

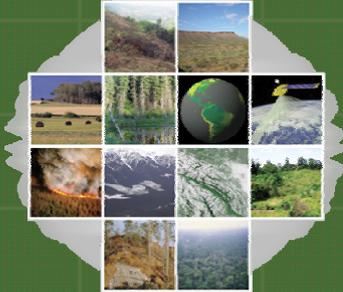


GOFC-GOLD
Global Observation of Forest and Land Cover Dynamics



Monitoring Deforestation for Compensated Reductions

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on behalf of GTOS/GOFC-GOLD and the workshop
participants



Background

- Workshop on "Remote Sensing Analysis of Tropical Deforestation and Baselines for Carbon Crediting"
July 6-7, 2005 Carnegie Headquarters, Washington DC
 - Chapter (DeFries et al.) in IPAM/ED book (eds: Moutinho + Schwartzman)
- Establishment of ad hoc working group to develop technical guidance on current and future capabilities for monitoring deforestation in the context of UNFCCC present discussions
- GOFC-GOLD workshop on "Monitoring Tropical Deforestation for Compensated Reductions", held 21.-22. March 2006 in Jena, Germany



GOFC-GOLD workshop overview

- Overview of policy level discussions and activities
- Assess standard practices for monitoring deforestation and degradation (nationally, internationally)
- Common understanding and vision:
 1. Comprehensive experiences for monitoring tropical deforestation to measure forest cover and change in consistent, transparent, and cost-effective manner
 2. Forest changes can be monitored with confidence for assessing and comparing historical and future rates of deforestation *(Considering existing satellite databases and assuming continuity for future missions and processing capacities)*
 3. Consensus technical guidelines can be developed

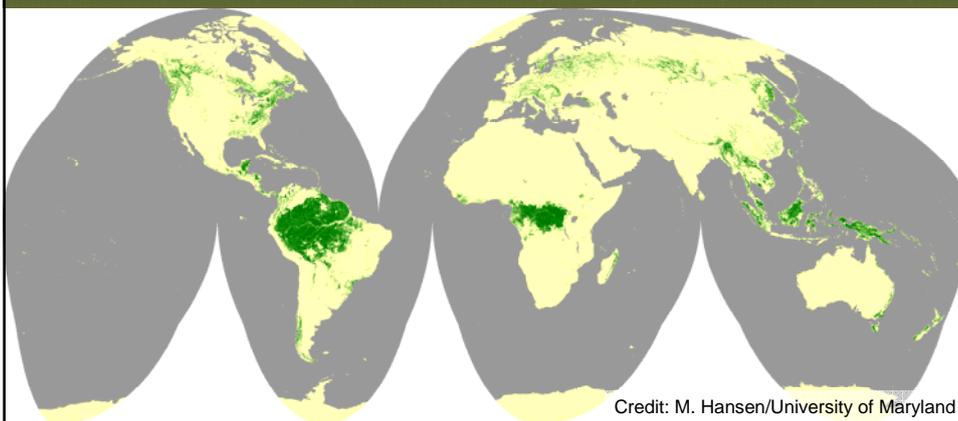
GOFC-GOLD workshop overview

➤ Develop consensus for technical guidelines:

- Best practices – Monitoring deforestation (*P. Mayaux*)
- Best practices – Monitoring degradation and regeneration (*C. De Souza*)
- Best practices – Biomass and forest types especially in relation to carbon (*S. Brown*)
- Historical deforestation and projections (*B. Schlamadinger / V. Vereau*)
- Verification (*D. Pandey / J. Seifert-Grazin*)
- Structure of best practices report and input to SBSTA Workshop (*F. Achard / R. De Fries*)



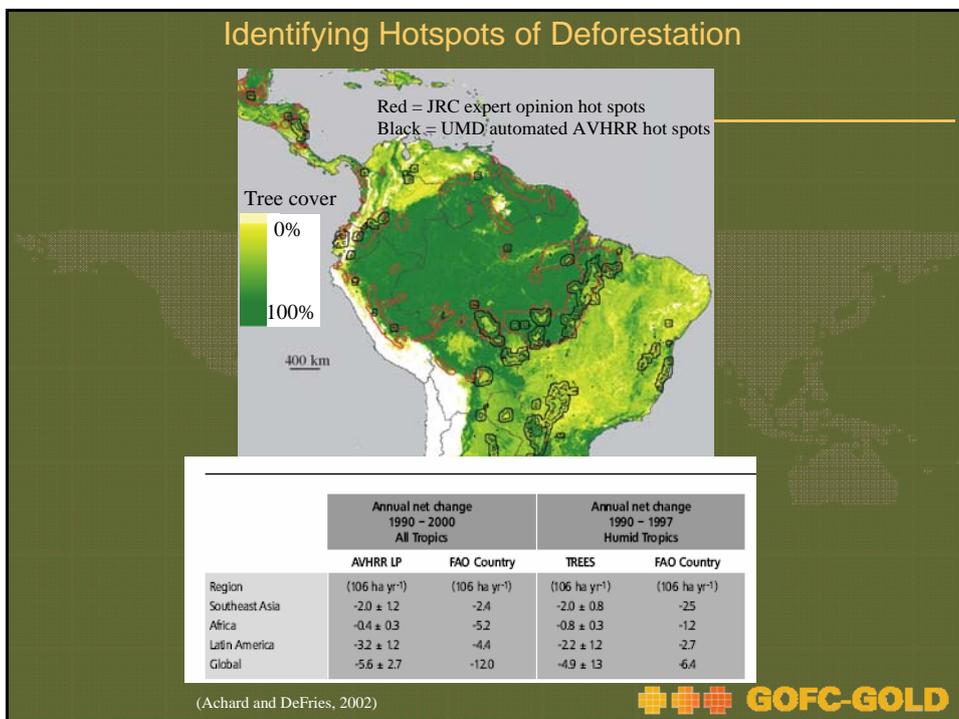
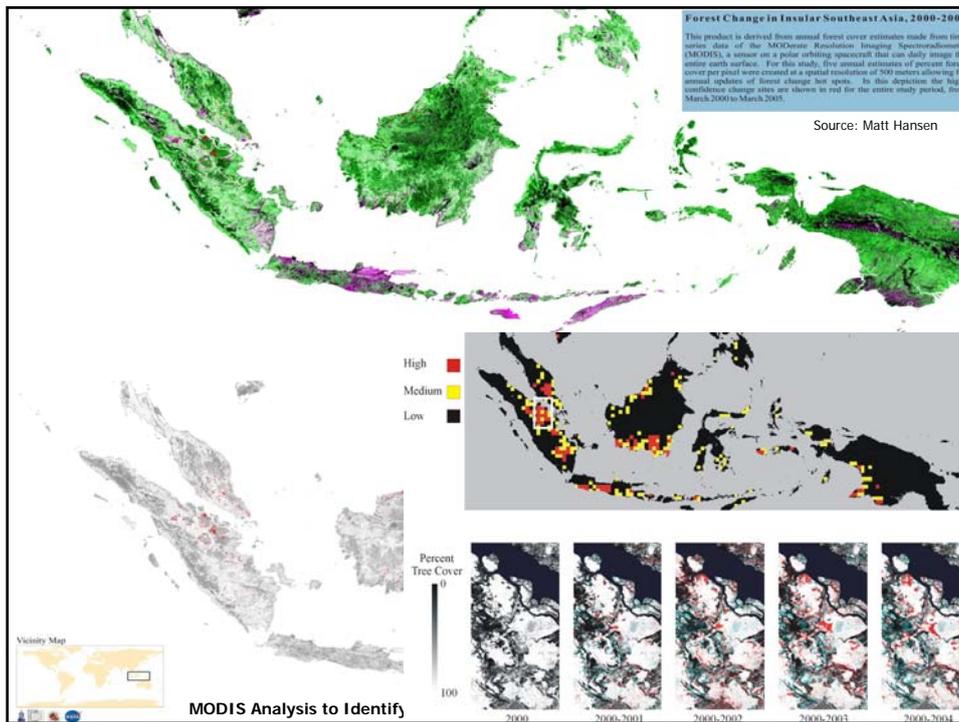
Global forest observations from satellite data



Credit: M. Hansen/University of Maryland

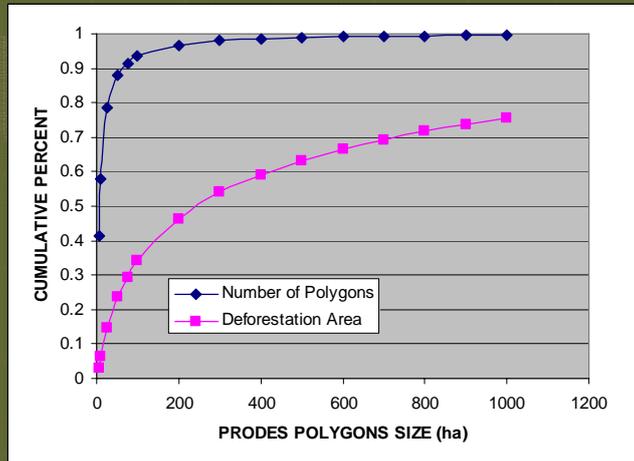
0% tree cover threshold 100%





Importance of large clearings

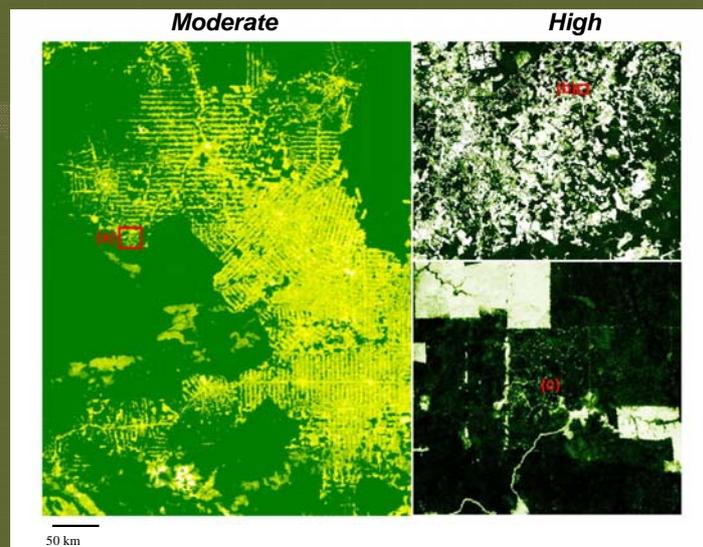
- Only 20% of deforested polygons are greater than 25 ha but account for 80% of deforested area
- But this does not include clearings ≤ 6 ha or any logging



Amazon deforestation polygons merged from Brazil INPE PRODES 2001-04

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Combining Moderate and High Resolution Satellite Data for Monitoring of Clear-cutting and Other Forest Losses



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High and Moderate Resolution Satellite Data for Pan-tropical Deforestation Monitoring

Satellite	Sensor	Spatial Resolution (ground sample distance)	Temporal Resolution (days)	Overall Status	Cost of Data and Analysis	
High Resolution (< 50 m)						
Landsat 5	TM	30 m	16	Aging	Higher	
Landsat 7	ETM+	30 m	16	Crippled by sensor component failure		
IRS-2	ResourceSAT	6-56 m	5-24	Unknown availability		
CBERS-2				Unknown availability		
Terra	ASTER	20 m	26	Acquired on a task by task basis		
SPOT	MSS	20 m	26	Acquired on a task by task basis		
ERS	Synthetic Aperture Radar	30 m	35	Acquired on a task by task basis		
RadarSAT	Synthetic Aperture Radar	8-100 m	24	Acquired on a task by task basis		
Moderate Resolution (> 50 m)						
Terra/Aqua	MODIS	250 m 500 m 1000 m	Up to daily	Highly available		Lower
TIROS	AVHRR	> 1100 m	Up to daily	Highly available		
SPOT	VGT	1000 m	Up to daily	Highly available		
IRS	AWFS	60 m	5	Available		
EnviSAT	MERIS	300 m	3			

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Standard methods available?

Examples of Existing Satellite Analyses of Tropical Deforestation at Country-wide, Regional, and Global Scales

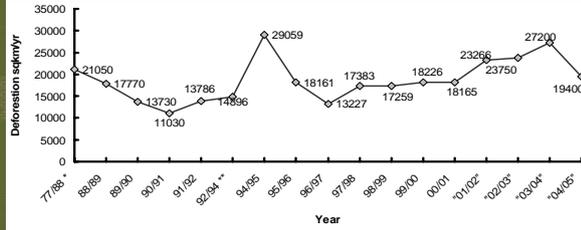
TABLE 2. Examples of existing, satellite-derived analyses of tropical deforestation at country-wide, regional, and global scales

Data	Time period	Spatial coverage	Source
Country-wide GEO Cover Landsat analyses	1990-2000	10 countries	Conservation International
AVHRR analysis	1982-2000	Global deforestation hotspots	(Hansen and DeFries, 2004)
TREES analysis	1990-97	Pan-tropics hotspots	(Achard <i>et al.</i> , 2002)
Landsat Pathfinder	1980-90	Pan-Amazon/ central Africa	University of Maryland/ Michigan State University
Geocover	1980-90	Albertine Rift, Africa	(Plumptre <i>et al.</i> , 2003)
Individual country monitoring programs	varies	Country-wide	E.g., (INPE, 2000), (Forest_Survey_of_India, 2001)

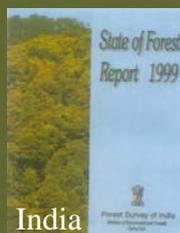
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National level examples

Annual deforestation rates estimated for the Brazilian Amazon



Brazil



India

Cycle	Year of assessment	Satellite and sensor	Spatial resolution	Mapping scale
I	1987	Landsat MSS	80 m x 80 m	1:1 million
II	1989	Landsat TM	30 m x 30 m	1:250,000
III	1991			
IV	1993			
V	1995			
VI	1997	IRS-1B / LISS-II	36 m x 36 m	1:50,000
VII	1999	IRS-1C / LISS-III	23 m x 23 m	
VIII	2001	IRS-1C/1D / LISS-III	23 m x 23 m	1:50,000
IX	2003	IRS-1D / LISS-III	23 m x 23 m	1:50,000

Forest assessments completed by the Forest Service of India



International/National level examples

- Global scale observations:
 - Standardized international perspective
 - Identification of large deforestation (<10-20 ha) and hot spots
- Multiple methods and approaches have been successfully used and are appropriate at national level
 - High resolution data are needed (deforestation < 0,5-1 ha)
- Synergies among national, regional, and global efforts for efficient use of resources
- Methods proven; implementation depending on deforestation processes, data access, costs, capacities



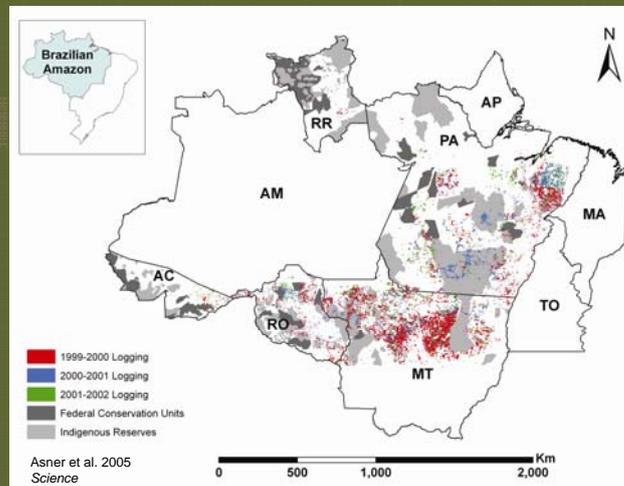
Deforestation and degradation



Monitoring forest degradation



Only One Large Regional Logging Study – 2005

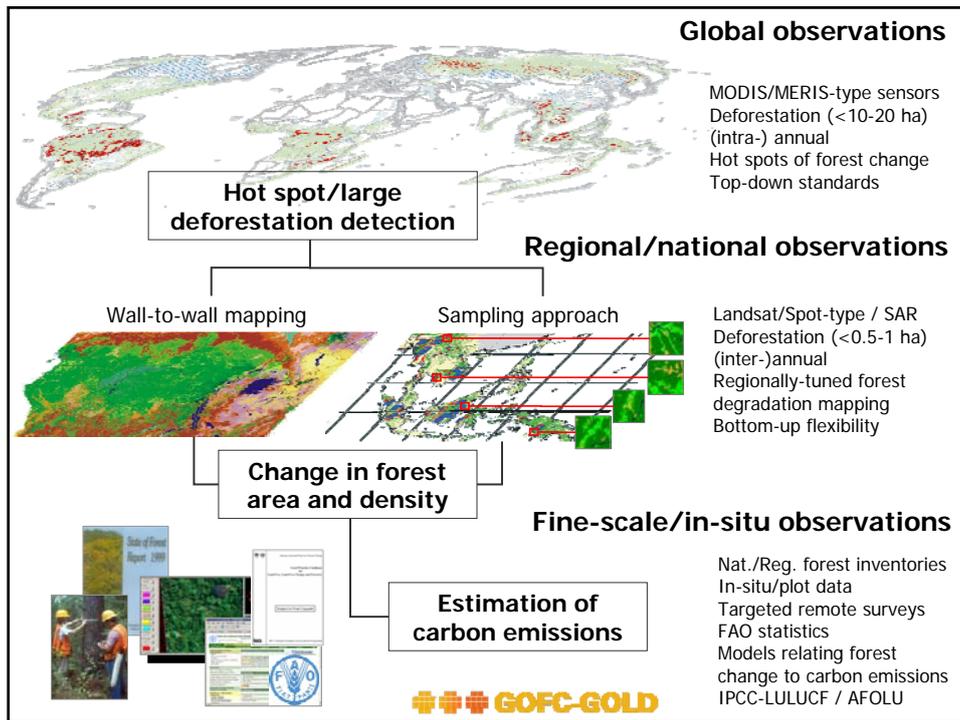


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Estimating changes in carbon stocks

- Relationship between observed land change in forest area and density, and net carbon emissions
- IPCC GPG on LULUCF and the upcoming AFOLU guidelines already provide a number of approved concepts
- Common sources are ground reference data, national and regional forest inventories, FAO statistics, and remote sensing observations (LIDAR + RADAR)
- Targeted field observations of key metrics determining biomass stocks (i.e. tree crown area and height) complimented/calibrated with remote measurements

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Historical deforestation and projections

- Inter-annual variability of deforestation is large
- Historical database of satellite observations is adequate to determine previous deforestation rates in 1990ies (flexibility)
- Methodological issues to be defined

Verification

- Verification is a key component of operational monitoring
- Not routinely done in current deforestation monitoring
- Upfront planning for consistent methodology and resources
- Verification procedures should be in place for all components of a deforestation monitoring system
- Responsibilities for independent validation
- GOFC-GOLD and CEOS develop agreed protocols for land cover accuracy assessments/harmonization

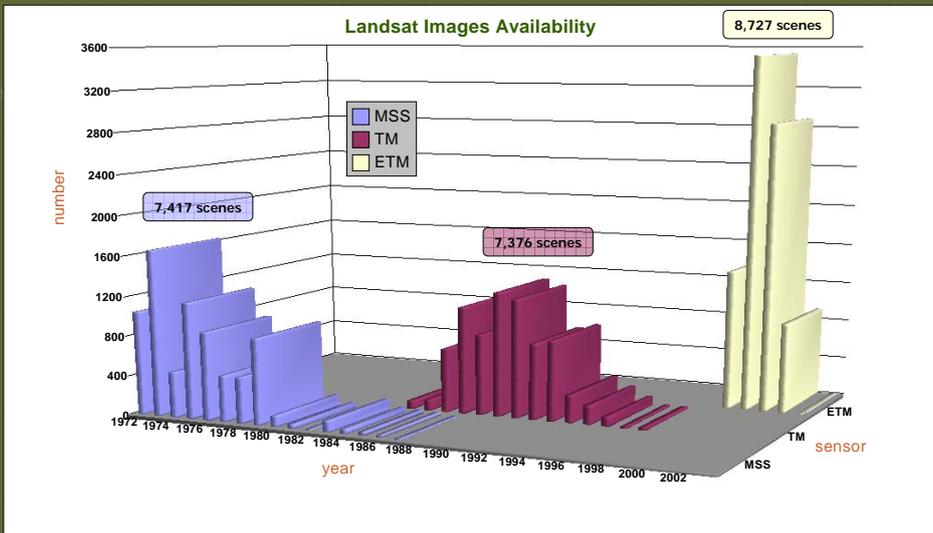


Capacities and challenges

- Data acquisition and distribution:
 - High-resolution satellite continuity
 - Coordinated and continuous data acquisition and dissemination scenarios
- National capabilities:
 - Some developing countries have operational or project-level experiences
 - Establishing/improving essential infrastructure and resources to acquire, process, and analyze satellite, and refine, integrate and disseminate products and results



Global Landsat Data Archive



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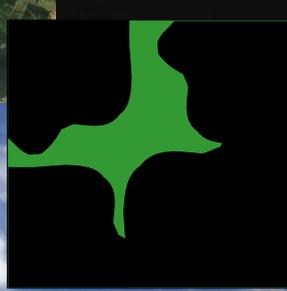
Why?

Satellite data access

Data Storage

Data Analysis/Validation

Data Dissemination



Capacity building

Developing institutional capabilities for monitoring tropical deforestation calls for a consortium effort that:

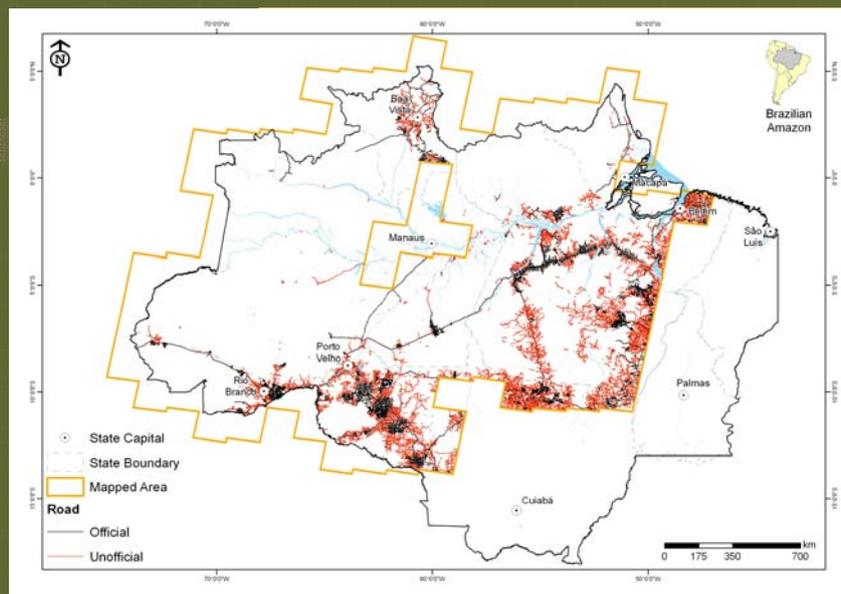
- 1. brings cutting-edge satellite monitoring technology from the North to tropical countries;*
- 2. provides a conduit for validation studies on a timely basis;*
- 3. develops regional capabilities within developing countries for data acquisition and analysis;*
- 4. allows for dissemination of results by both outside and host country stakeholders.*

Key global forest observation actors:

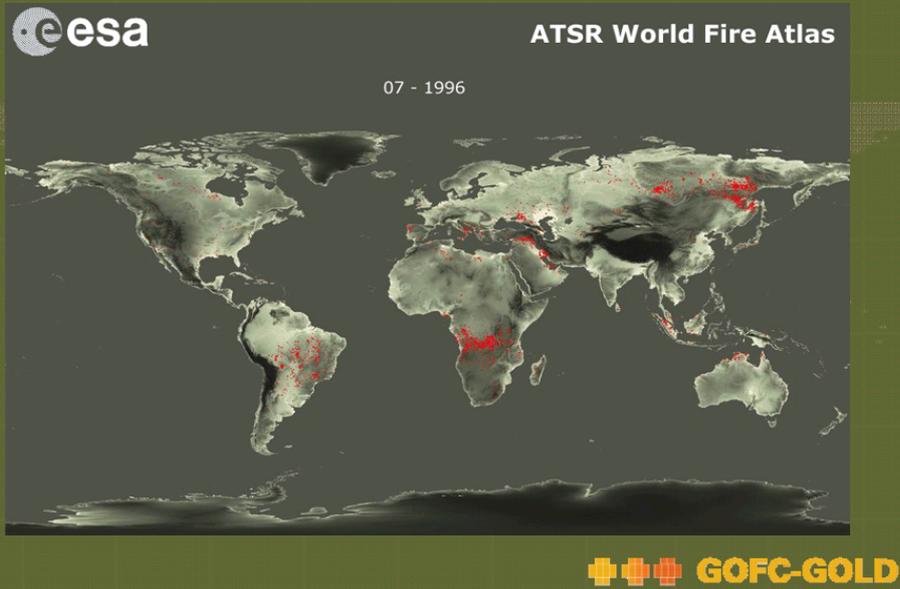
- GTOS/GOFC-GOLD, space agencies, FAO/UNEP, land cover facilities ...*



Mapping Unofficial Roads



Global fire observations



Workshop outcomes and documentation

- March 31st submissions to UNFCCC:
 - Outcomes of GOFC-GOLD workshop recognized by accredited observers (GTOS, ED, CAN)
 - Seven party submissions more or less support the use of Earth Observation
- General workshop report (version 1.1 in review)
- Technical guideline document:
 - Based on "best practices" consensus – does not imply "perfect"
 - Version 1.0 in review by workshop participants
 - Finalized as input to SBSTA workshop
- Side event anticipated for COP 12
- www.gofc-gold.uni-jena.de

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REPORT OUTLINE
**Reducing Greenhouse Gas Emissions from
Deforestation in Developing Countries:
Considerations for Monitoring and Measuring**

- *Executive summary*
 - Common statements on technical feasibility
- *Context from agenda item 6 of COP-11*
- *Monitoring deforested area*
 - Can be done with confidence, variety of methods
- *Monitoring degraded forest area*
 - Important, more challenging
- *Monitoring carbon stock changes*
 - Already established in IPCC + remote sensing
- *Estimating emissions*
 - Area x carbon stock change

