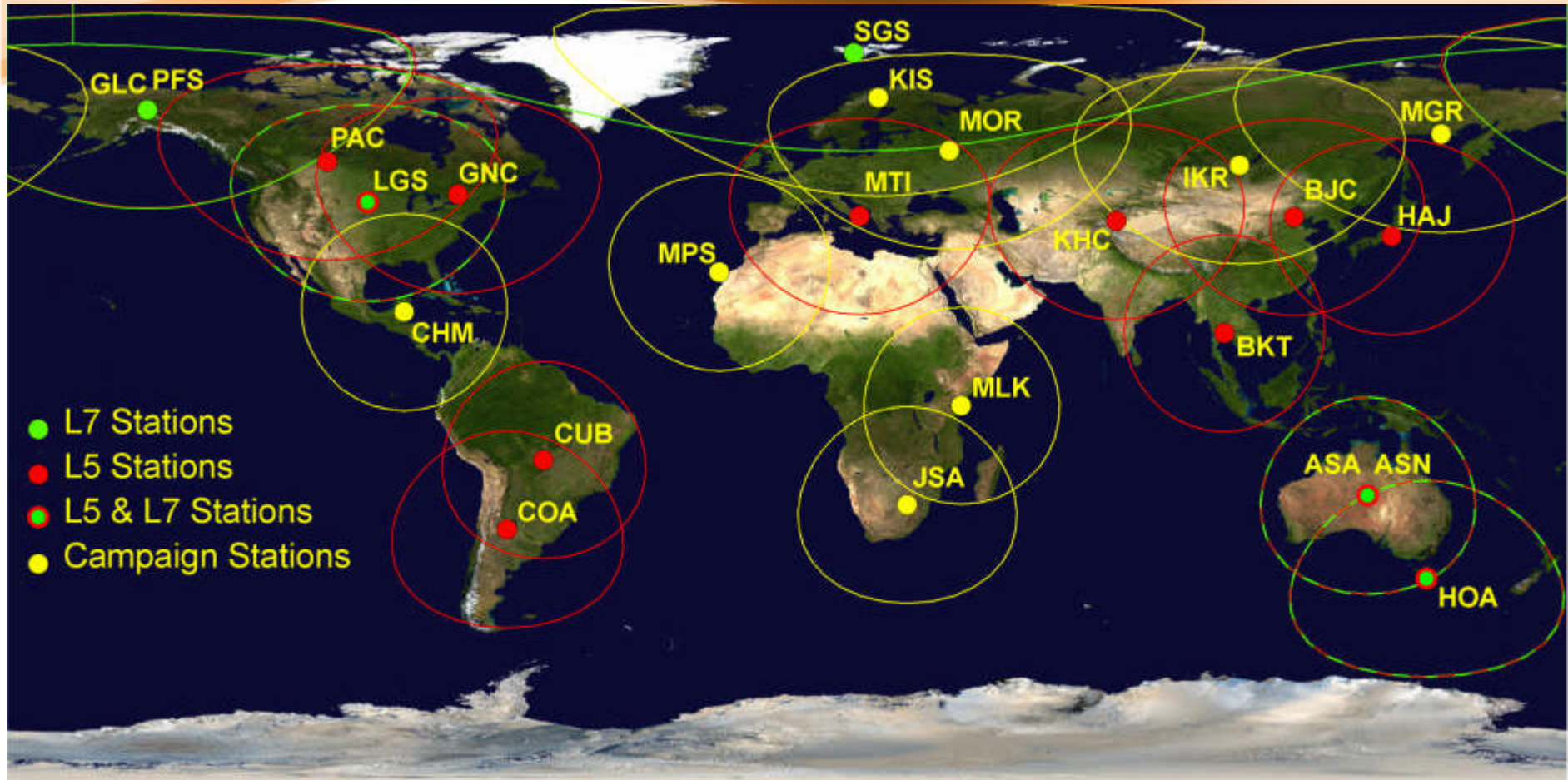
Data Processing: 2010-2011

- ▶ - scene selection via LASSI
- ▶ - standard LIT product for L5
- ▶ - L7 gap-filled (for cloud-cover < 8%) at USGS
- ▶ - Additionally, stand-alone gap filling algorithm created and provided to user's



Delivery in late 2011



Combined Ground Station Network



2009 and 2010 campaign acquisitions

(as of 9/7/2010)  

Organization	Country	Location	GSID	Desired Start Date	Desired Finish Date	Actual Start Date (WBDR)	Actual Finish Date (WBDR)	Scenes (WBDR)	Actual Start Date (Archive)	Actual Finish Date (Archive)	Scenes (Archive)
CONABIO	Mexico	Chetumal	CHM	N/A	N/A	8/6/2009	8/6/2009	16	3/6/2009	8/20/2009	156
				10/15/2009	12/31/2010	11/23/2009	2/26/2010	1135	11/24/2009	3/2/2010	1897
CSIR-SAC	South Africa	Hartebeesthoek	JSA	2/1/2009	5/31/2009	3/18/2009	5/30/2009	1723	3/19/2009	5/30/2009	1161
				2/1/2010	5/31/2010	2/1/2010	5/29/2010	1857	2/1/2010	5/18/2010	1016
ESA	Kenya	Malindi	MLK	6/1/2009	7/19/2009	6/1/2009	7/18/2009	1568			0
				11/1/2009	1/20/2010	11/2/2009	1/19/2010	2364	11/2/2009	12/8/2009	817
				6/1/2010	7/19/2010	6/24/2010	9/1/2010	766	6/24/2010	7/16/2010	152
				11/1/2010	1/20/2011						0
	Spain	Maspalomas	MPS	6/1/2009	12/31/2010	6/3/2009	8/12/2010	7573	6/3/2009	8/12/2010	7378
	Sweden	Kiruna	KIS	6/1/2009	12/31/2010	6/8/2009	9/7/2010	9892			0
ScanEx	Russia	Irkutsk	IKR	6/1/2009	10/1/2009	6/17/2009	9/30/2009	6866	6/5/2009	9/30/2009	7606
				6/1/2010	10/1/2010	6/1/2010	9/7/2010	3727	6/1/2010	8/29/2010	4182
		Magadan	MGR	6/1/2009	10/1/2009	6/10/2009	9/30/2009	4808	6/5/2009	9/30/2009	5648
				6/1/2010	10/1/2010	8/1/2010	9/6/2010	542	8/1/2010	8/20/2010	530
		Moscow	MOR	6/1/2009	10/1/2009	6/5/2009	9/30/2009	5864	6/5/2009	9/30/2009	6900
				6/1/2010	10/1/2010	6/1/2010	9/7/2010	3453	6/1/2010	9/2/2010	4437
4	6	8	8					52154			41880

 Currently active
 Currently in-active



GLS Data Availability

Free per-scene download:

- ▶ USGS Global Visualization Viewer: www.glovis.usgs.gov
- ▶ USGS EarthExplorer: edcsnsl7.cr.usgs.gov/EarthExplorer/

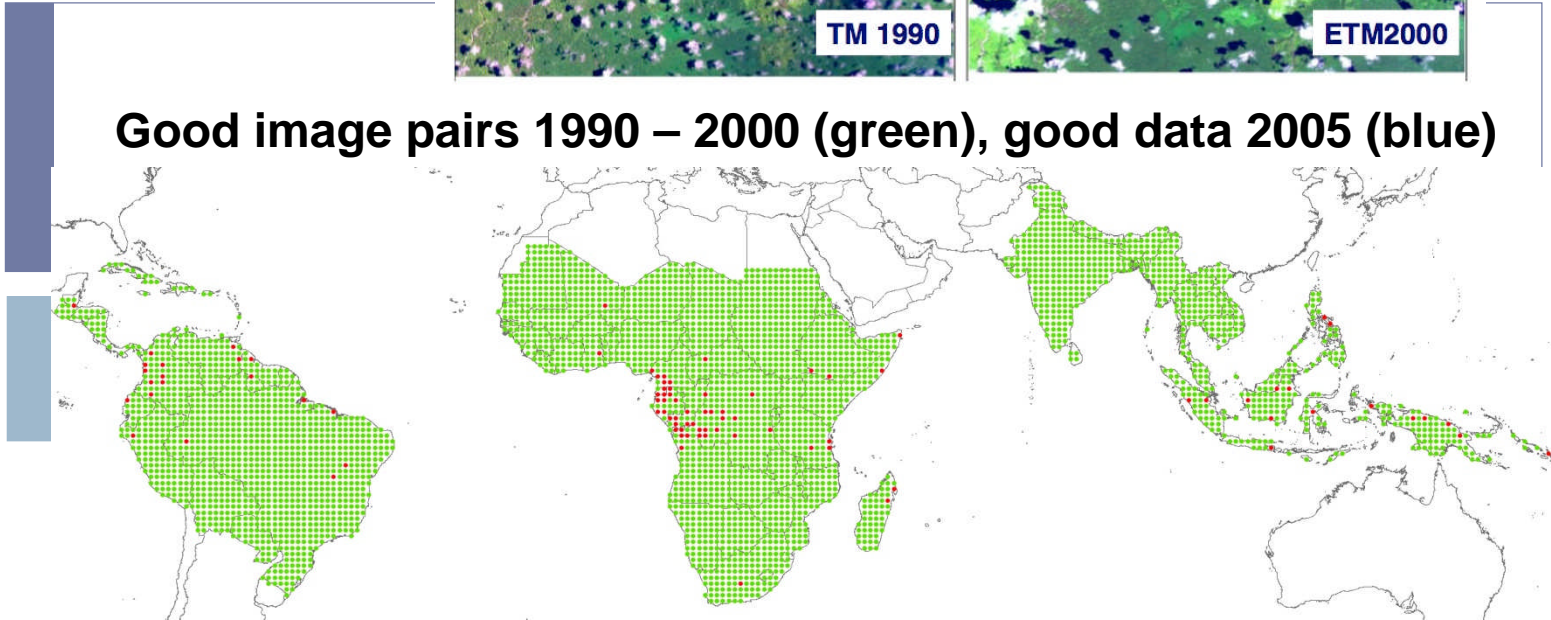
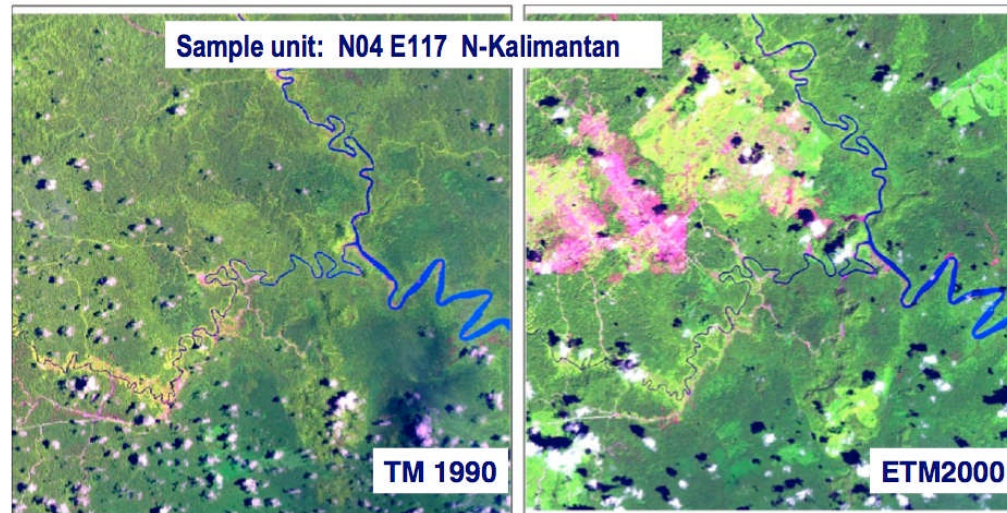
Bulk distribution:

- ▶ Bulk distribution from UMD GLCF for fee
- ▶ Bulk distribution from USGS if disk provided (?)



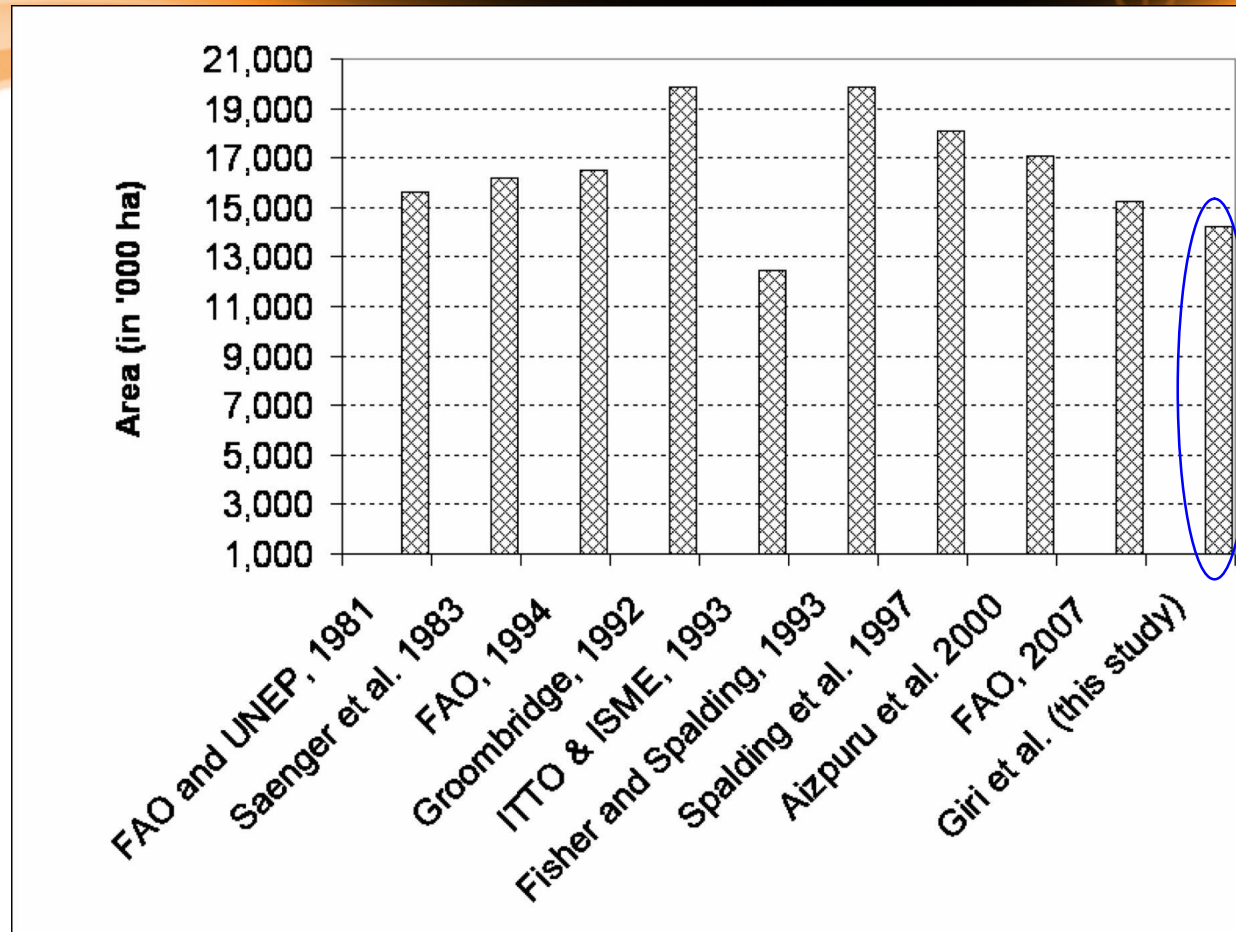
TREES-3 (Joint Research Centre, European Commission)

Program to update FAO Forest Resource Assessment using sample of satellite data
Currently basing assessments on GLS data sets



Courtesy A. Belward/ JRC

Giri C. (USGS EROS) Monitoring Tropical Mangrove Forest: Global Mangrove Area (2000)



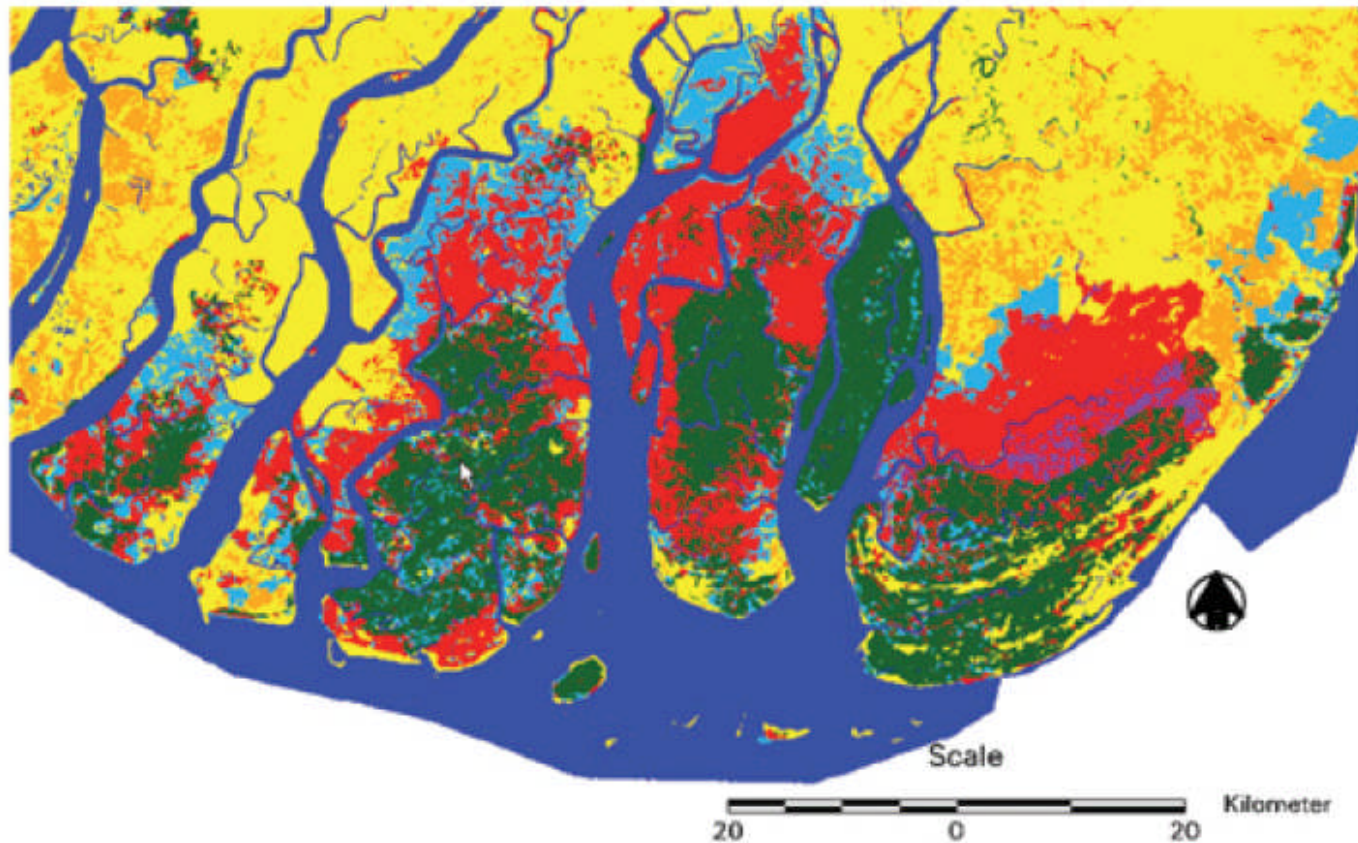
137,800 ha global area (0.7% of tropical forests)

75% mangroves in just 15 countries

Only 6.9% protected (IUCN I-IV)



Mangrove Loss, 1975 - 2005

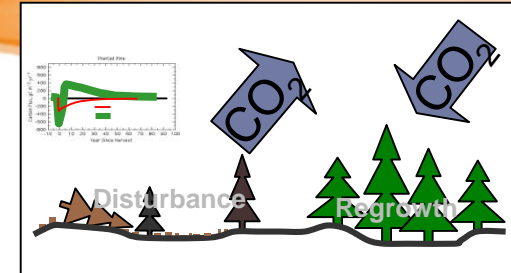


- Mangrove Forest
- Non-mangrove
- Barrenlands
- Waterbodies
- 1975-1990 Deforestation
- 1990-2000 Deforestation
- 2000 - 2005 Deforestation



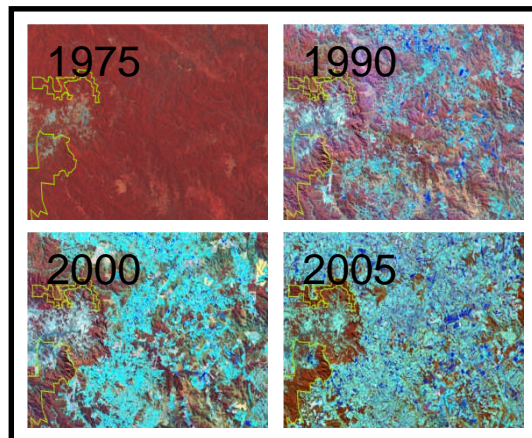
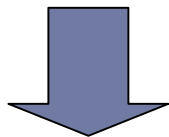
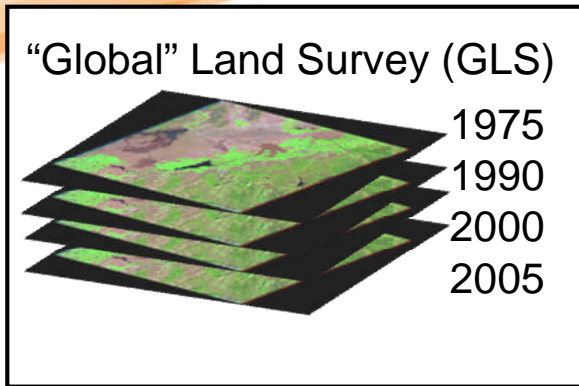
Townshend, J. (UMD) – Earth Science Data Records (ESDR) of Global Forest Cover Change

- ▶ Develop global Forest Cover Change products (30m resolution) to support
 - ▶ Modeling
 - Climate
 - Carbon: REDD
 - Hydrology
 - ▶ Biodiversity and conservation
- ▶ Demonstrate routine global Forest Cover Change monitoring capability

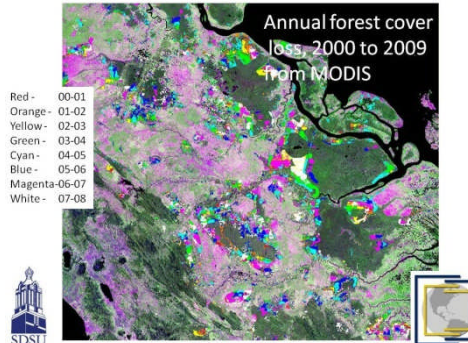


Deliverables

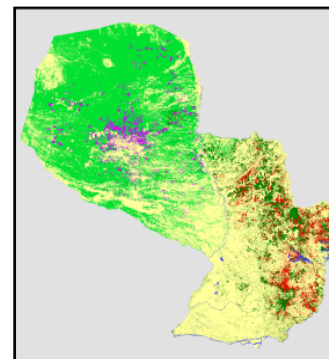
Forest cover change (MODIS) ESDR



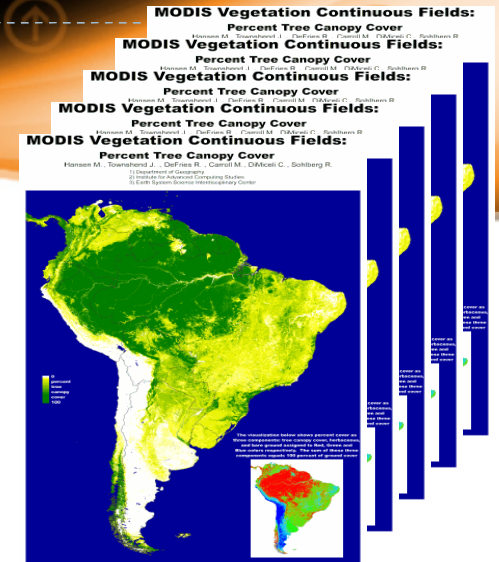
Surface reflectance ESDR



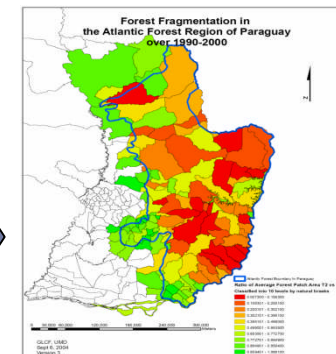
Landsat-MODIS consistency



Forest cover change (Landsat) ESDR



MODIS VCF (2000-2005)



Fragmentation & change ESDR

Current availability of fine-scale satellite data sources and capacities for global land change observations

(courtesy GOFC/GOLD Sourcebook on REDD & Martin Herold, Wageningen U)

	Satellite observation system/program	Technical observation challenges solved	Access to information on quality of archived data worldwide	Continuous observation program for global coverage	Pre-processed global image datasets generated & accessible	Image data available in mapping agencies for land change analysis	Capacities to sustainably produce/use map products in developing countries
O P T I C A L	LANDSAT TM/ETM						
	ASTER				On demand		
	SPOT HRV (1-5)				Commercially		
	CBERS 1-3				Regionally		
	IRS / Indian program				Regionally		
	DMC program			Probably	Commercially		
S A R	ALOS/PALSAR + JERS				Regionally		
	ENVISAT ASAR, ERS 1/2				Regionally		
	TERRARSAR-X				Commercially		
HR	IKONOS, GEOEye			Probably	Potentially		
	ICESAT/GLAS (LIDAR)						

(Note: darker gray= more common or more fully applicable)



Thank You

