El Sourcebook para REDD
Del GOFC-GOLD

(Global Observation of Forest Cover /
Global Observation of Land Dynamics)
Consortio de investigadores bajo del UN FAO

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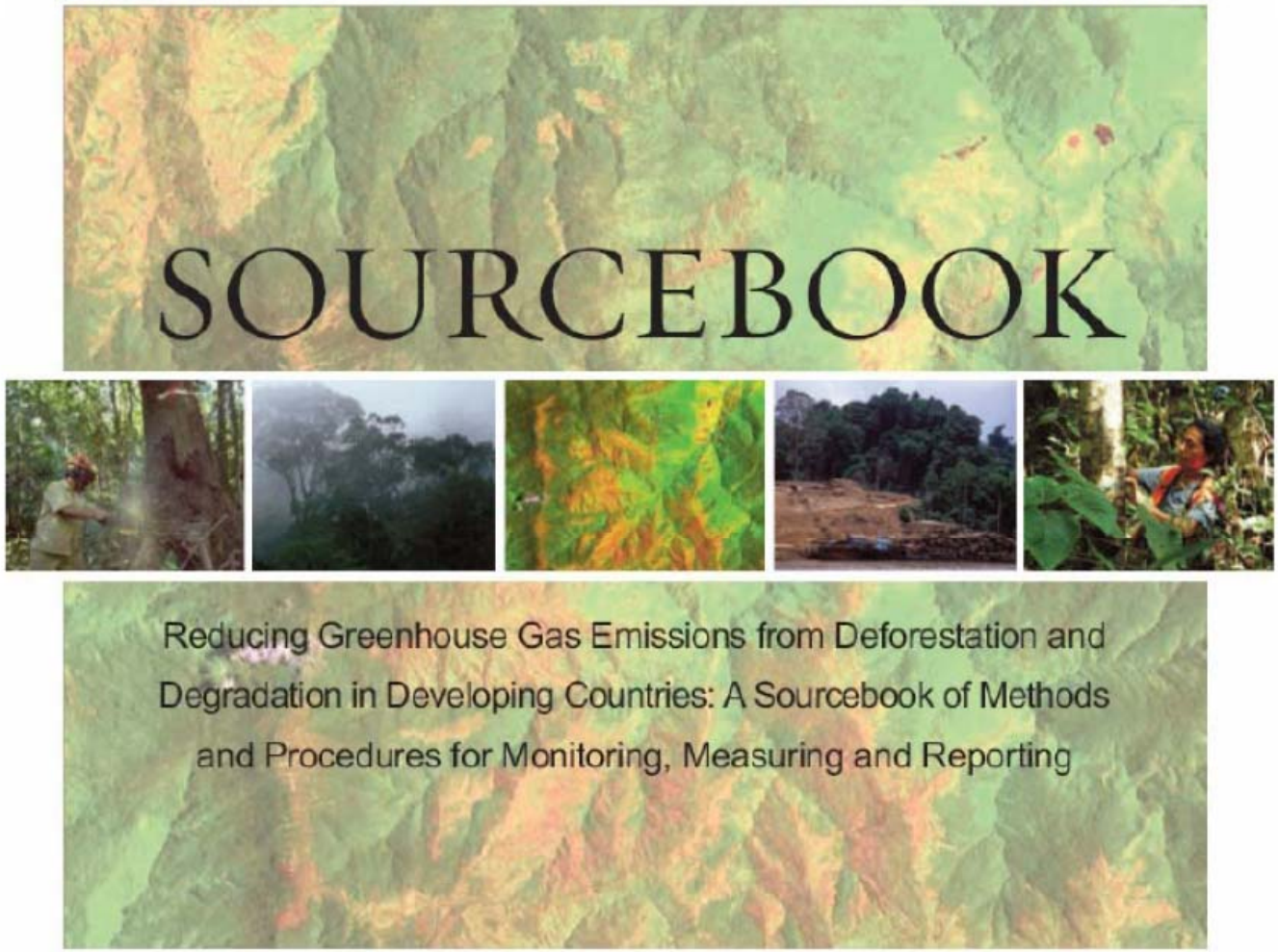

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Capitulos Sobre Asuntos Generales

- Monitoreo de cubertura de bosque
- Estimacion de estoques de carbonn en el campo
- Estimacion de emissiones basado en estos
- Como reportar

* Muy utile para una referencia general, especialmente sobre como reportar.
* Enfoque a nivel nacional
* No se trata de modelisacion

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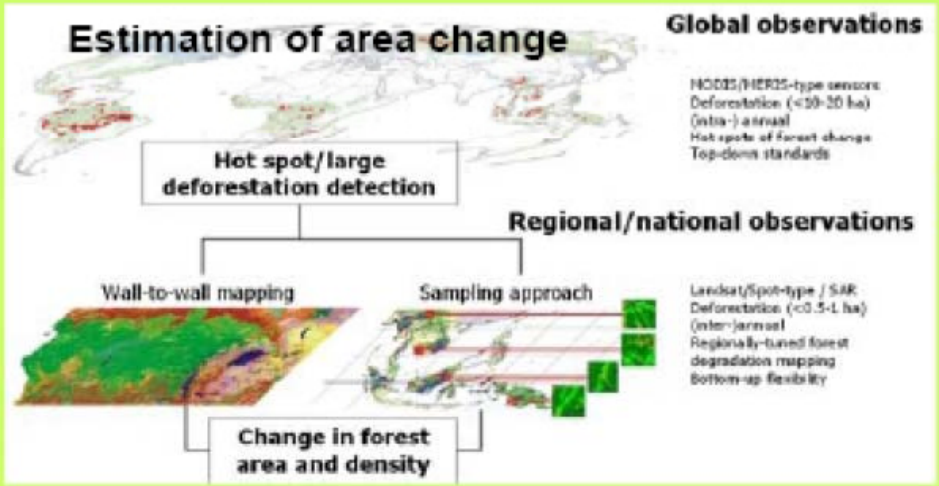
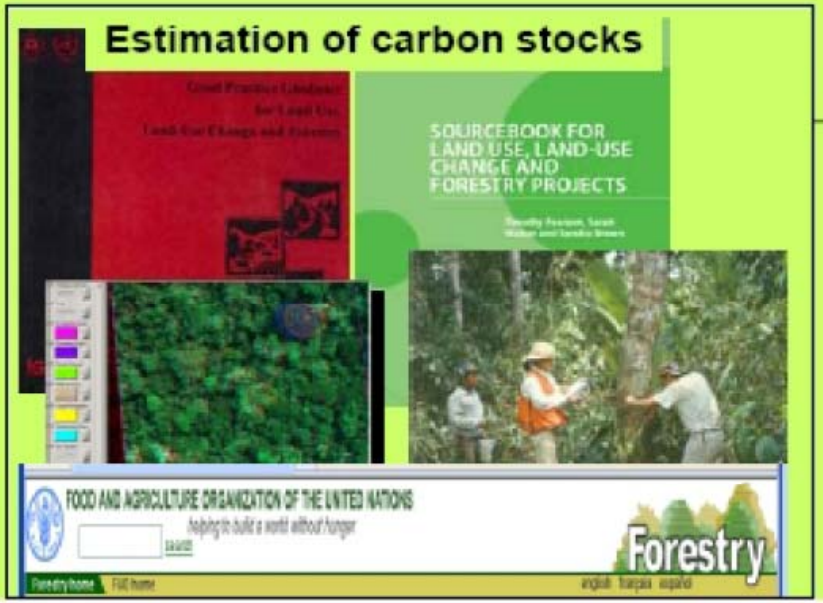


Chapter 3



Chapter 4

Chapter 5

Estimation of CO_2 emissions

Chapter 6

Guidance on reporting of CO_2 emissions

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Publisher

GOFC-GOLD Project Office, hosted by Natural Resources Canada, Alberta, Canada

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Table 2.1: Existing frameworks for the Land Use, Land Use Change and Forestry (LULUCF) sector.

Land Use, Land Use Change and Forestry		
UNFCCC (2003 GPG and 2006 GL-AFOLU)	**Kyoto**	**Kyoto-Flexibility**
Six land use classes and conversion between them: Forest lands Cropland Grassland Settlements Wetlands Other Land	**Article 3.3** Afforestation, Reforestation, Deforestation **Article 3.4** Cropland management Grazing land management Forest management Revegetation	**CDM** Afforestation Reforestation
Deforestation= forest converted to another land category	Controlled by the Rules and Modalities (including Definitions) of the Marrakesh Accords	

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Approach for activity data: Area change	Tiers for emission factors: Change in C stocks
1. Non-spatial country statistics (e.g. FAO) – generally gives net change in forest area	1. IPCC defaults
2. Based on maps, surveys, and other national statistical data	2. Country specific data for key factors
3.Spatially specific data from interpretation of remote sensing data	3.National inventory of key C stocks, repeated measurements of key stocks through time or modeling

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Tier	Data needs/examples of appropriate biomass data
Tier 1 (basic)	Default MAI* (for degradation) and/or forest biomass stock (for deforestation) values for broad continental forest types—includes six classes for each continental area to encompass differences in elevation and general climatic zone; default values given for all vegetation-based pools
Tier 2 (intermediate)	MAI* and/or forest biomass values from existing forest inventories and/or ecological studies. Default values provided for all non-tree pools Newly-collected forest biomass data.
Tier 3 (most demanding)	Repeated measurements of trees from permanent plots and/or calibrated process models. Can default data for other pools stratified by in-country regions and forest type, or estimates from process models.

* MAI = Mean annual increment of tree growth

Table 3.1: Utility of optical sensors at multiple resolutions for deforestation monitoring

Sensor & resolution	Examples of current sensors	Minimum mapping unit (change)	Cost	Utility for monitoring
Coarse (250-1000 m)	SPOT-VGT (1998-) Terra-MODIS (2000-) Envisat-MERIS (2004 -)	~ 100 ha ~ 10-20 ha	Low or free	Consistent pan-tropical annual monitoring to identify large clearings and locate "hotspots" for further analysis with mid resolution
Medium (10-60 m)	Landsat TM or ETM+, SPOT HRV IRS AWiFs or LISS III CBERS HRCCD	0.5 - 5 ha	<$0.001/km² for historical data $0.02/km² to $0.5/km2 for recent data	Primary tool to map deforestation and estimate area change
Fine (<5 m)	IKONOS QuickBird Aerial photos	< 0.1 ha	High to very high $2 -30 /km²	Validation of results from coarser resolution analysis, and training of algorithms

Table 3.2: Present availability of optical mid-resolution (10-60 m) sensors

Nation	Satellite & sensor	Resolution & coverage	Cost (archive[8])	Feature
USA	Landsat-5 TM	30 m 180×180 km²	600 US$/scene 0.02 US$/km2	Images every 16 days to any satellite receiving station. Operating beyond expected lifetime.
USA	Landsat-7 ETM+	30 m 60×180 km²	600 US$/scene 0.06 US$/km2	On April 2003 the failure of the scan line corrector resulted in data gaps outside of the central portion of images, seriously compromising data quality
USA/ Japan	Terra ASTER	15 m 60×60 km²	60 US$/scene 0.02 US$/km²	Data is acquired on request and is not routinely collected for all areas
India	IRS-P2 LISS-III & AWIFS	23.5 & 56 m		Experimental craft shows promise, although images are hard to acquire
China/ Brazil	CBERS-2 HRCCD	20 m	Free in Brazil	Experimental; Brazil uses on-demand images to bolster their coverage.
Algeria/ China/ Nigeria/ Turkey/ UK	DMC	32 m 160×660 km²	3000 €/scene 0.03 €/km²	Commercial; Brazil uses alongside Landsat data
France	SPOT-5 HRVIR	5-20 m 60×60 km²	2000 €/scene 0.5 €/km²	Commercial Indonesia & Thailand used alongside Landsat data

Table 3.3: Main analysis methods for moderate resolution (~ 30 m) imagery

Method for delineation	Method for class labeling	Practical minimum mapping unit	Principles for use	Advantages / limitations
Dot interpretation (dots sample)	Visual interpretation	< 0.1 ha	- multiple date preferable to single date interpretation - On screen preferable to printouts interpretation	- closest to classical forestry inventories - very accurate although interpreter dependent - no map of changes
Visual delineation (full image)	Visual interpretation	5 – 10 ha	- multiple date analysis preferable - On screen digitizing preferable to delineation on printouts	- easy to implement - time consuming - interpreter dependent
Pixel based classification	Supervised labeling (with training and correction phases)	<1 ha	- selection of common spectral training set from multiple dates / images preferable - filtering needed to avoid noise	- difficult to implement - training phase needed
	Unsupervised clustering + Visual labeling	<1 ha	- interdependent (multiple date) labeling preferable - filtering needed to avoid noise	- difficult to implement - noisy effect without filtering
Object based segmentation	Supervised labeling (with training and correction phases)	1 - 5 ha	- multiple date segmentation preferable - selection of common spectral training set from multiple dates / images preferable	- more reproducible than visual delineation - training phase needed
	Unsupervised clustering + Visual labeling	1 - 5 ha	- multiple date segmentation preferable - interdependent (multiple date) labeling of single date images preferable	- more reproducible than visual delineation

Box 3.4: Example of results of interpretation for a 10 km x 10 km sample in Congo Basin

Landsat image (TM sensor) of year 1990 Landsat image (ETM sensor) of year 2000

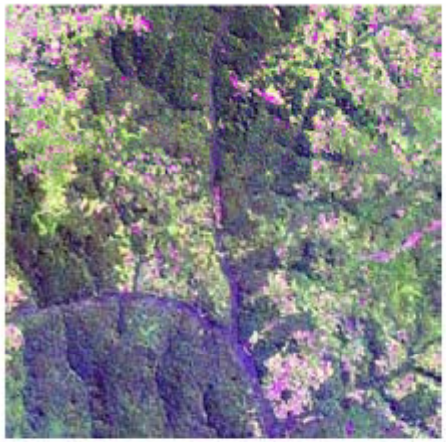


Image interpretation of year 1990

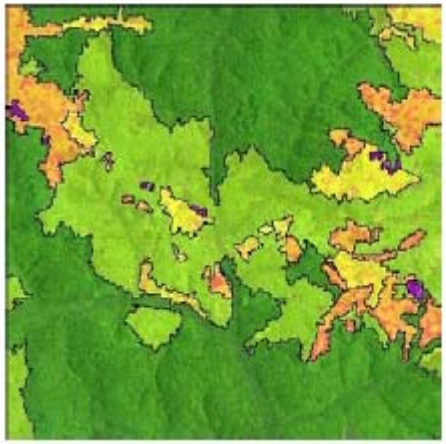
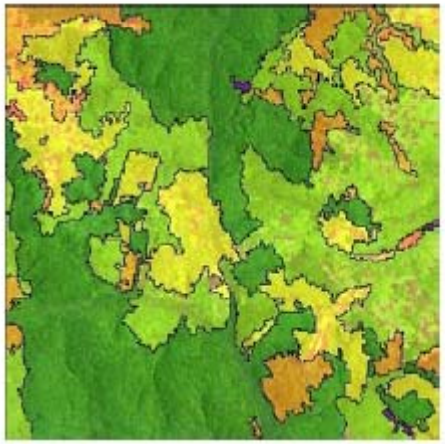


Image interpretation of year 2000



Legend: green = Dense forest, light green = degraded forest, yellow = forest/agriculture mosaic, orange = agriculture & fallow.

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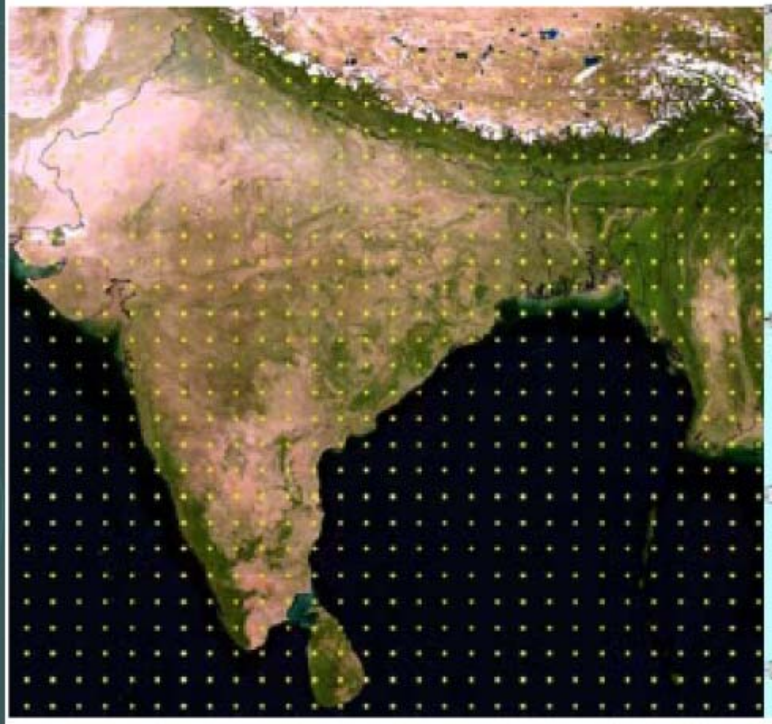
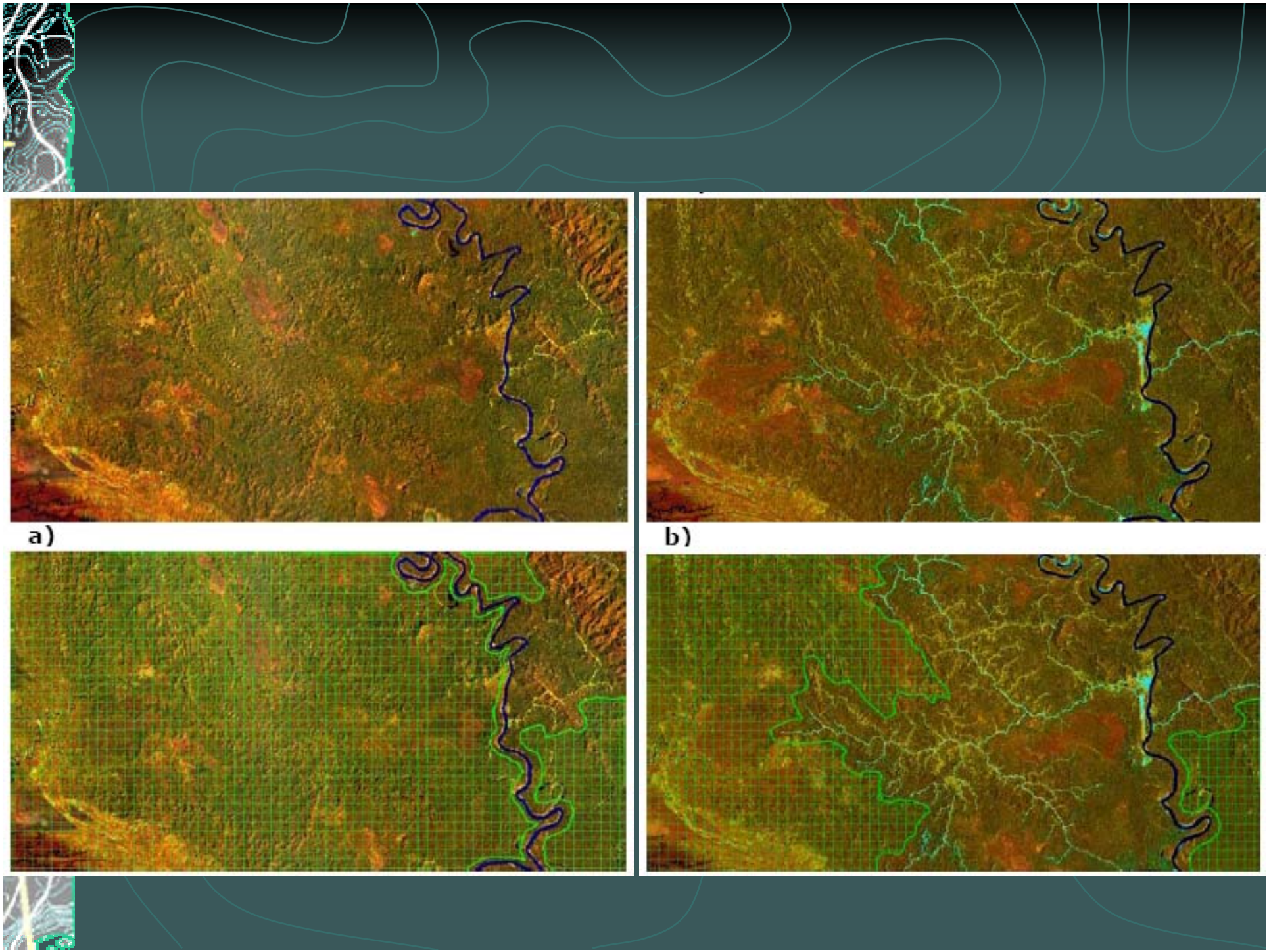
Example of systematic sampling



Example of stratified sampling


a)
b)

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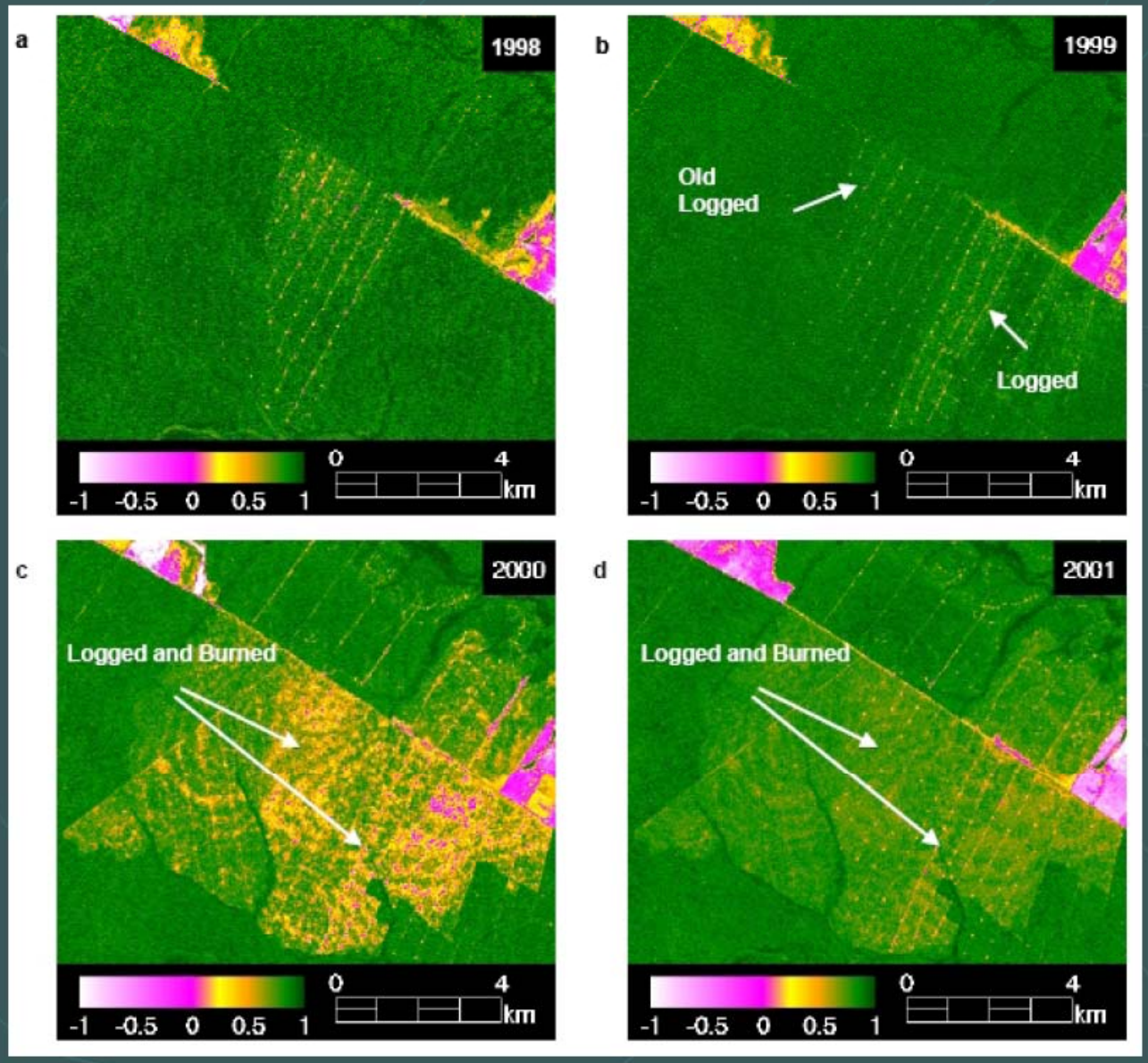
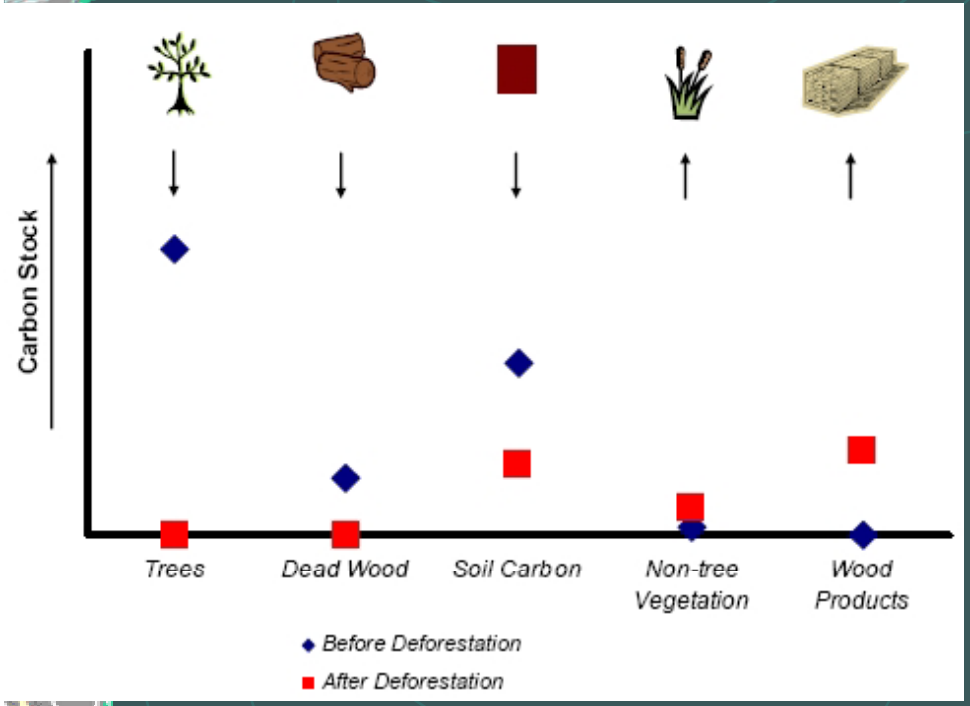
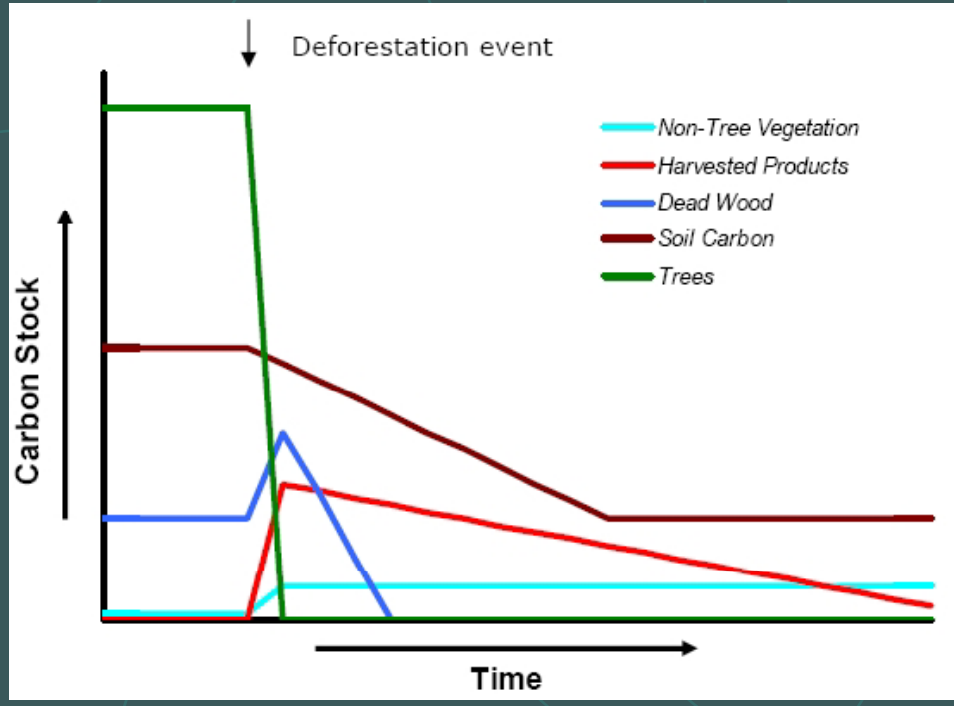


Location	IPCC Definition	Tier 1 Default (t C/ha)	Plot Measurements (t C/ha)	Tier 1 as % of Plot Measurements
Brazil	Tropical Rainforest, North and South America	150	218	-31
Mexico	Temperate Mountain Systems, North and South America	65	49	+33
Indonesia	Tropical Rainforest Asia Insular	175	212	-17
Republic of Congo	Tropical rainforest Africa	155	277	-44
Republic of Guinea	Tropical rainforest Africa	155	209	-26
Madagascar	Tropical rainforest Africa	155	148	+5


Carbon Stock
Trees
Dead Wood
Soil Carbon
Non-tree Vegetation
Wood Products
Before Deforestation
After Deforestation


Deforestation event
Non-Tree Vegetation
Harvested Products
Dead Wood
Soil Carbon
Trees
Carbon Stock
Time

BOX 5.1: Example of a Propagation of Error Uncertainty Analysis

	Mean	95 % CI
	t (C/ha)	
Living Trees	113	11
Down Dead Wood	18	3
Litter	7	2

Therefore the total stock is 138 t C/ha and the uncertainty =

$$\sqrt{11^2 + 3^2 + 2^2} = 11.6 tC / ha$$

	Mean	95 % CI	Uncertainty
		%	
Area (ha)	8,564	1158	14
Carbon Stock (t C/ha)	138	11.6	8

Therefore the total carbon stock over the stratum is:

8564 * 138 = 1,181,832 t C

And the uncertainty =

$$\sqrt{14^2 + 8^2} = 15.9\%$$

15.9% of 1,181,832 = 188,165 t C

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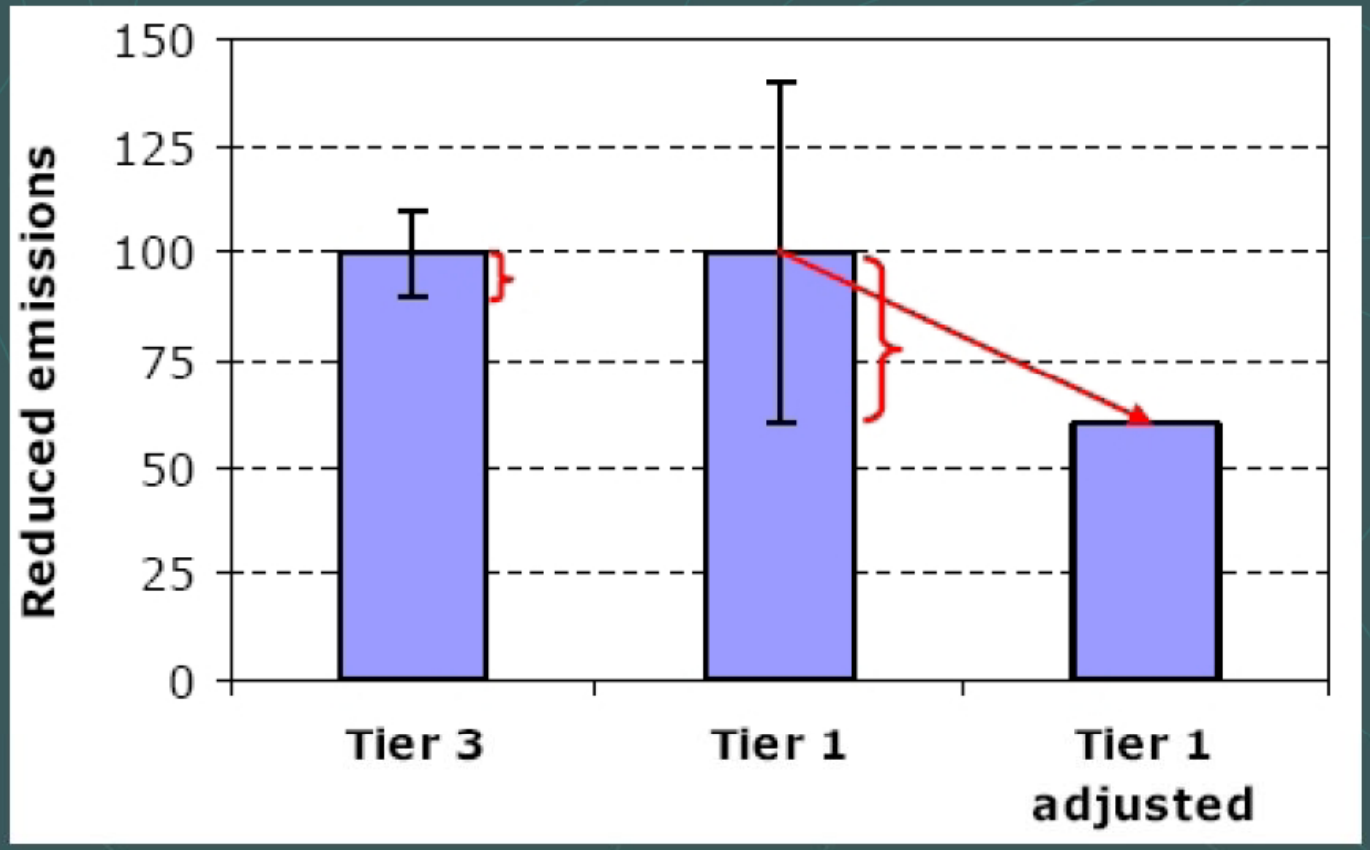

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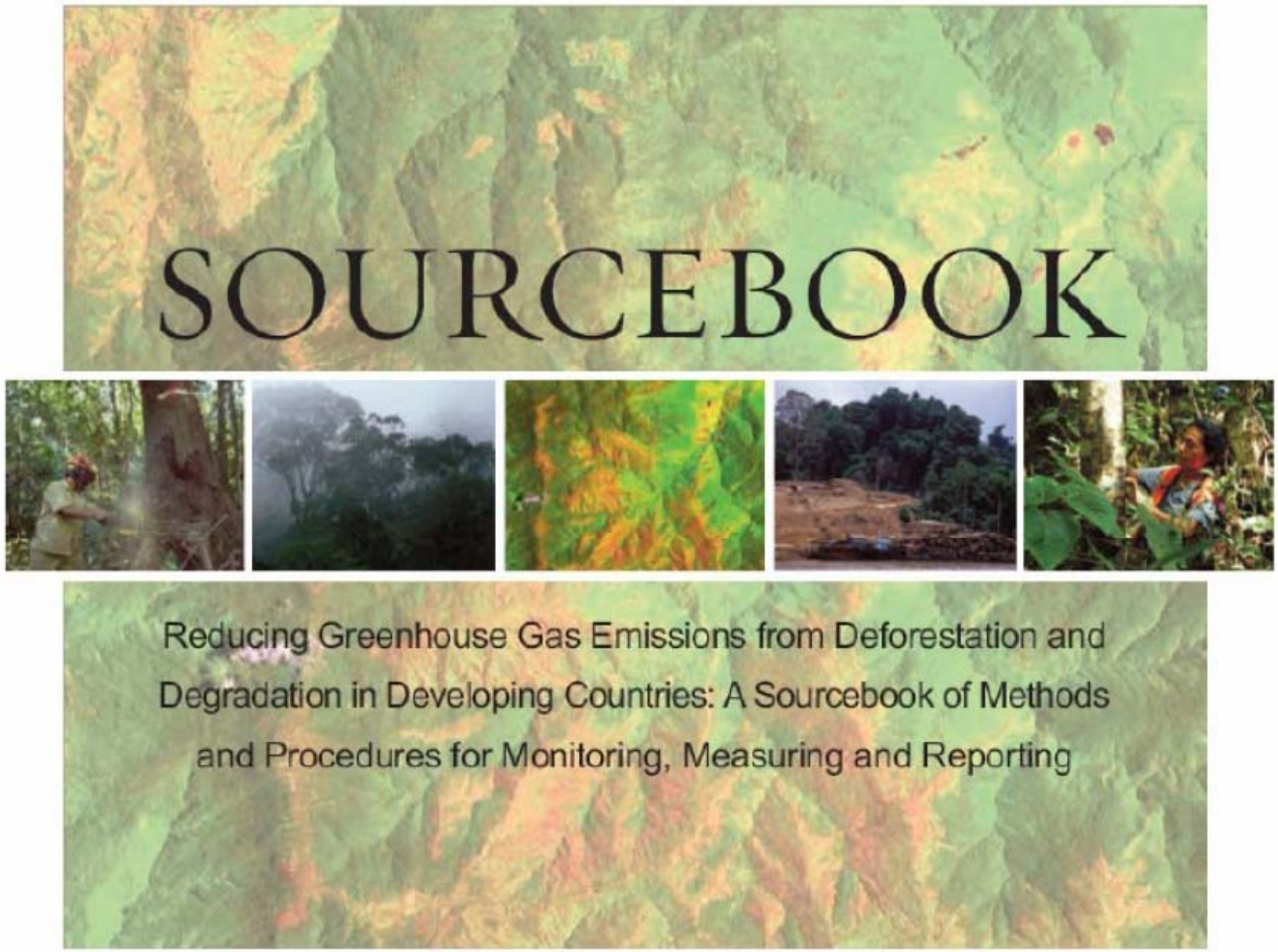

Gracias

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