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Global Observation of Forest and Land Cover Dynamics

Critical issues and evolving technologies

Side event at UNFCCC COP 14 in Poznan
3. December 2008

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GOFC-GOLD REDD workshop Oct'08

Dedicated breakout group discussions on:

1. **Monitoring forest degradation**
2. Evolving technologies
3. Observing emissions from biomass burning
4. Capacity building

Emphasis on data collection

New sourcebook version

Utilizing existing national datasets

Variable	Focus	Existing observations	Existing information
Area changes (activity data)	Deforestation		
	Degradation		
Changes in carbon stocks / emission factors	Land use change (deforestation)		
	Degradation		
	Other pools (i.e. soils)		
Biomass burning	Emissions of several GHG		
Ancillary (spatial) data	Drivers & factors of forest changes		

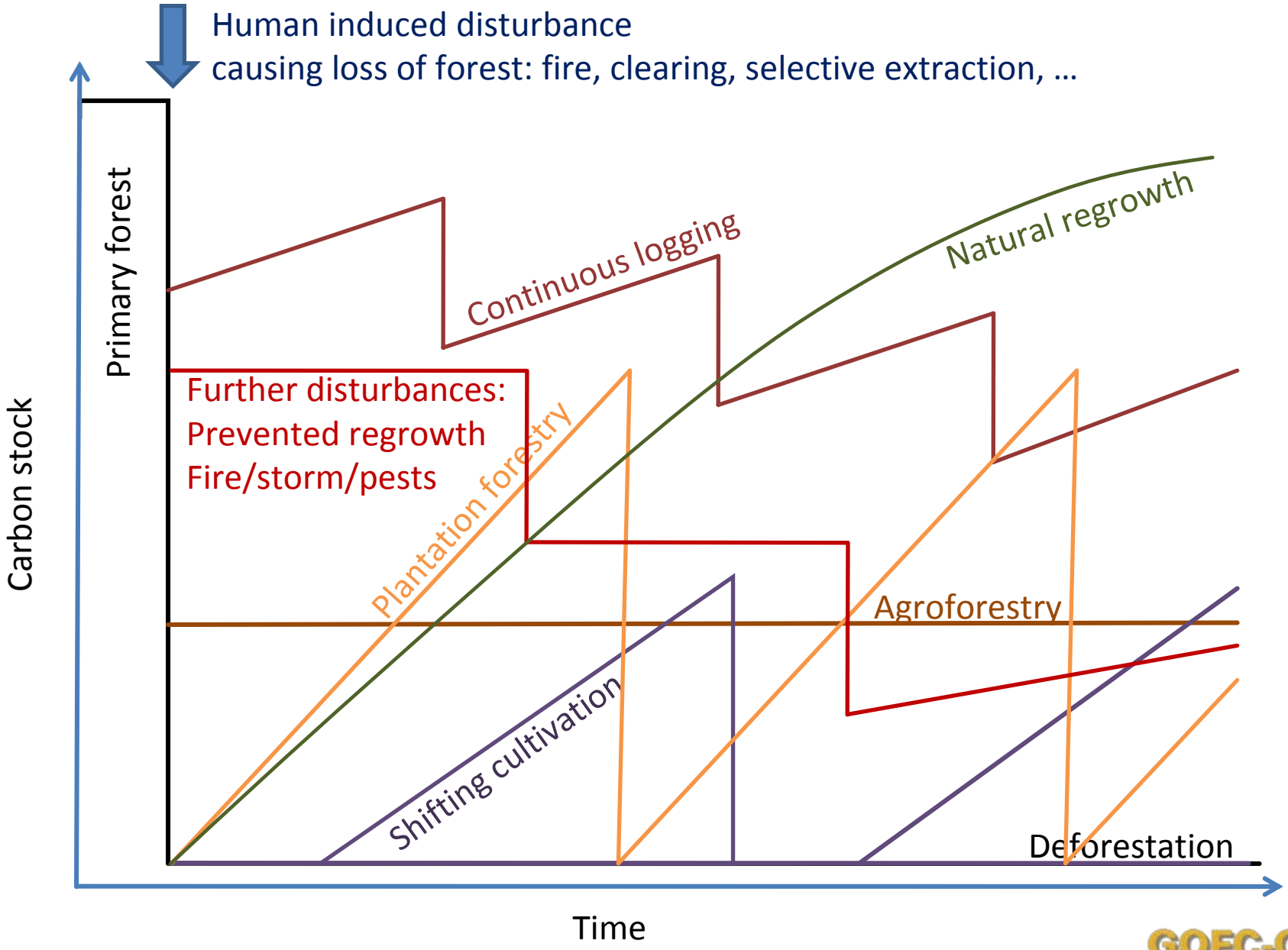
Utilizing existing national datasets

Variable	Focus	Existing observations	Existing information
Area changes (activity data)	Deforestation	*Archived satellite data & airphotos* *Forest maps and field data* *Maps of forest use and human infrastructures*	*Deforestation maps/rates* *National statistical data* *Land use change maps*
	Degradation		*Area affected by degradation and rates*
Changes in carbon stocks / emission factors	Land use change (deforestation)	*Forest inventory, permanent sample plots, research sites, in-situ measurements* *Forest/ecosystem stratifications* *Forest concessions/harvests* *Volume to carbon conversions* *Regional carbon stock data/maps*	*Carbon stock change and emission/ha estimates*
	Degradation		*Long-term C-reduction measurements*
	Other pools (i.e. soils)		*Long-term measurements of soil carbon changes*
Biomass burning	Emissions of several GHG	*Records of fire events* *Satellite data* *Emission factor measurements*	*Satellite data products* *Fire regime, area, frequency & emissions*
Ancillary (spatial) data	Drivers & factors of forest changes	*Topographic maps* *Field surveys* *Census data*	*GIS-datasets on population, roads, land use, planning, topography, settlements …*

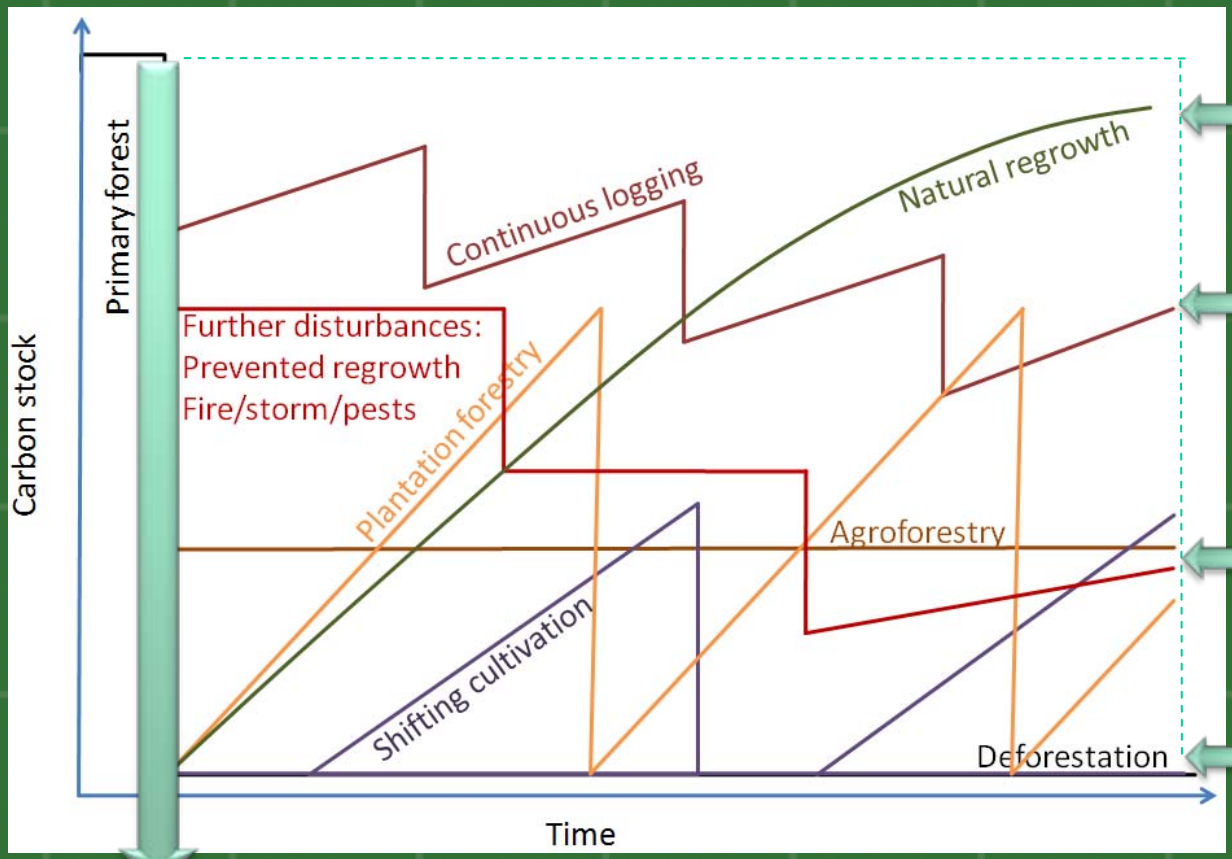
Degradation: introduction

- Forest degradation leads to loss of carbon stocks
- Some monitoring assumptions:
  - IPCC good practice guideline/methods to account for changes areas of forests remaining as forests
  - Monitoring degradation requires understanding and emission significance of human processes
  - Assessment of degraded forest area and the carbon stocks changes per unit area
  - Less efficient than for deforestation: lower C-emissions per ha versus higher costs & lower accuracies
- Monitoring forest degradation important to avoid displacement of emissions from reduced deforestation

Forest degradation and carbon stocks



Degradation processes & monitoring



Net emissions:

- Changes of carbon stocks in degraded/ secondary forest
- Requires regular monitoring and pilots
- Land use practices (sustainability?)
- Natural succession (permanent plots)
- Effects on other ecosystem services

Initial (gross) emissions (conversion of primary forest to degraded forest):

Creates a complex environment: canopy gaps, exposed soils, dead vegetation …

Area effected: direct monitoring of canopy damage, indirect – human infrastructure

Emission factors: in-situ measurements, harvest estimates, national stratification by carbon density & human induced degradation process

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Change in forest areas remaining as forest (degradation)

1. Inventory based approaches and long-term field observations:
   - Establish emission factors: national stratification by carbon density, degradation process & its temporal dynamics
   - Continuous monitoring to assess net emissions from land use practices, regeneration, further disturbances etc.
2. Remote sensing to detect degraded area:
   - Direct detection of degradation (i.e. canopy damage):
     - Landsat-type data with annual observations or very high-resolution datasets (IKONOS type)
     - Hot spot sampling approach maybe effective
   - Indirect approaches:
     - Detecting required infrastructure (roads, log landings)
     - Suitable also for historical periods
3. Operational fire monitoring systems

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National carbon inventory needs (example)

Issue	Needs for national carbon monitoring system	Traditional forest inventories in developing countries
Definitions	Compatibility with IPCC GPG requirements	Activity (area change) and carbon stock data available?
Stratification of forest area	Carbon density and relevant human activities (land use changes)	Forest ecosystem types?
Coverage	Full national coverage with focus on areas with “REDD implementation”	Focus on specific areas? Non-spatial information?
Measurements	Carbon stock change (potentially) in all pools (aboveground, belowground, soil, litter, deadwood)	Volume of merchantable timber? Uncertainty in conversion to biomass and carbon
Time	Continuous measurement of carbon stock change and emission factors (i.e. for forest degradation)	One time efforts? Sustainability of permanent sample plots?
Uncertainty	Verification and robust for independent international review	Accuracy assessment for carbon data?
Integration with remote sensing	Useful to measure height and canopy cover in situ	Limited integration potential?

Direct approaches to detect forest degradation

Highly Detectable	Detection limited & increasing data/effort	Detection very limited
• Deforestation • Forest fragmentation • Recent slash-and-burn agriculture • Major canopy fires • Major roads • Conversion to tree monocultures • Hydroelectric dams and other forms of flood disturbances • Large-scale mining	• Selective logging • Forest surface fires • A range of edge-effects • Old-slash-and-burn agriculture • Small scale mining • Unpaved secondary roads (6-20-m wide) • Selective thinning of canopy trees	• Harvesting of most non-timber plants products • Old-mechanized selective logging • Narrow sub-canopy roads (<6-m wide) • Understory thinning and clear cutting • Invasion of exotic species

(using Landsat-type observations)

Peres et al., (2006) TREE

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Only few large area examples

Monitoring forest degradation has never been the target of one operational forest area monitoring system, but recently this issue has been investigated in several research activities and some of them have obtained significant results:

Selective Logging in the Brazilian Amazon

Gregory P. Asner,[1]* David E. Knapp,[1] Eben N. Broadbent,[1]
Paulo J. C. Oliveira,[1] Michael Keller,[2,3] Jose N. Silva[4]

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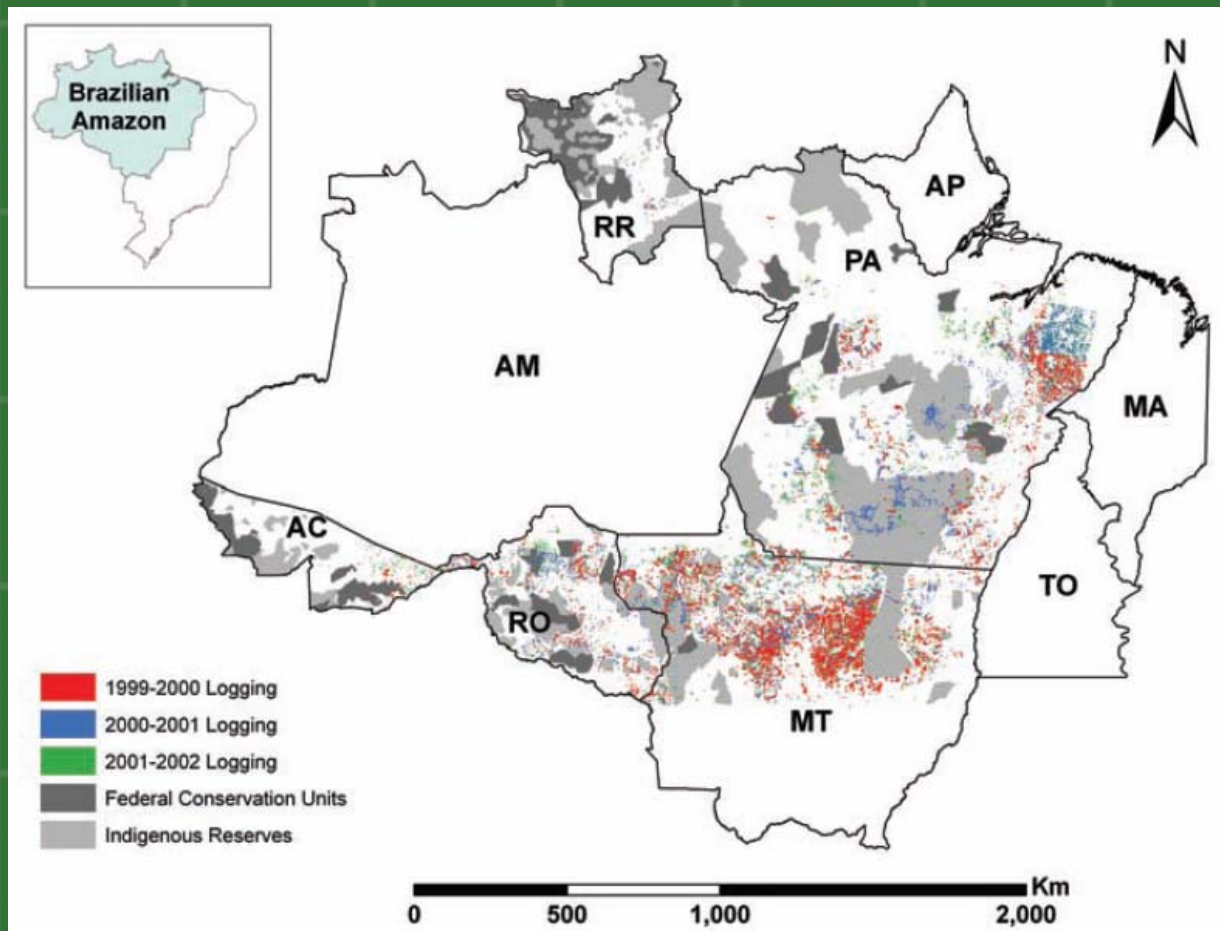
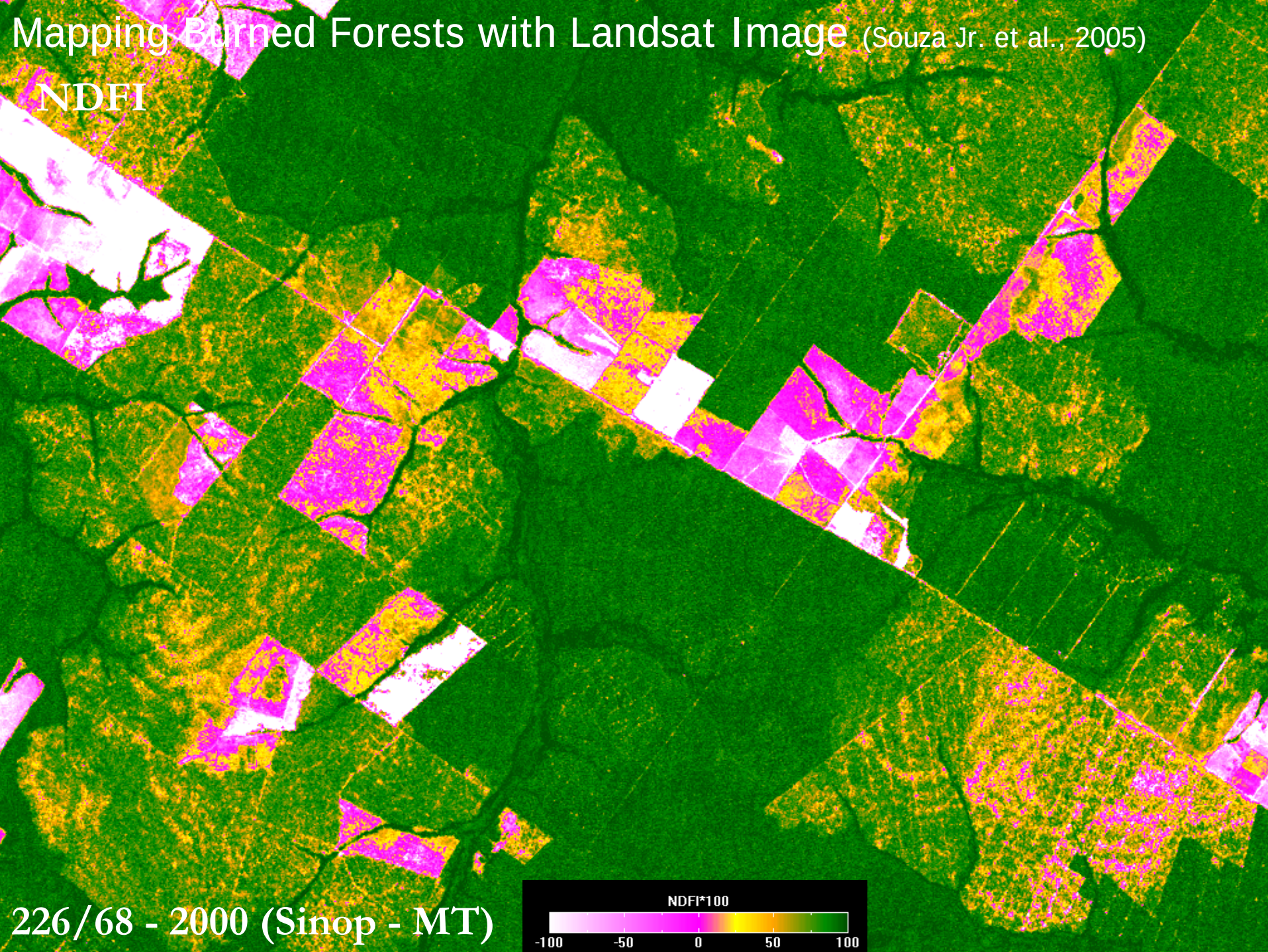


Mapping Burned Forests with Landsat Image (Souza Jr. et al., 2005)



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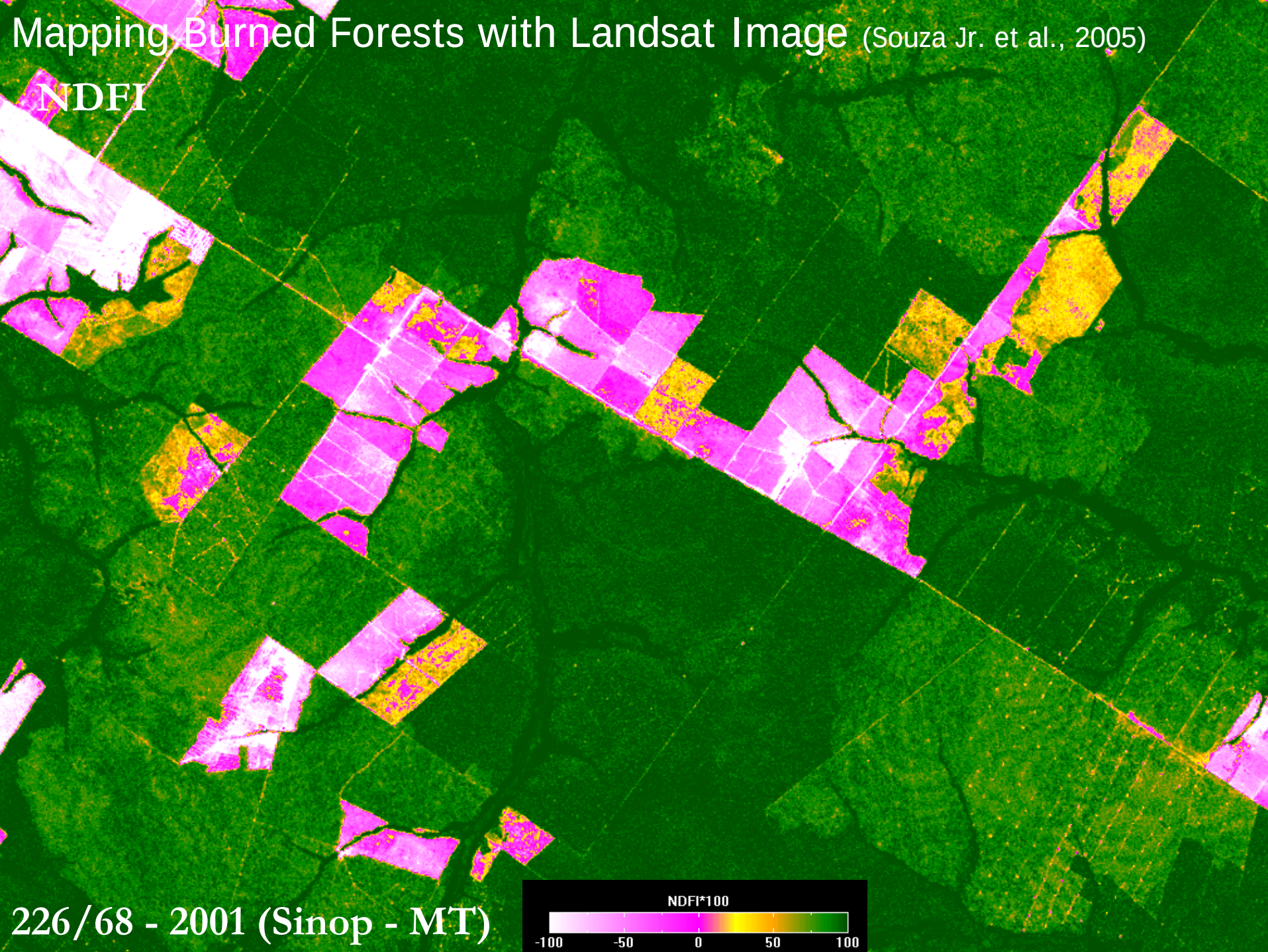

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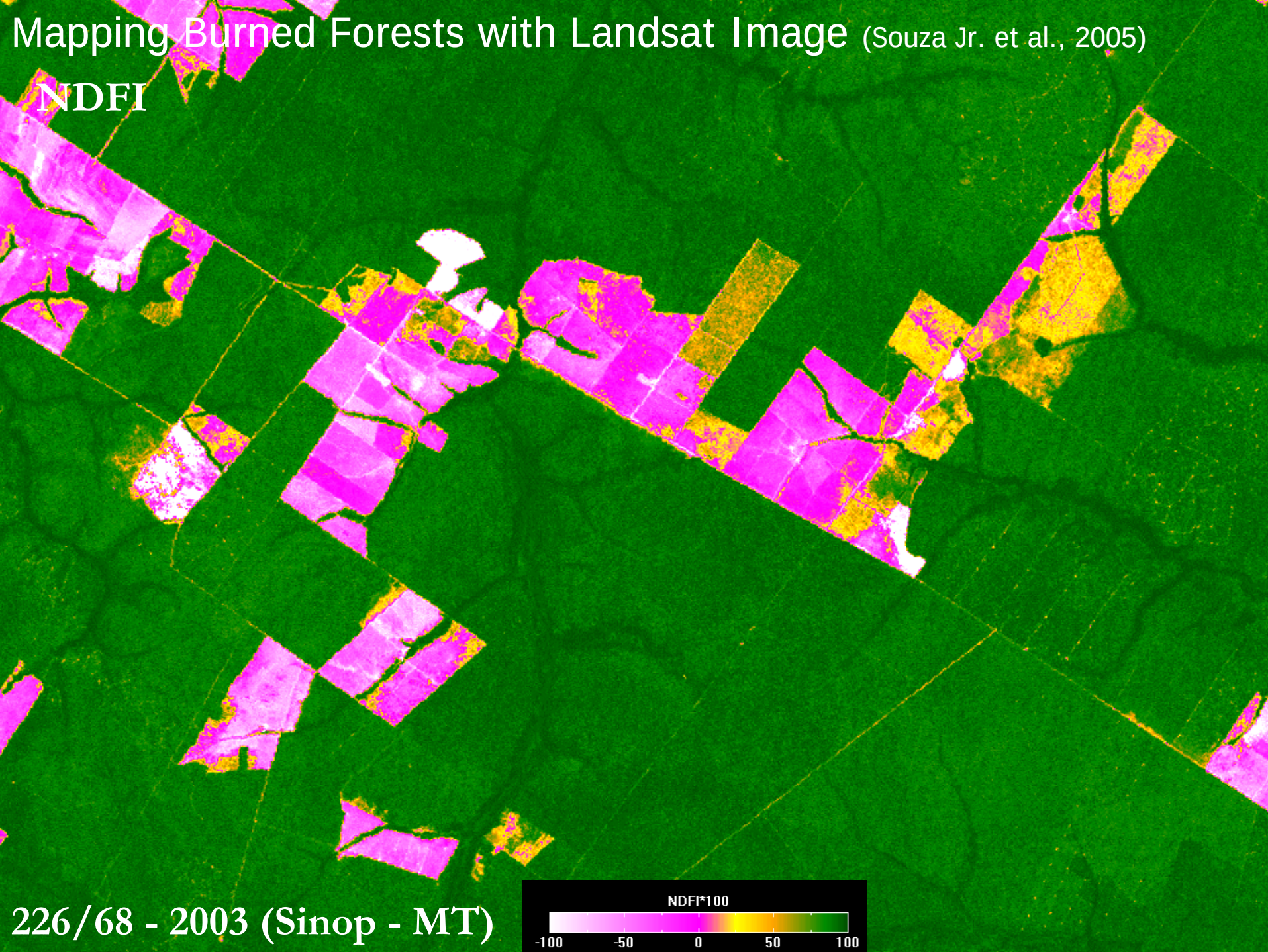
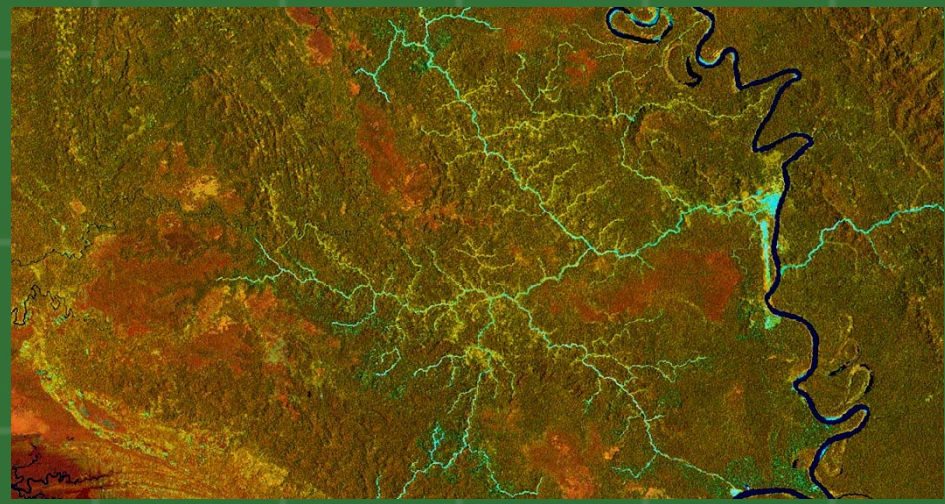
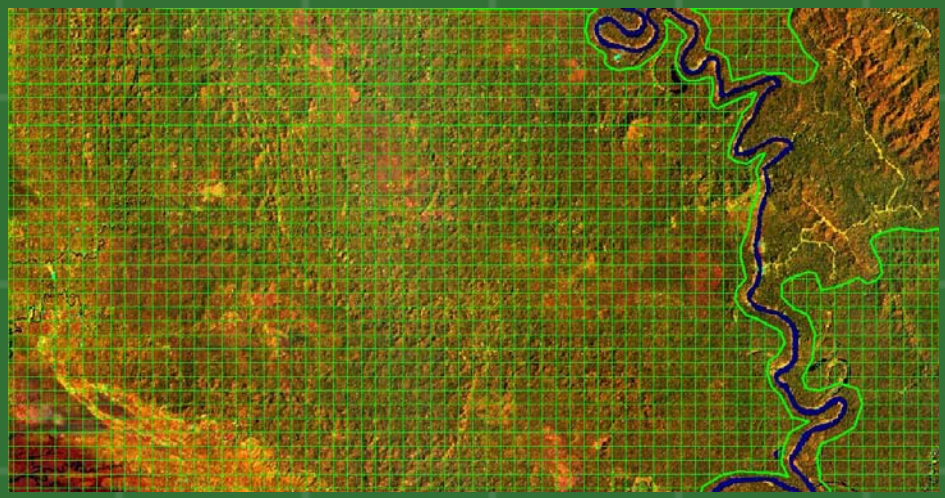


Example for indirect approach

Landsat 1990

Landsat 2000





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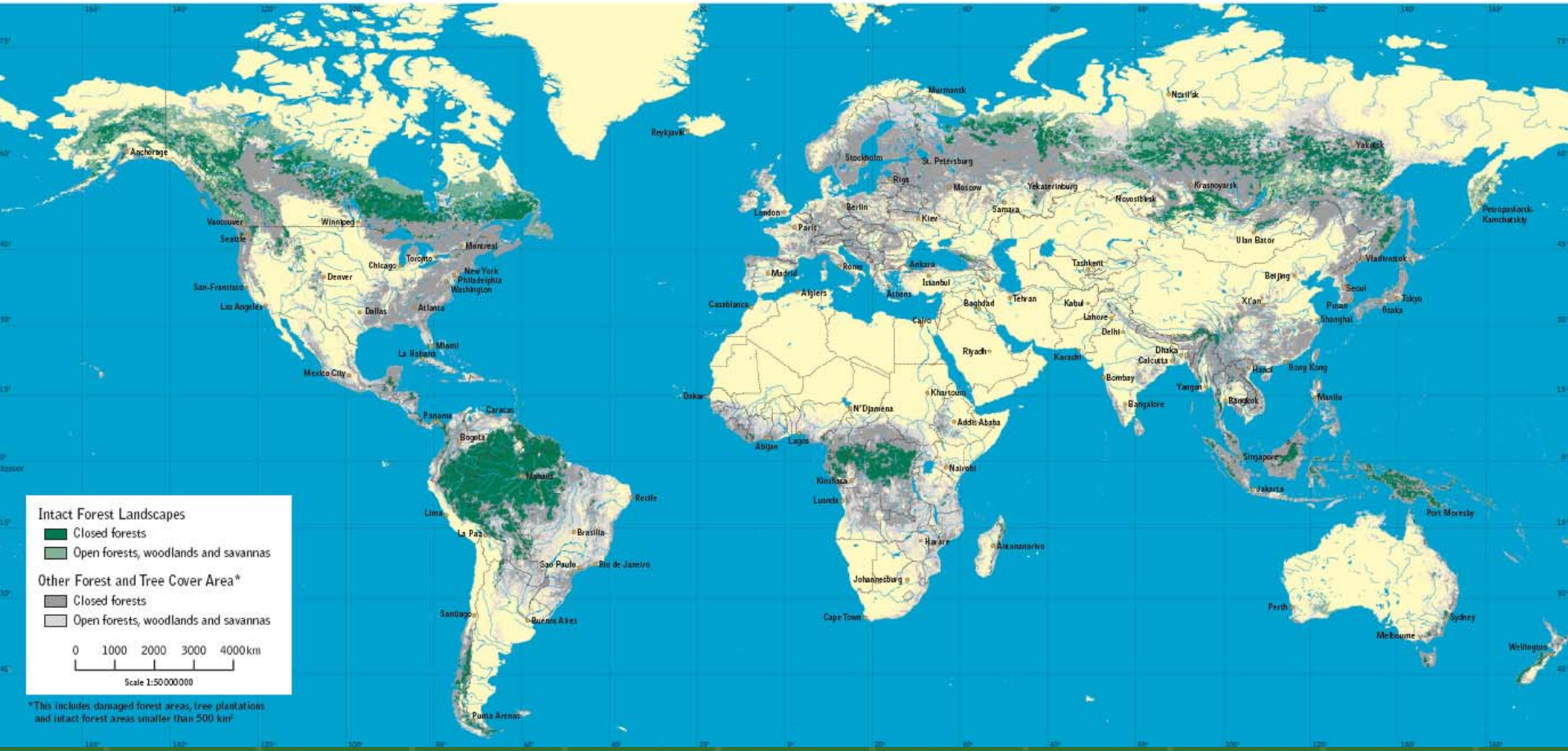
Indirect approach: the origin

The world's last intact forest landscapes

GREENPEACE



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Examples of remote sensing use

Forest sub-type	Method	Operational examples at national level
Humid Tropics		
Logged forests	IMAZON (Souza) Stanford Uni (Asner)	Brazilian Amazon
Forest regrowths / secondary forests	Louvain Uni / JRC	Congo basin
Tree/Crops mosaics	Louvain Uni / JRC	Congo basin
(Forest) Plantations	Some local examples	
Non-Intact Forests	Greenpeace / WRI	Tropical belt
Burned Forests	GOFC team, Munich University/RSS	Indonesia/Africa
Dry Tropics		
(Forest) Plantations		Africa/Australia
Non-Intact Forests	Greenpeace / WRI	Tropical belt

Final remarks

- Building a national forest carbon monitoring system is a process (that can start now):
  - Assess and use existing national capacities and data
  - Start conservative with motivation to improve monitoring system over time
  - Some limitations in historical period for challenging issues (long-term carbon stock change from degradation)
- Updated GOFC-GOLD sourcebook guidance on:
  - Monitoring forest degradation
  - Observations of biomass burning
  - Accuracy assessments
  - Evolving technologies and data sources
- Capacity building key factor for “readiness phase”

Web resources

- **GOFC-GOLD REDD sourcebook:**
  - http://www.gofc-gold.uni-jena.de/redd
- **Global Terrestrial Observing System (GTOS):**
  - http://www.fao.org/gtos/
- **GOFC-GOLD:**
  - http://www.fao.org/gtos/gofc-gold/
- **GOFC-GOLD land cover project office:**
  - http://www.gofc-gold.uni-jena.de/