Experiences in Mexico with uncertainty analysis in AFOLU

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Presentation outline

- Methodological options in AFOLU
  - Sources of uncertainty in Mexico (biomass, LU maps).
- Examples of uncertainties
  - Stratification
  - Level of Approaches and Tiers
- Changes in methodologies tested in Mexico

Applying IPCC Good Practice Guidance and Guidelines (LULUCF, AFOLU):

Approaches (Area change)	Tiers (C pool change)
1. Basic land use data -country statistics, i.e. FAO	1. IPCC default values (i.e. biomass in forest types, carbon fraction etc.)
2. Surveys of land change: i.e. national statistics on land use transitions	2. Country specific data (i.e. from field surveys, inventory, permanent plots)
3. Spatially explicit data: a. From remote sensing b. National inventory	3. National inventory of C stocks in different pools and assessment of any change in carbon pools or national methodologies which are fulfilling IPCC tier 3 requirements

Stock change versus Gain-Loss

Accuracy and Precision

Existing datasets in Mexico:

Land-use maps:

1970s LU/LC map; scale 1:250,000, min resolution 50 has, based on aerial photographs
1993 LU/LC map; scale 1:250,000, min resolution 50 has, based on Landsat
2002 LU/LC map; scale 1:250,000, min resolution 50 has, based on Landsat
2007 LU/LC map; scale 1:250,000, min resolution 50 has, based on SPOT

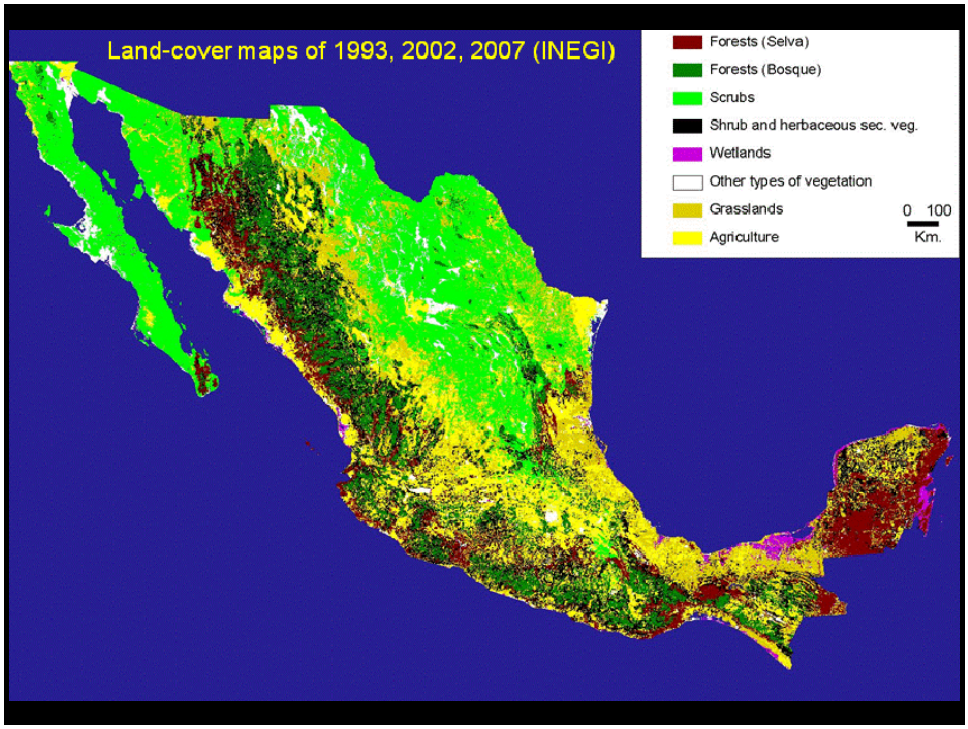
National LU classification system based on RS and ground surveys is under construction

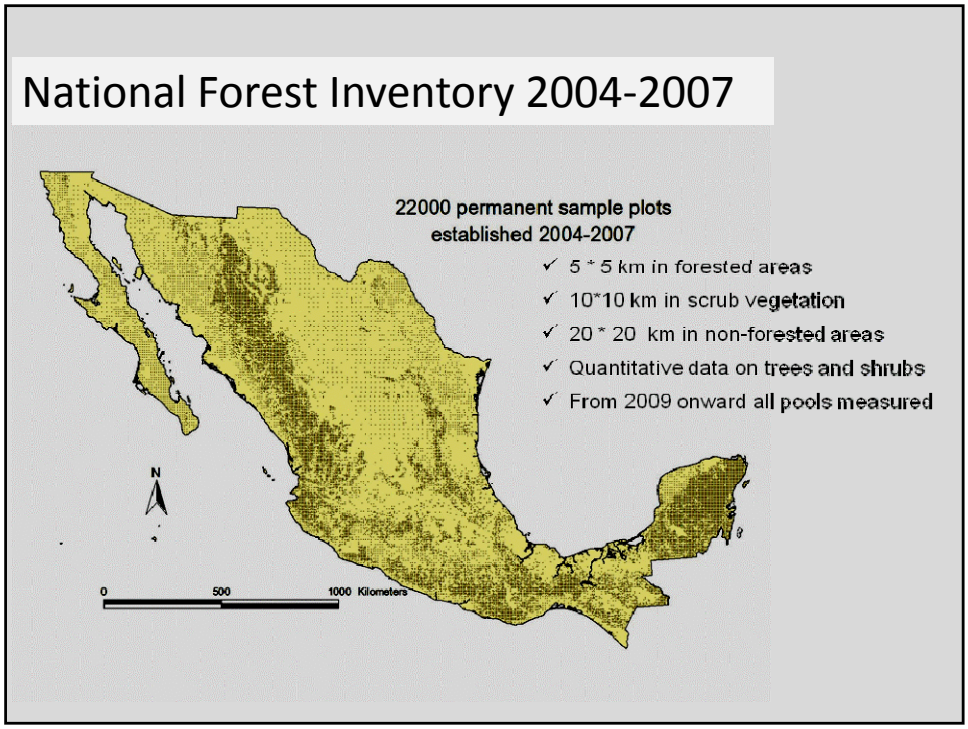
Inventory data

1992-1994	National Forest Inventory (16,000 plots)
2004-2007	Permanent National Forest and Soil Inventory (>22,000 permanent plots established)
2008-2009	Re-measurement of approximately 7,000 plots
From 2009	Measurements of all C pools, according to IPCC methodology

Other data sources

National, state and municipality-level statistics on forest harvesting and fire disturbances


Land-cover maps of 1993, 2002, 2007 (INEGI)
Forests (Selva)
Forests (Bosque)
Scrubs
Shrub and herbaceous sec. veg.
Wetlands
Other types of vegetation
Grasslands
Agriculture
0 100
Km.


National Forest Inventory 2004-2007
22000 permanent sample plots
established 2004-2007
✓ 5 * 5 km in forested areas
✓ 10*10 km in scrub vegetation
✓ 20 * 20 km in non-forested areas
✓ Quantitative data on trees and shrubs
✓ From 2009 onward all pools measured
N
0 500 1000 Kilometers

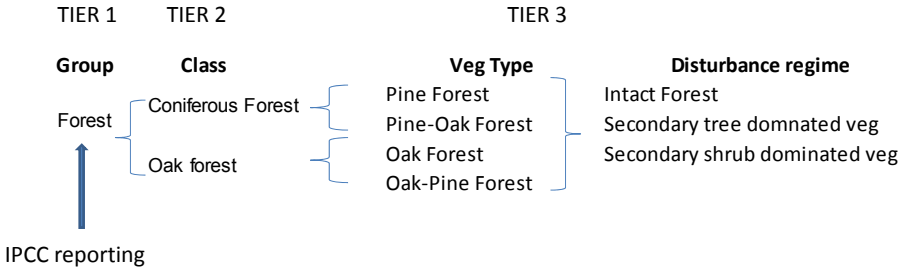
Important sources of uncertainty in data

- LU classification
- Carbon stocks (biomass and soils) in forests and other land uses
- Changes in carbon stocks within forests (that is, both gains from growth and losses from extraction of wood for timber and fuel, fires and other disturbances).

Important sources of uncertainty in methodology

- Level of Approach and Tier
- Stock change versus Gain-Loss

LU-classification system applied in Mexico (as reported to FAO and UNFCCC)



Pine forests contain in general a combination of 2-3 Pine species, out of 70 species
Oak forests contain2-4 Oak species out of 150 species

Possible errors in LU maps

Comparing map classification (2002,2007) with field classification (16,000 plots)

Change 02-07	12.5%
Error in disturbance regime	14.8%
Error in class	28.4%
Error in group	4.4%

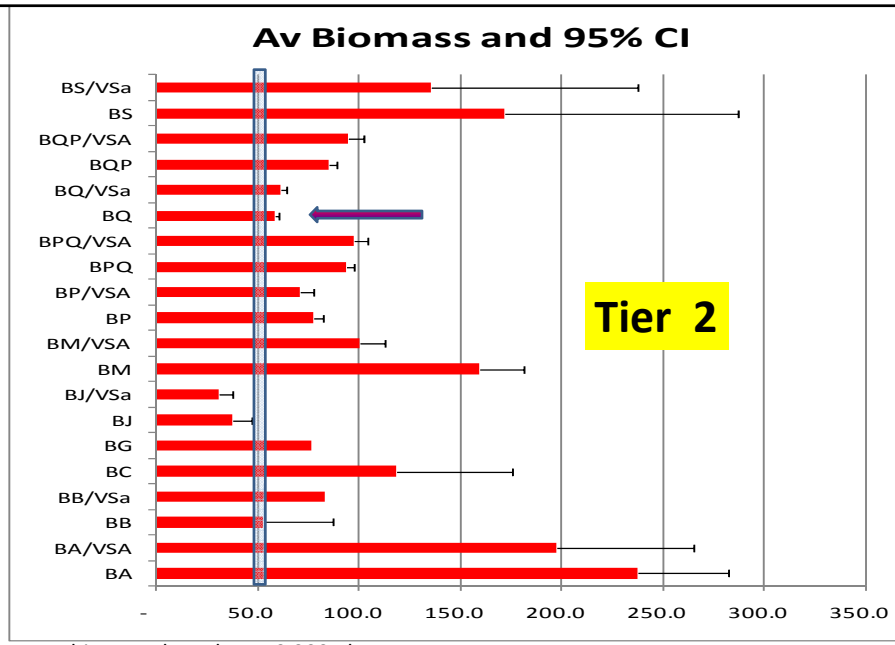
Differences in area change according to approach

	Approach 1	
	1993-2002	2002-2007
Deforestation	330,800	197,702
Degradation	294,762	181,534
Total (ha/yr)	625,562	379,236

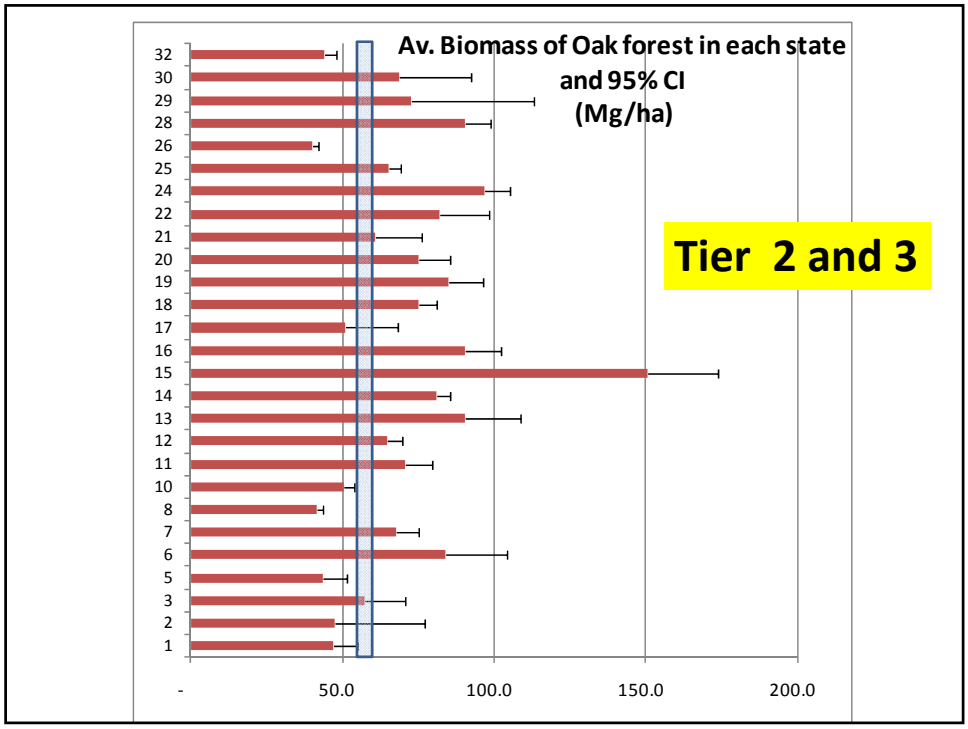
	Approach 2-3	
	1993-2002	2002-2007
Gross deforestation	595,413	590,418
Degradation	633,018	415,803
Recovering	176,079	109,375
Reforestation	264,612	392,715
Total (ha/yr)	1,669,122	1,508,311

Error in biomass stock estimations

- Conversion of inventory data to biomass.
- Aggregation of inventory plots in classes (forest type, disturbance regime, spatial disaggregation)

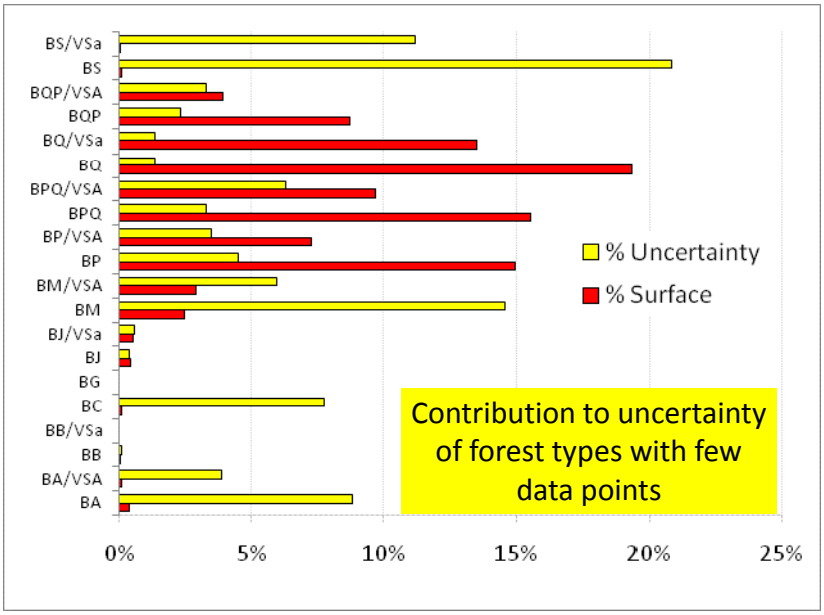


Average biomass, based on 10,300 plots.
Average range from 31 to 237 Mg/ha 95% CI ranges from 4 to 113 %



Uncertainty contribution of total biomass in each forest type and area represented by type

(uncertainty in total biomass = Surface * (Av. Biomass * CI)^2)



Difference between stock and stock/flux approach

	1993-2002	2002-2007	
Deforestation + degradation stock Tier 3	68,971	66,651	1)
Reforestation Stock tier 3	24,457	37,082	2)
Recovering Stock Tier 3	4,895	3,503	
Net loss / yr	39,619	26,065	
Reforestation flux tier 3	14,551	11,411	3)
Recovering flux tier 3	11,441	4,470	
Net loss / yr	42,978	50,769	

Assumptions:

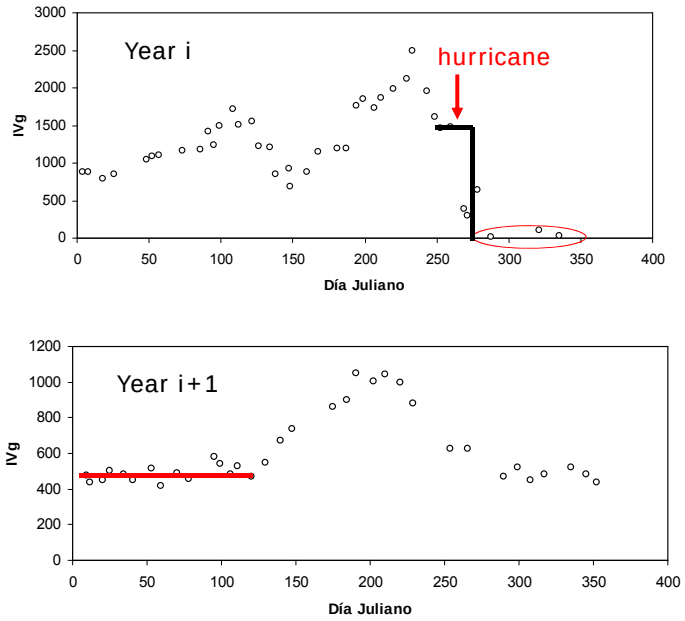
1) All biomass lost in the year that deforestation and degradation occur.
2) Average biomass stock in forest does not change over time due to LU change
3) Recovering and reforestation accumulate carbon over time, according to increment calculations

Changes in methodologies that are tested

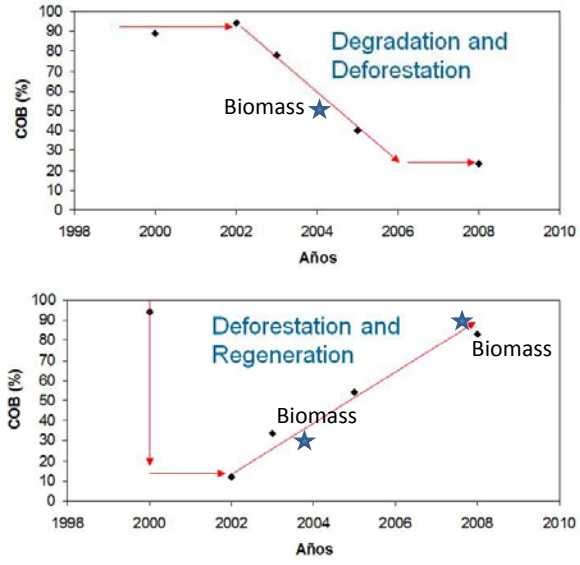
1. Change from Maps to Remote Sensing

- Modis-derived anomalities in phenological behavior of vegetation is for certain rapid disturbance types, such as hurricanes and fires.

Impact of hurricanes on phenological patterns

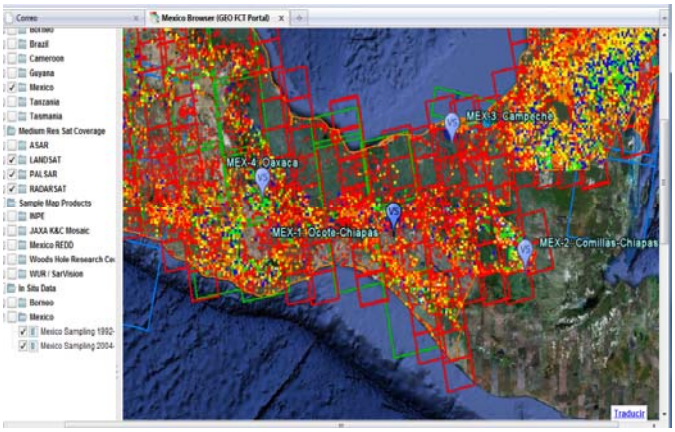


Detecting forest disturbance and biomass dynamics from stacking multi-annual satellite information and validating these with biomass data from forest inventory (see also Powell et al 2010)



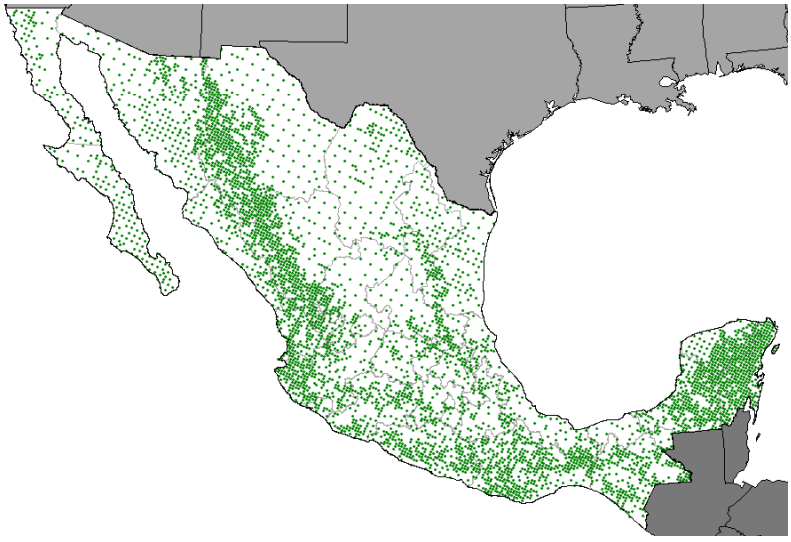
The Forest Carbon Tracking Task (GEO FCT) has been established to support countries wanting to establish national forest-change, carbon estimation and reporting systems. It will facilitate access to long-term satellite, airborne and in situ data**,** provide the associated analysis and prediction tools, and create the appropriate framework and technical standards for a global network of national forest carbon tracking systems.

Mexico is one of the 7 demonstrator countries

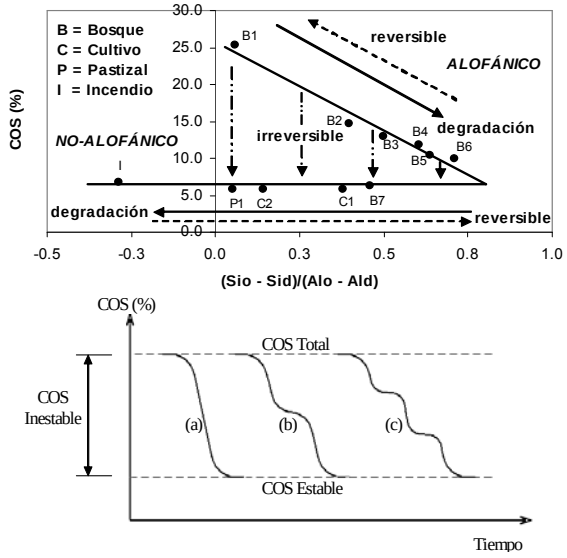


2. Change from Stock change to modelling of C-flows

2009 resampling: aprox. 5,000 data points with all pools measured



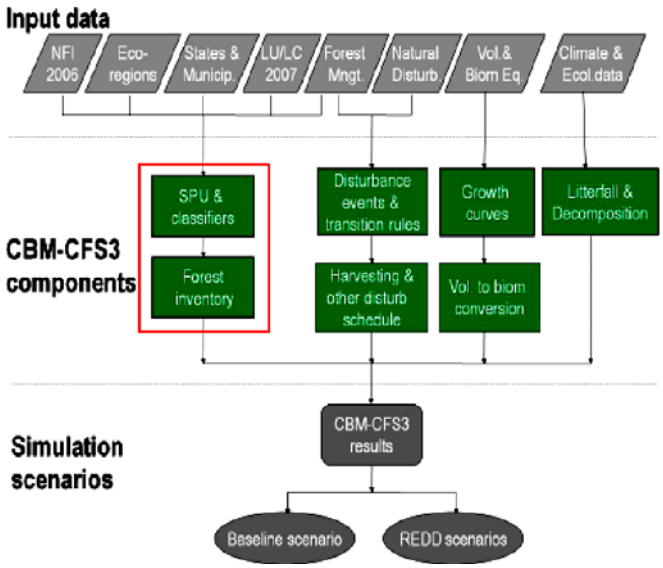
Relation between Biomass and SOC



Additional information that will become available from the 2009 inventory data

- Combustion material in each forest type (impact of fires)
- Losses and gains in forest litter and DOM due to LU change, degradation and restoration.
- Changes in above-ground biomass due to disturbances

3. Integration of information in a modelling environment



Thanks

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