

# GOFC/GOLD Requirements for ALOS

John Townshend  
Chair GOFC/GOLD

The Kyoto and Carbon Initiative, 2<sup>nd</sup>. Science Advisory Panel  
Meeting, UCSB, Santa Barbara, USA 14<sup>th</sup>-15<sup>th</sup>. May 2002

# What is GOFC/GOLD?

- An ambitious, multifaceted, international strategy to bring the Earth's forests/land cover under continuous observation.
- Origins: GOFC was one of the original IGOS prototype projects
  - ◆ (proposed by the Canadian Space Agency).
- Current status: Panel of the Global Terrestrial Observing System (GTOS)
  - ◆ (sponsors: FAO, UNEP, WMO, ICSU)
- Now includes all land cover – hence Global Observations of Landcover Dynamics
  - ◆ Official definitions of forests >10% tree cover.

# Uncertainties concerning forest monitoring

- Different definitions and protocols between and within countries.
- Very varying national capabilities to monitor forests and land cover.
- Remote sensing data are often unavailable
  - ◆ Costs
  - ◆ Satellite acquisition strategies
- Internationally published results yield uncertain results.
- No current commitment for many key products and services.

# Who is involved?

## ■ Key players:

- ◆ International bodies
- ◆ Researchers
- ◆ Space agencies
- ◆ NGOs
- ◆ National forest agencies
- ◆ TCO

## ■ Operates through:

- ◆ Implementation Teams (Land cover and Fire)
- ◆ Regional Networks
- ◆ Scientific and Technical Board.

# Roles of GOFC/GOLD

- International coordination mechanism
- Improve applications and awareness of new methods of observation, especially remote sensing.
- Need to make in situ observations more available.
- Improve understanding of the causes of changes and their impacts

# Organization of GOFC/GOLD

- Land Cover/Forest Cover Implementation Team
  - ◆ Carbon
  - ◆ Ecosystem Assessment
  - ◆ Resource Management
- Fire Implementation Team
- *Biophysical Implementation Team*
- Regional Networks

# Cover IT Membership

- **David Skole, MSU, USA**
- **Iwan Gunawan, Indonesia**
- **Hervé Jeanjean, CNES, France**
- **Eric F. Lambin, IGBP-LUCC, Belgium**
- **Tom Loveland, U.S. Geological Survey, USA**
- **Philippe Mayaux, JRC, Italy**
- **Ake Rosenqvist, NASDA-EORC, Japan**
- **Christiane Schmullius, Friedrich-Schiller-University, Germany**
- **Gilbert Saint, CNES, France**
- **Olga Tarakanova, R & D Center-ScanEx, Russia**
- **Curtis Woodcock, Boston University, USA**
- *Thelma Krug, INPE, Brazil*
- *Paul Reichert, FAO, Italy*



# The world's forests continue to change rapidly

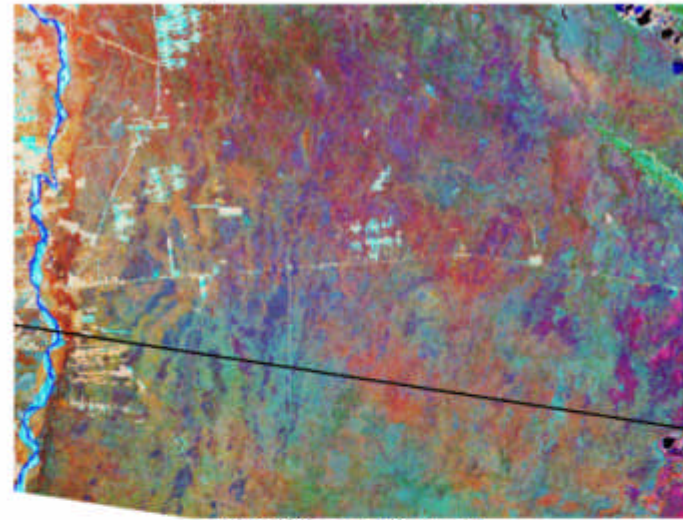
- Bolivia
- Paraguay
- Indonesia
- Canada
- Russia



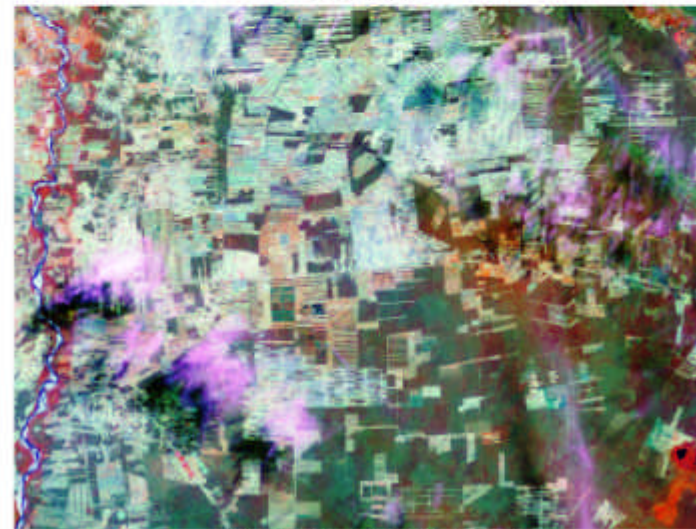
# Bolivia

- Large parts of the Pan-Amazon are being deforested.
- Spatially-concentrated "deforestation zone" in Santa Cruz where >60% of the Bolivian deforestation is occurring at an accelerating rate in areas of tropical deciduous forest.

Land Cover Change - Tierras Bajas, Santa Cruz, Bolivia



July 2, 1986 Landsat 5 bands 4,5,3  
135 Km. x 102 Km.

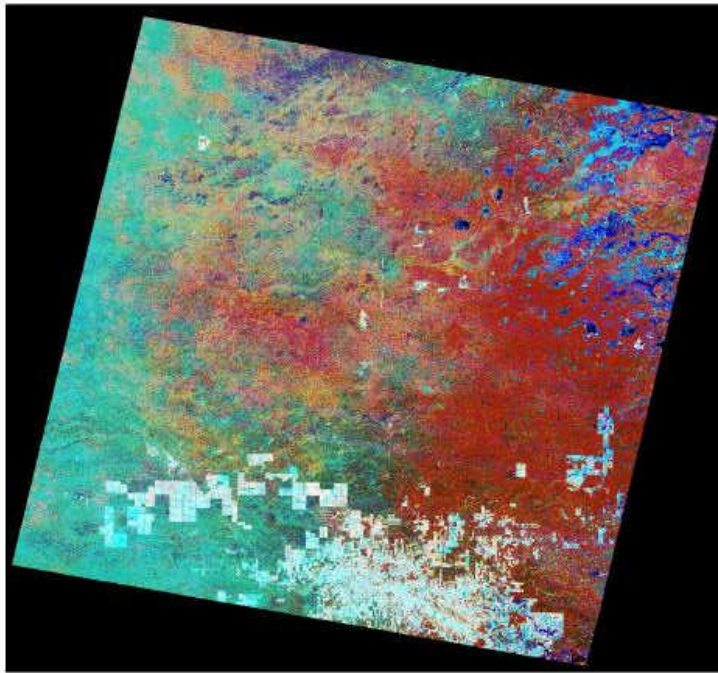


August 31, 1999 Landsat 7 bands 4,5,3  
135 Km. x 102 Km.

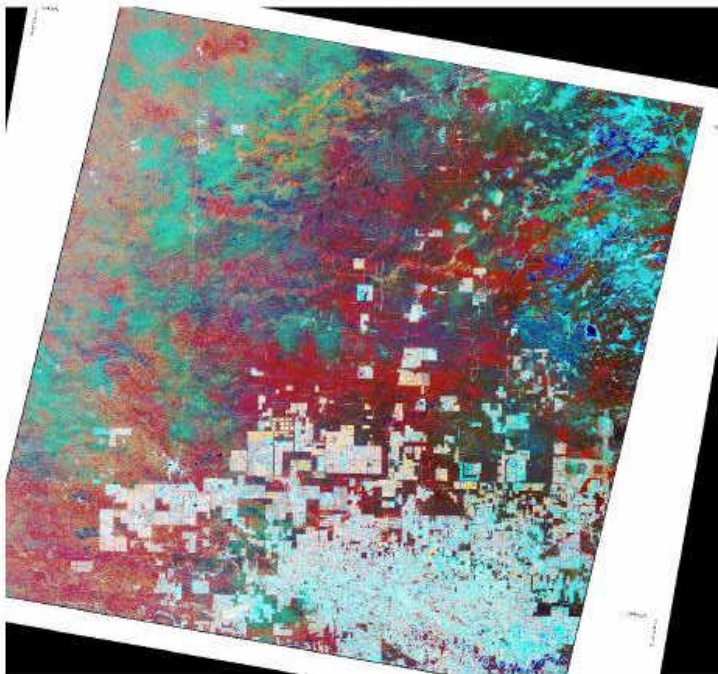
Data Source: Global Land Cover Facility - Deforestation Mapping Group  
<http://glcf.umiacs.umd.edu>



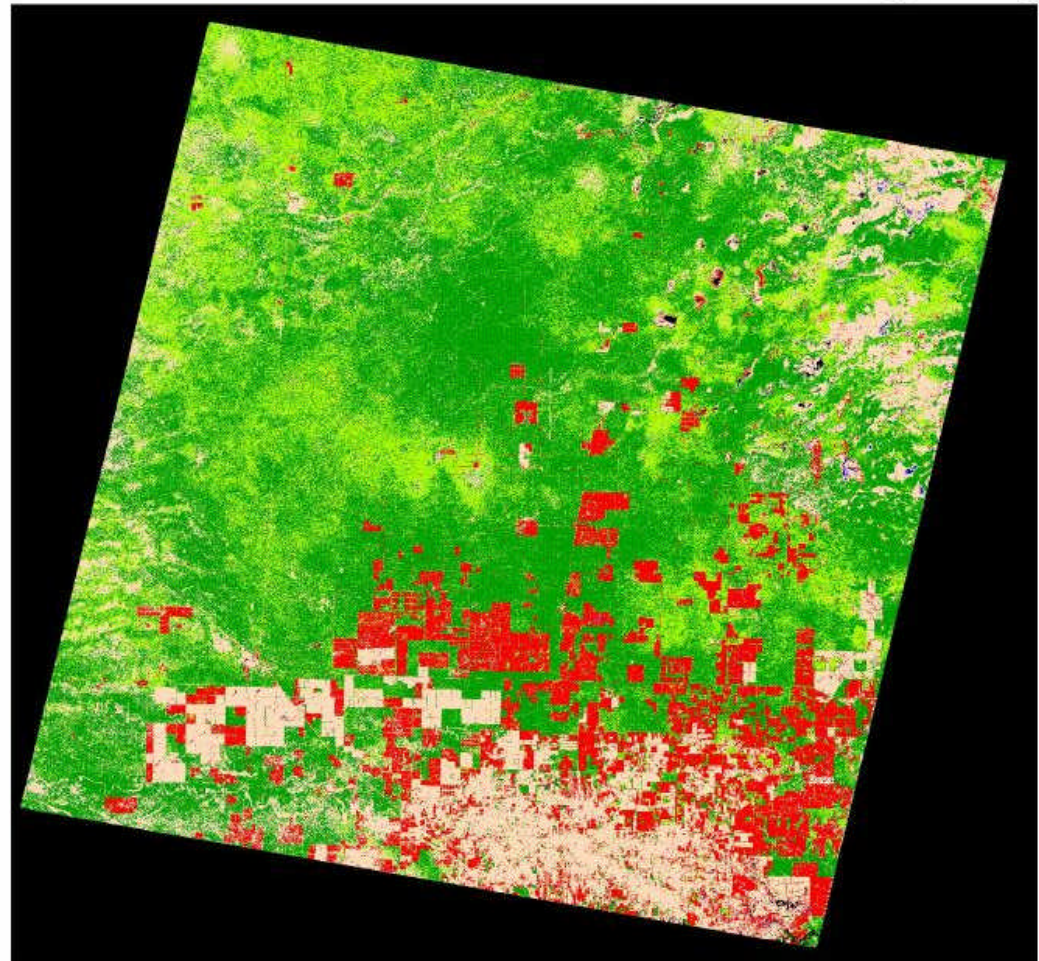
# Northwest of Filadelfia Nueva Asuncion, Paraguay



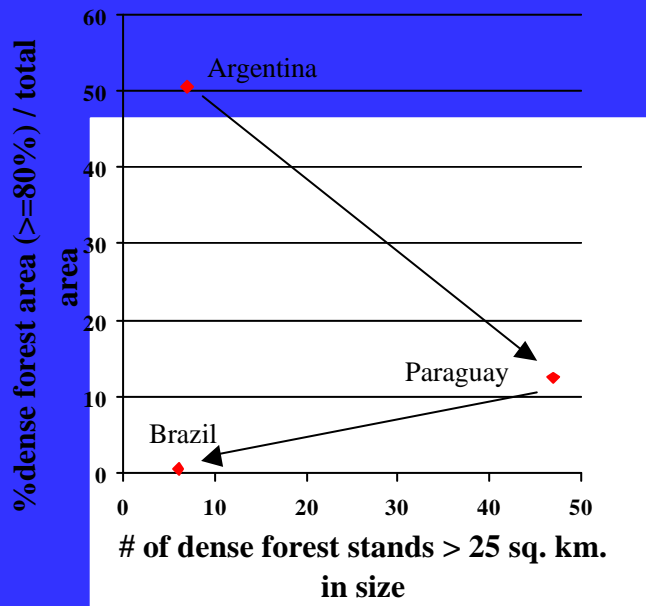
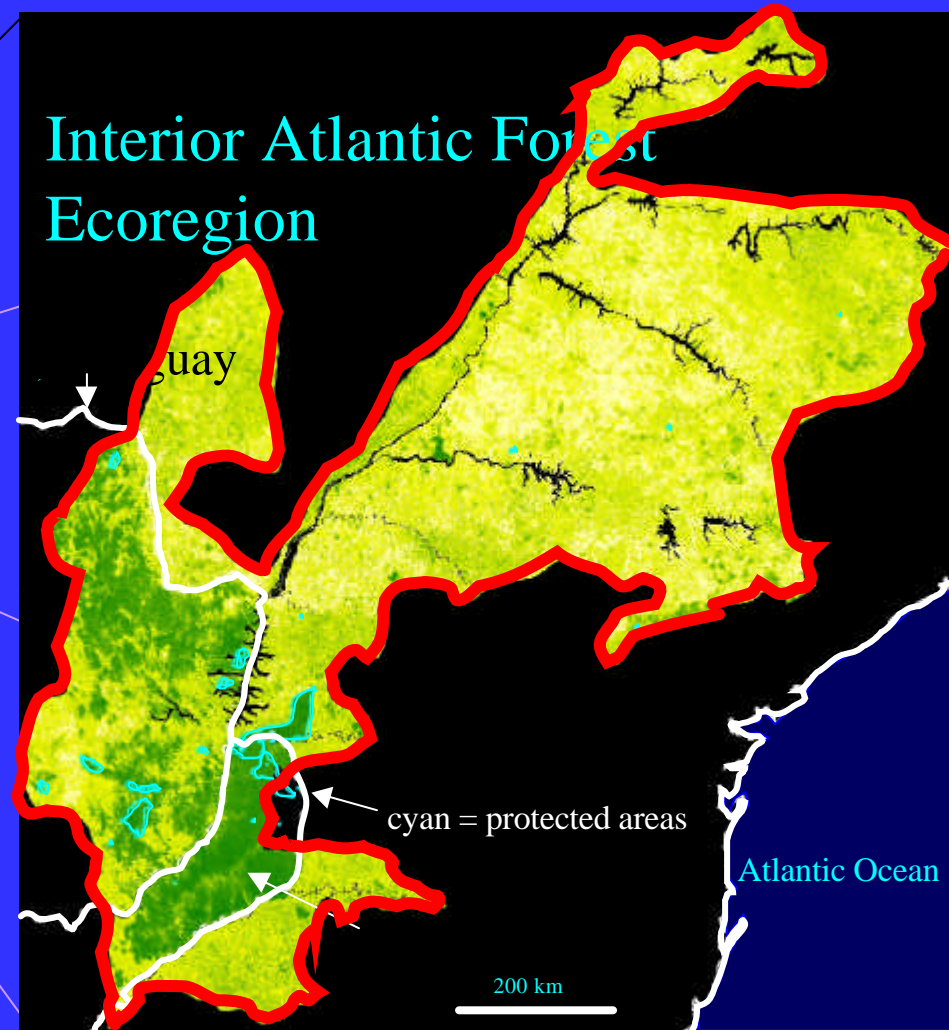
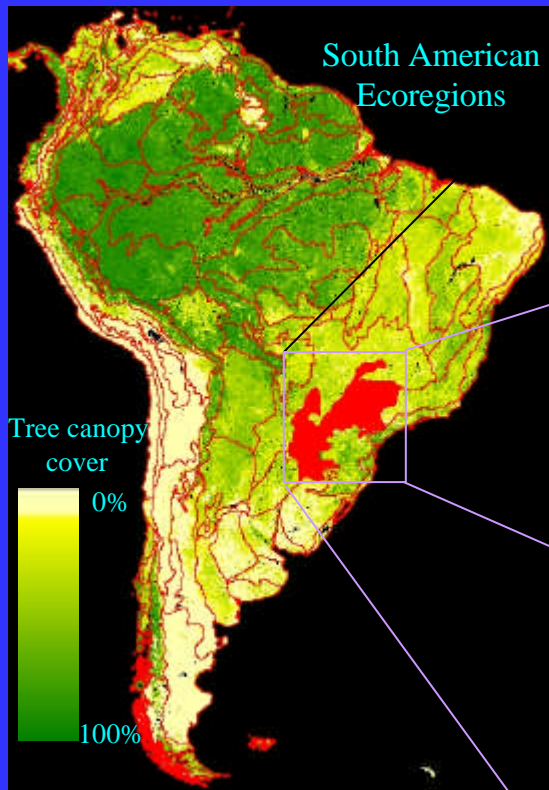
April 14, 1985



January 23, 1997



The above illustration is a land cover classification of forest (green), non-forest (tan), deforestation (red), and water (blue). Deforestation includes tropical forest and chacoan forest conversion. In total there was 3,799 square kilometers of deforestation detected. In the images on the left, tropical forest is shown through tones of red. The dryer chacoan forest is located in areas that have a textured blue color. Pasture and ranches are located in areas that have a bright cyan color. (Path/Row - 228/075)



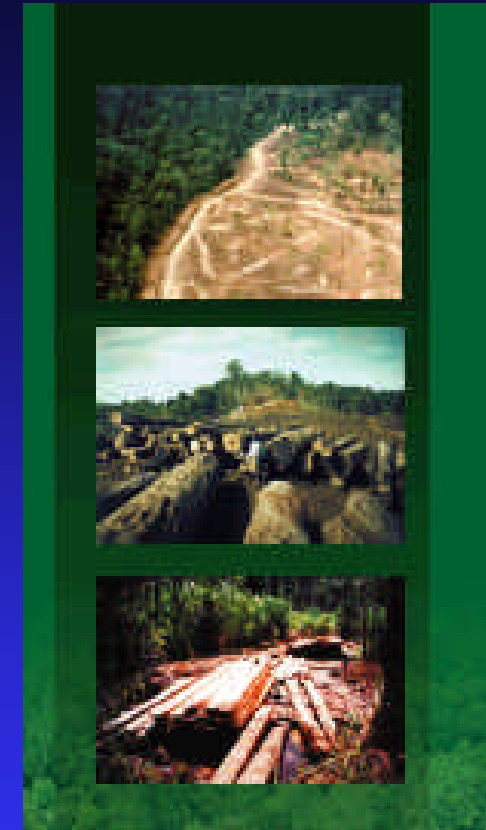
% Tree Cover Derived from AVHRR Data to Assess Forest Degradation within Ecoregions

R. DeFries and M. Hansen



# Deforestation in Indonesia

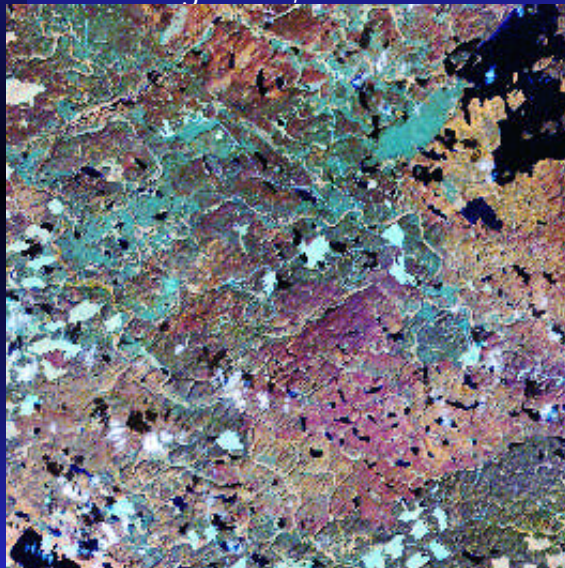
- Indonesia is experiencing one of the highest rates of forest loss in the world.
- Deforestation of lowland forests: 1985-1997
  - ◆ Sumatra 61%
  - ◆ Kalimantan 58%
  - ◆ Sulawesi 89%
- More than 20 million ha of forest has been cleared since 1985
- Majority of cleared land has not been put to productive alternative use.



FWI/GFW. 2002. *The State of the Forest: Indonesia*. Bogor, Indonesia: Forest Watch Indonesia, and Washington DC: Global Forest Watch; D. Holmes, "Deforestation in Indonesia: A Review of the Situation in 1999."

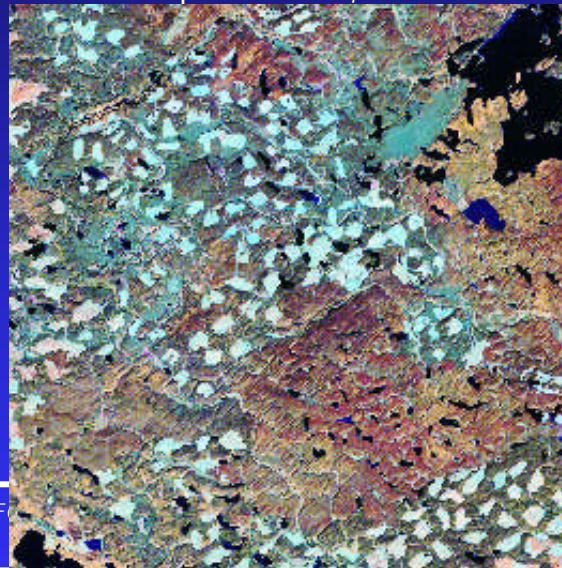
**British Columbia, Canada:** The bright blue patches are areas of mostly bare ground left after logging. While clearcuts in the 1992 image have likely been replanted, the limited red return from these patches in the 1999 image demonstrate how slowly forest regenerates in these environments. **This 1169 Km<sup>2</sup> region lost 92 Km<sup>2</sup> of forest (10%) from 1992-1999.**

August 15, 1992



4,5,3 (RGB) 049-022 Landsat TM

September 12, 1999

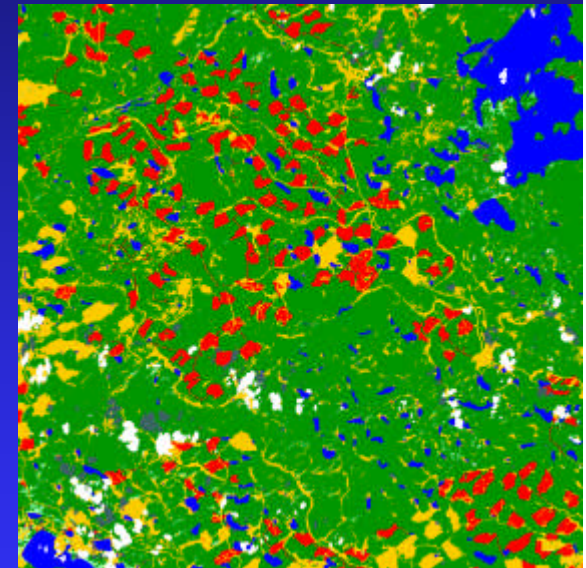


Percent Forest 15.3 (RGB) 049-022 Landsat TM+

Forest Lost/Year

13.1 Km<sup>2</sup>

Land Cover Classification



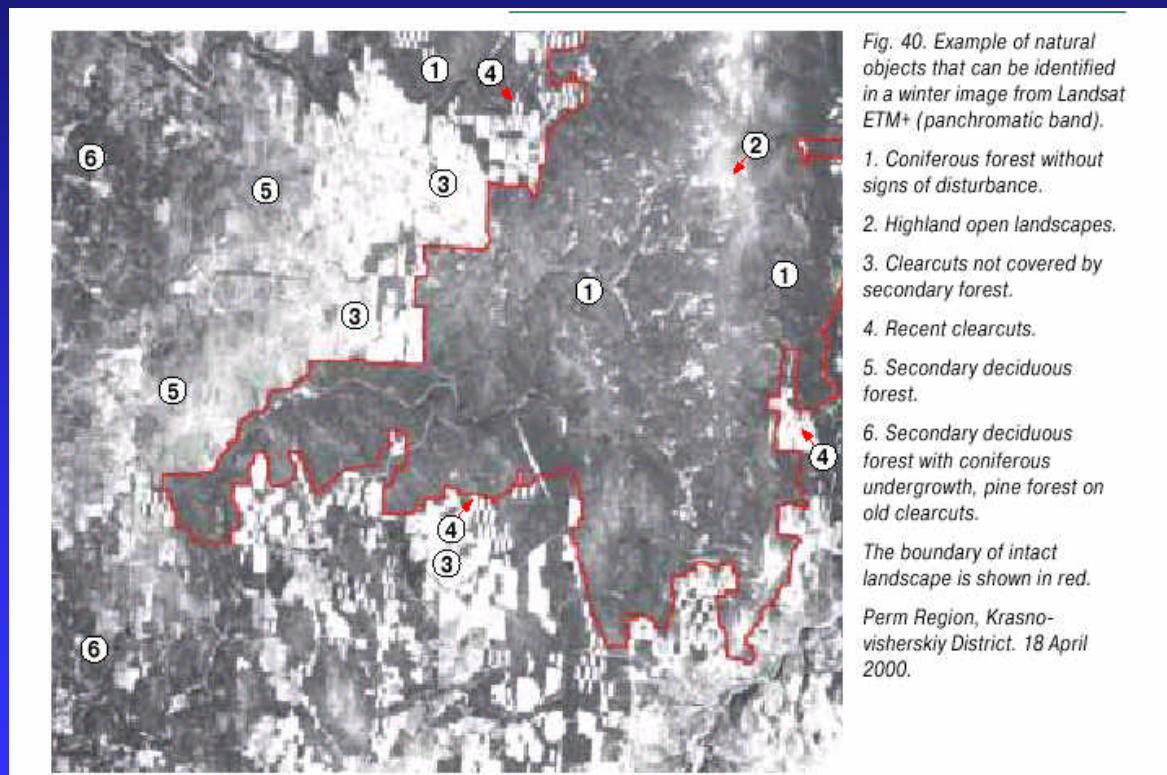
1992 - 1999

## Research Partners



# The Last Intact Forest Landscapes of Northern European Russia

- Forest landscapes that are still intact make up only about 14 percent (31.7million hectares) of the total forest area of European Russia



Alexey Yu. Yaroshenko, Peter V. Potapov, Svetlana A. Turubanova - Moscow: Greenpeace Russia, 2001.

# Many new sensors creating products to satisfy GOFC/GOLD needs

- Landsat 7/LDCM
- SPOT 5
- ASTER
- MODIS
- POLDER
- VIIRS/NPP, VIIRS/NPOESS
- GLI
- PRISM/AVNIR/PALSAR
- Hence need to examine the specific additional requirements of GOFC/GOLD

# Basic GOFCC/GOLD Requirements

- Characterization of land cover
  - ◆ classes
  - ◆ continuous fields.
- Systematic global reliable monitoring of land cover change
  - ◆ at 25-50m resolution every 5-10 years.
  - ◆ At 250 – 500m resolution, Identification of areas of rapid change every year (new hotspots).coupled with higher resolution samples
- Selective logging/thinning within forests
- Regrowth especially in humid tropics.
- Fundamental characteristic of most land cover change is small size of units.



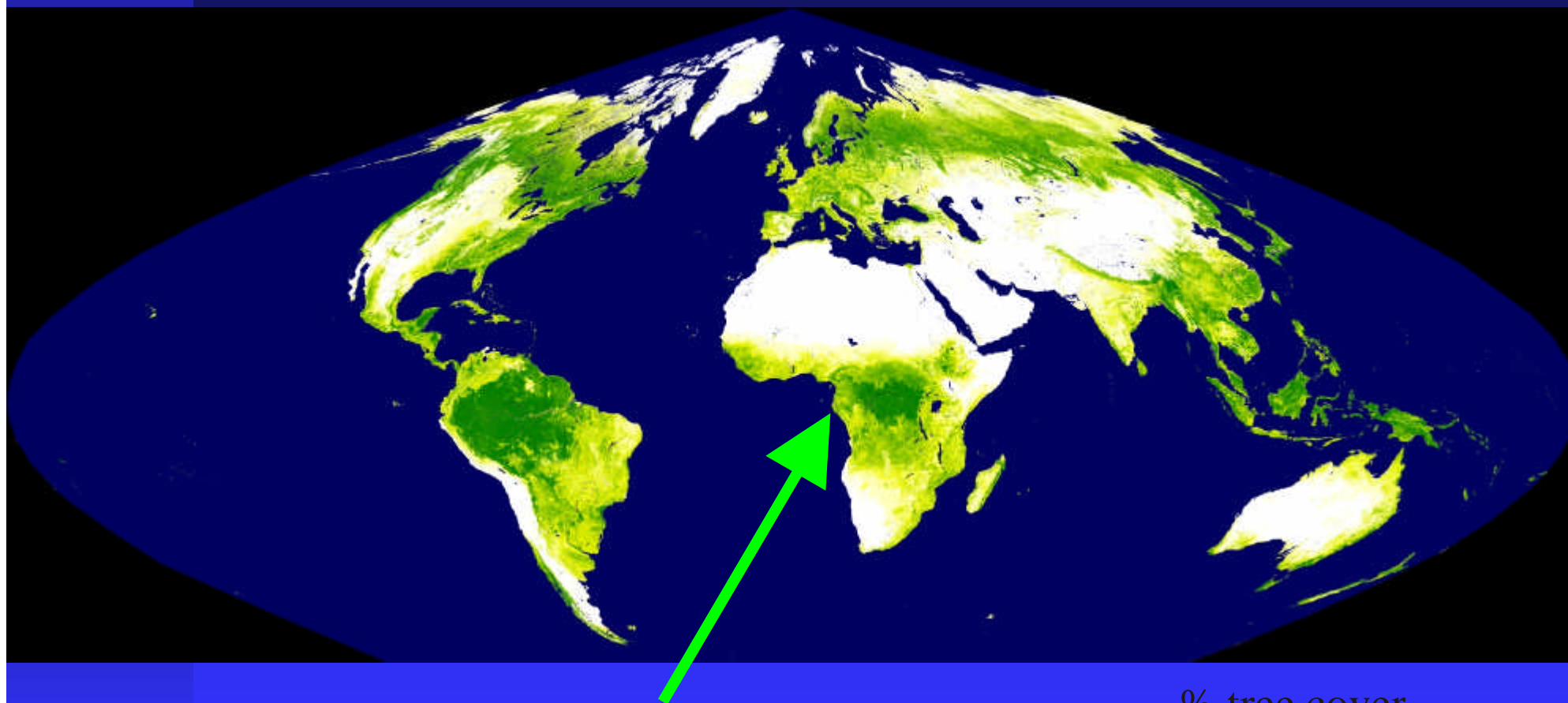
# Major Remote Sensing Requirements for GOFC/GOLD

- Land cover and land cover change
  - ◆ Regular high resolution monitoring of change/disturbance
  - ◆ Cloudy areas
    - ◆ Areas where high cloud frequency prevents monitoring – notably very high cloud-cover areas in human tropics (e.g. Gabon); Areas where clouds affect accuracy of monitoring – notably humid tropics

# Requirements continued

- Biomass monitoring
  - ◆ Laser based systems delayed
  - ◆ Sensitivity of radars at higher biomasses remains an issue
- Reliable monitoring of wetlands
  - ◆ Validation
    - ◆ Ground surveys are very time-consuming and expensive.; Need for high resolution products linked to field campaigns.
- Scaling from ground to fine and then to coarser resolutions

# New products: Global percent forest cover at 500m for 2000 from MODIS



Hansen Defries and  
Townshend



# Training from Landsat

Hansen Defries and Townshend

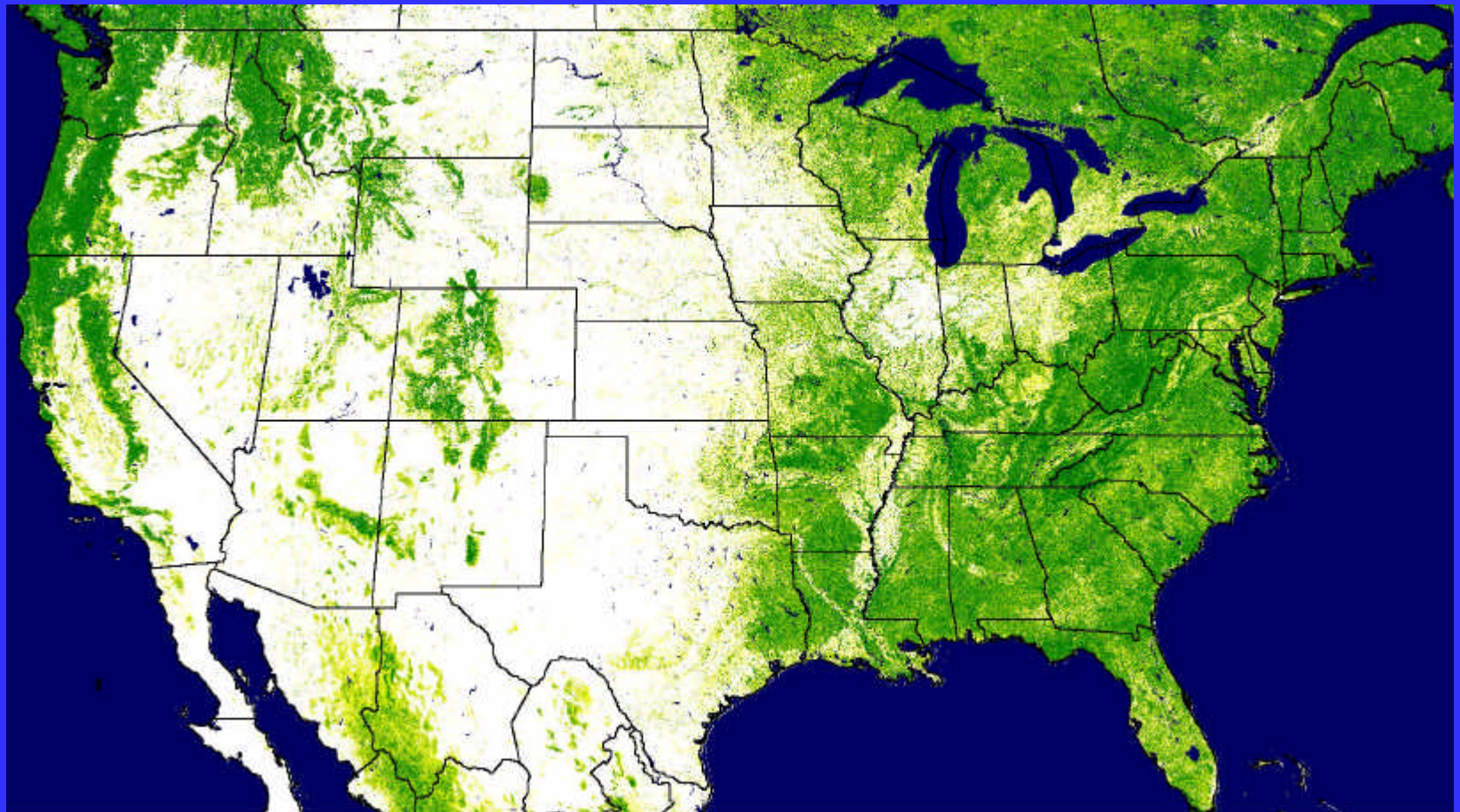
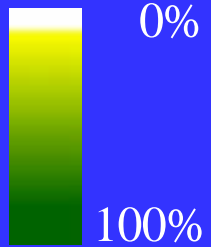


For details see  
<http://glcf.umiacs.umd.edu>

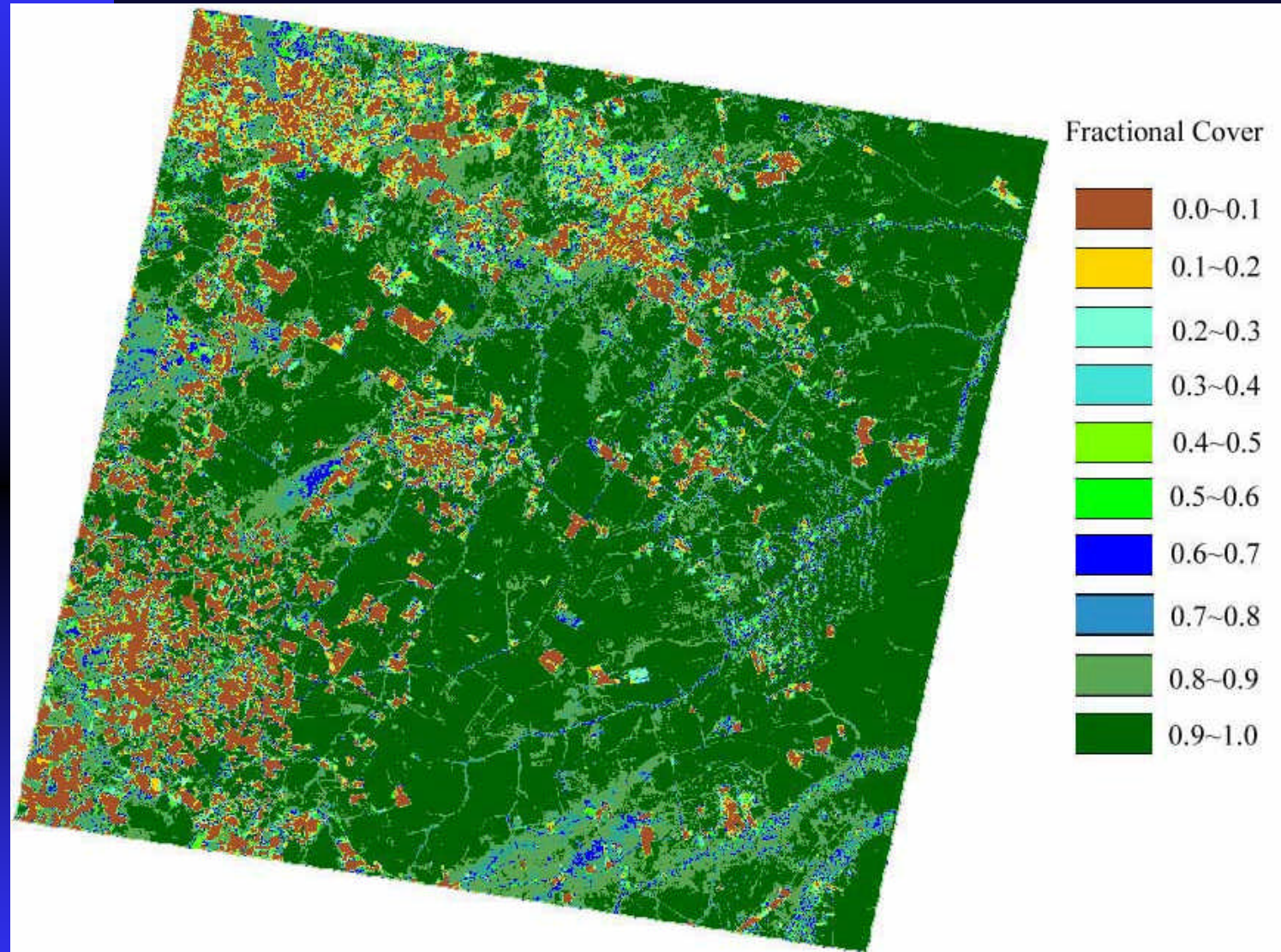


## MODIS 250m U.S. Tree Cover Prototype

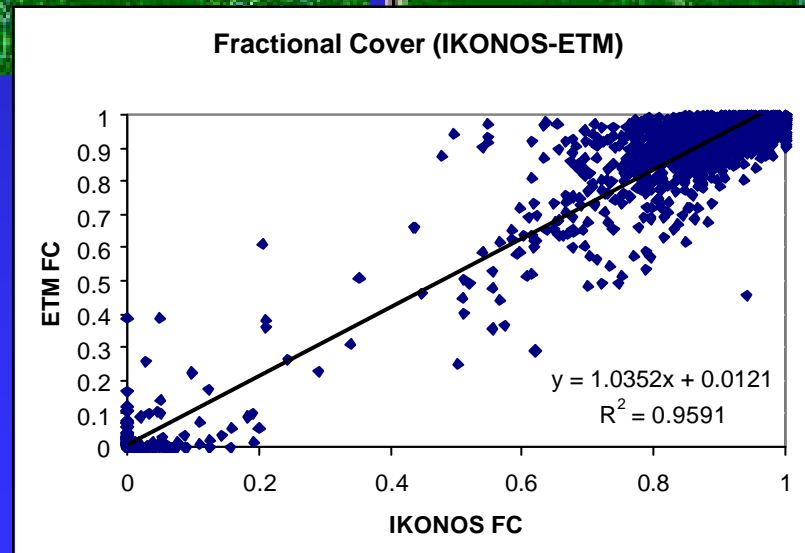
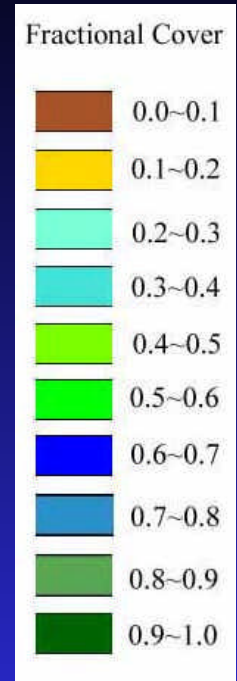
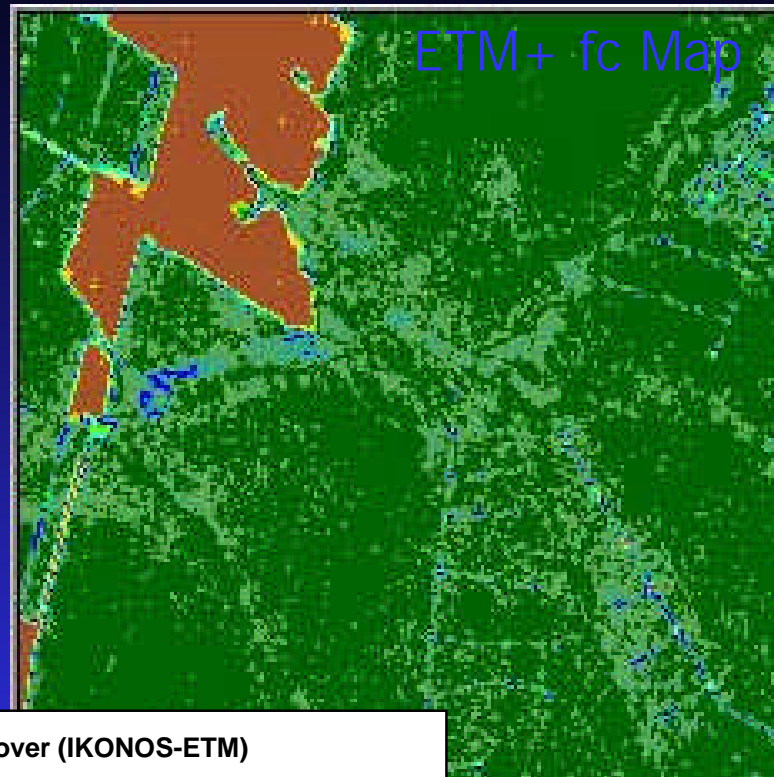
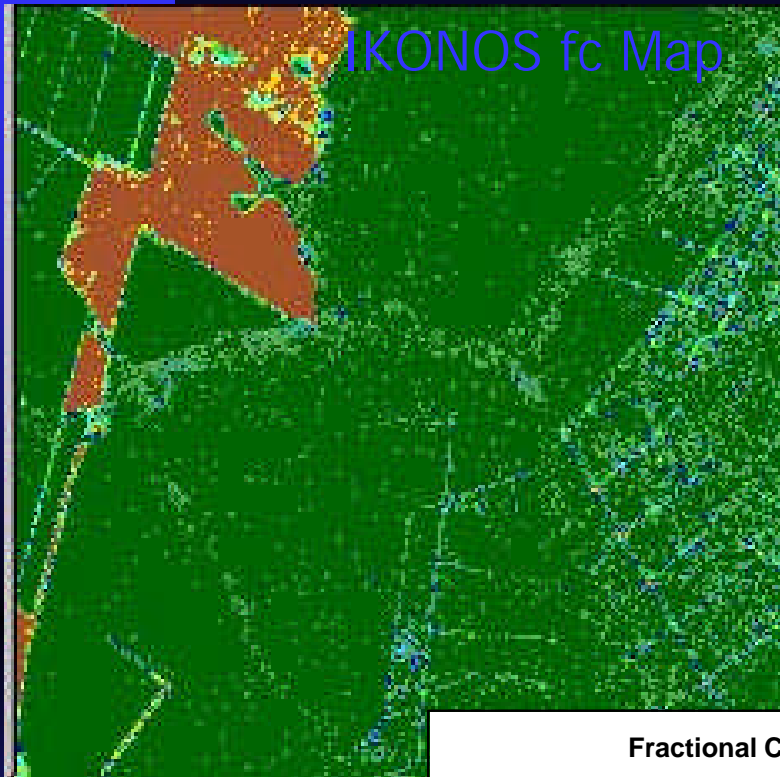
Tree Cover



# Fractional Cover Product Prototype



# Initial Validation of products



# Basic requirements for products

- Data must be low cost – preferably free
- Acquired data and products must be easily available.
- When data are not available globally on a regular basis then acquisition strategy must involve GOFC/GOLD community.
- Quality Assessment must accompany products
- Validation of products must be carried out

## GOFC Regionalized Network

### Components:

- Regional cal / val sites for detailed studies
- Existing regional forest cover
- Overlaid on single source land cover map
- National forest cover moving to regional harmonized
- Single system for information sharing
- ISS Sites

### Data Acquisition:

- Landsat, Spot VGT, MODIS

### Southeast Asia

#### Thailand Sites



1. Mae Chaem, Chiang Mai
2. Lin Thin, Kanchanaburi
3. Phu Si Phan, Nakhon Phanom
4. Eastern Forest, Chachoengsao
5. Thung Kha, Chumphon

#### Philippine Sites



1. Magat, Nueva Viscaya
2. Palawan Island

#### Malaysian Sites

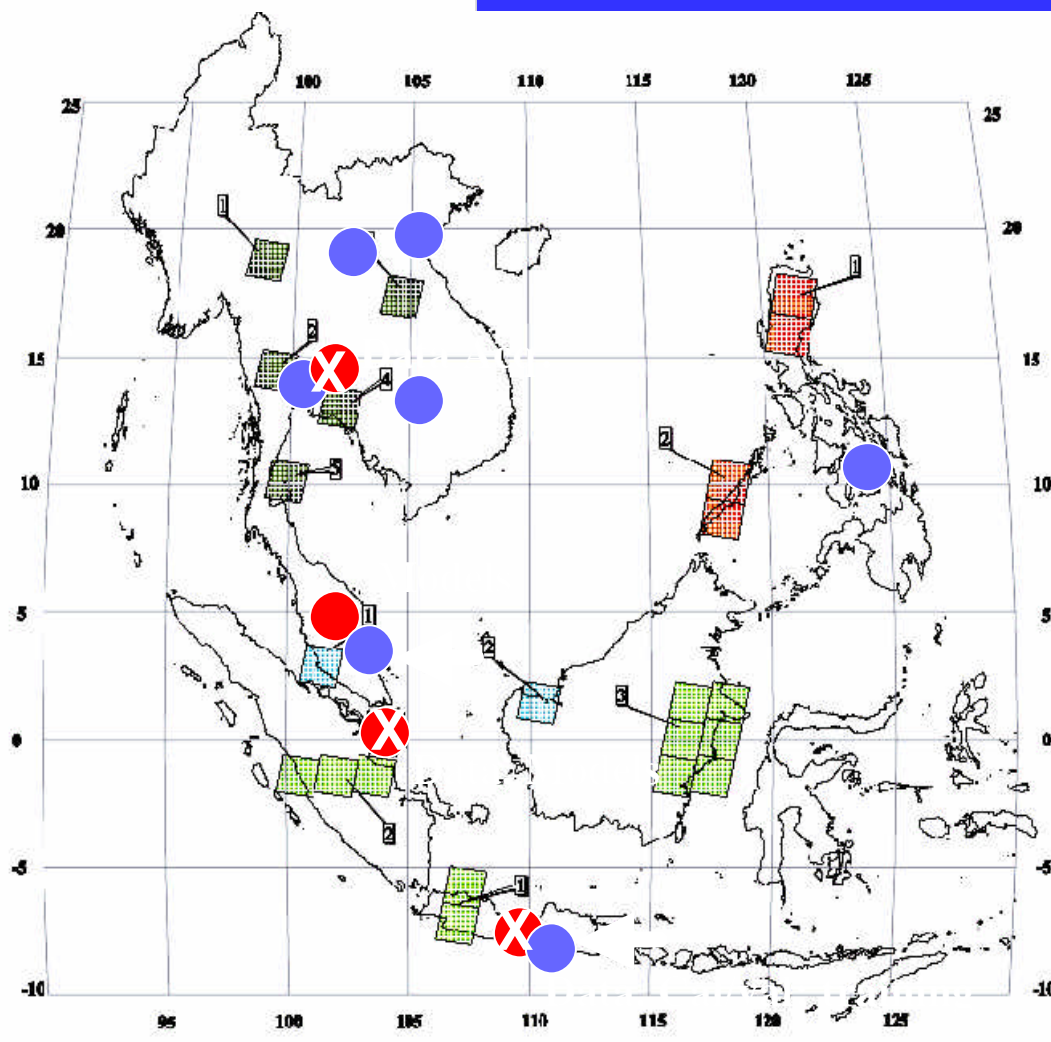


1. Kang Larang, Selangor
2. Sempadi Forest Reserve, Sarawak

#### Indonesian Sites



1. Citarum, West Java
2. Betanghari, Jambi, Sumatera
3. Mahakam, East Kalimantan



X Current receiving

○ ISS Nodes ←

In place

● Prod. Ctr



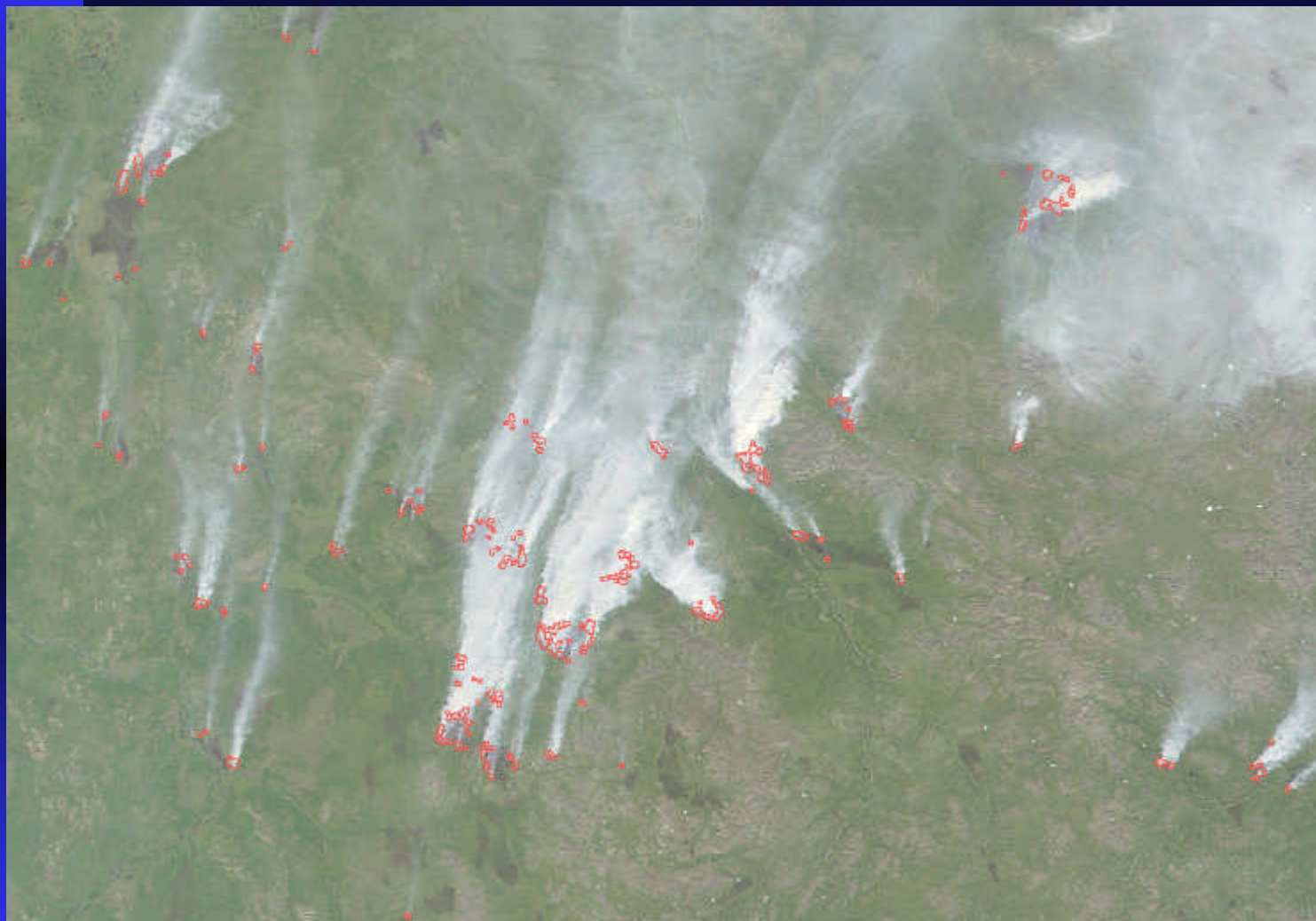
# MODIS Rapid Response System

Example of Active Fire / Corrected Reflectance Product – Star fire in California (08/29/01)



# MODIS Rapid Response System

Example of Active Fire / Corrected Reflectance Product – Siberia (05/22/01)



# Need for integrated sets of products

- *Regional carbon data bundles*

- ◆ Integrated sets of data (or bundle) relevant to regional carbon assessment including forest type, fractional cover, area of change and biomass inventory will be created and made available

# Compatibility between GOFC/GOLD and TCO

- GOFC/GOLD requirements for carbon are essentially the same as TCOs.