



# Afforestation and Reforestation Activities

## IPCC Good Practice Guidance for LULUCF

- CLA** B. Schlamadinger (Austria), K. Boonpragob (Thailand), H. Janzen (Canada), W. Kurz (Canada), R. Lasco (Philippines), and P. Smith (UK)
- LA** P Collas (Canada), E.A. El Siddig (Sudan), A. Fischlin (Switzerland), M. Matsumoto (Japan), A. Nakhutin (Russia), I. Noble (Australia), G. Pignard (France), Z. Somogyi (Hungary), and X. Zhang (China)
- CA** M. Easter (USA), W. Galinski (Poland), G. Patenaude (Canada), K. Paustian (USA), and Y. Yamagata (Japan)

Presented by

**Bernhard Schlamadinger, Joanneum Research, Austria**  
**IEA Bioenergy Task 38 Workshop**

## Definition of *Good practice* inventories...

- Contain neither over - nor under – estimates so far as can be judged
- Have uncertainties reduced so far as is practicable.

*GPG is delivered by advice on choice of estimation method, quality assurance and quality control in the application of methods, documentation, archiving and estimation of uncertainties.*

# Chapter summaries

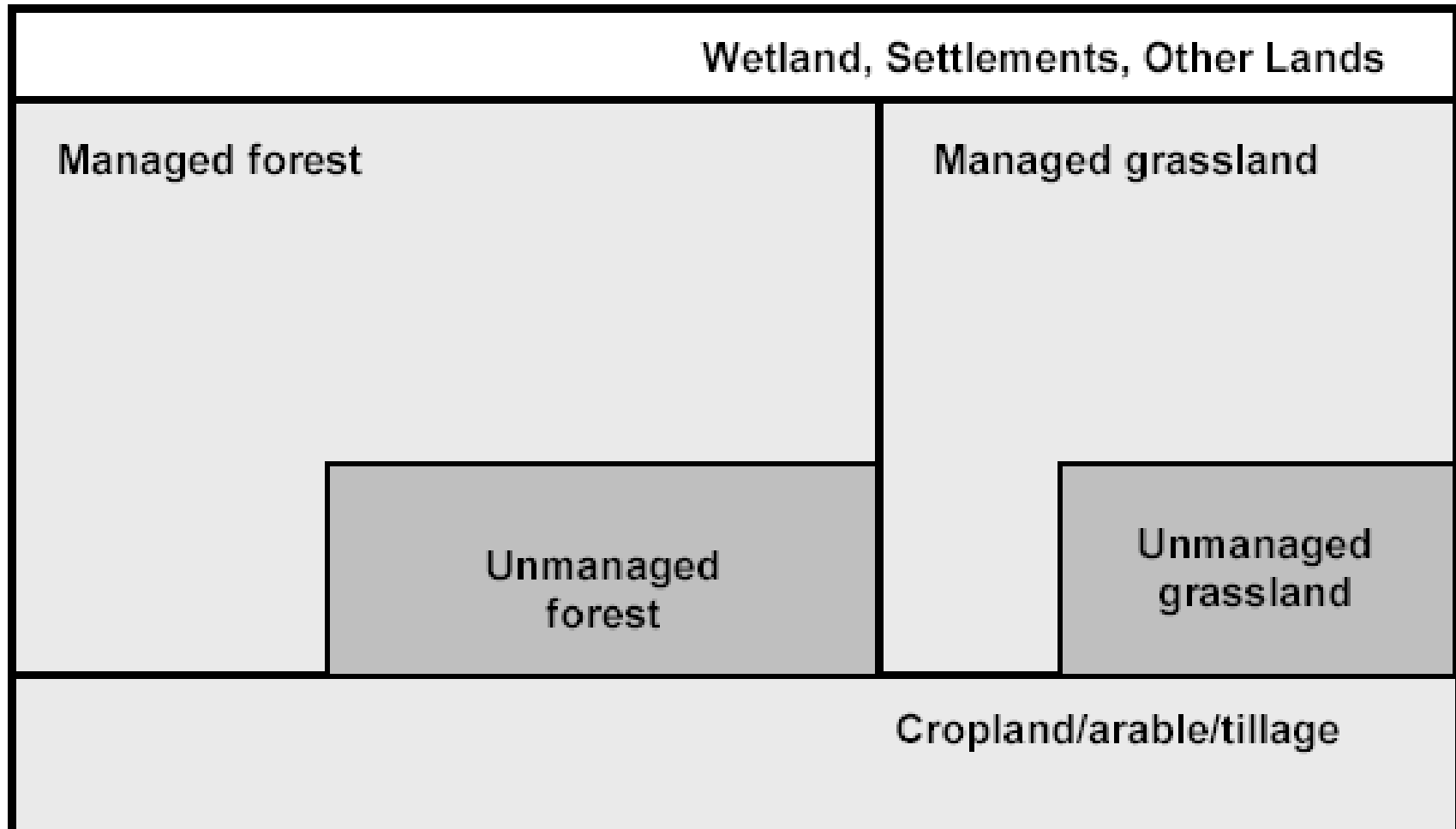
- Chapter 1 - Overview
- Chapter 2 - Representation of land area
- Chapter 3- Good practice for UNFCCC inventories
- Chapter 4 – Supplementary Methods for Kyoto Protocol (Ch 4.3: Projects)
- Chapter 5 – Cross-cutting issues

# UNFCCC National GHG Inventories

## **Land use categories**

1. Forest land
2. Cropland
3. Grassland
4. Wetlands
5. Settlements
6. Other Land

# Land classification in the UNFCCC inventory



# Land-use and Land-use change or transformation

## *3.2 Forest land*

3.2.1 Forest land remaining Forest land

**3.2.2 Land converted to Forest Land**

## *3.3 Cropland*

3.3.1 Cropland remaining cropland

3.3.2 Land converted to cropland

## *3.4 Grassland*

3.4.1 Grassland remaining grassland

3.4.2 Land converted to grassland

*{ Similarly for: wetlands –settlements- other land }*

# Kyoto Protocol LULUCF activities

## ➤ **Afforestation and reforestation**

- ✓ **Direct human induced**

- ✓ **Since 1990**

## ➤ Deforestation

## ➤ Forest management

## ➤ Cropland management

## ➤ Grazing land management

## ➤ Revegetation

# Objective chapter 4

To describe the

- ✓ information requirements
- ✓ methods and
- ✓ good practice guidance

for the reporting of CO<sub>2</sub> and non-CO<sub>2</sub> emissions by sources and removals by sinks as required by the Kyoto Protocol Articles

- ✓ 3.3
- ✓ 3.4
- ✓ 6 and 12

that are **supplementary** to those for National Greenhouse Gas Inventories under the UNFCCC



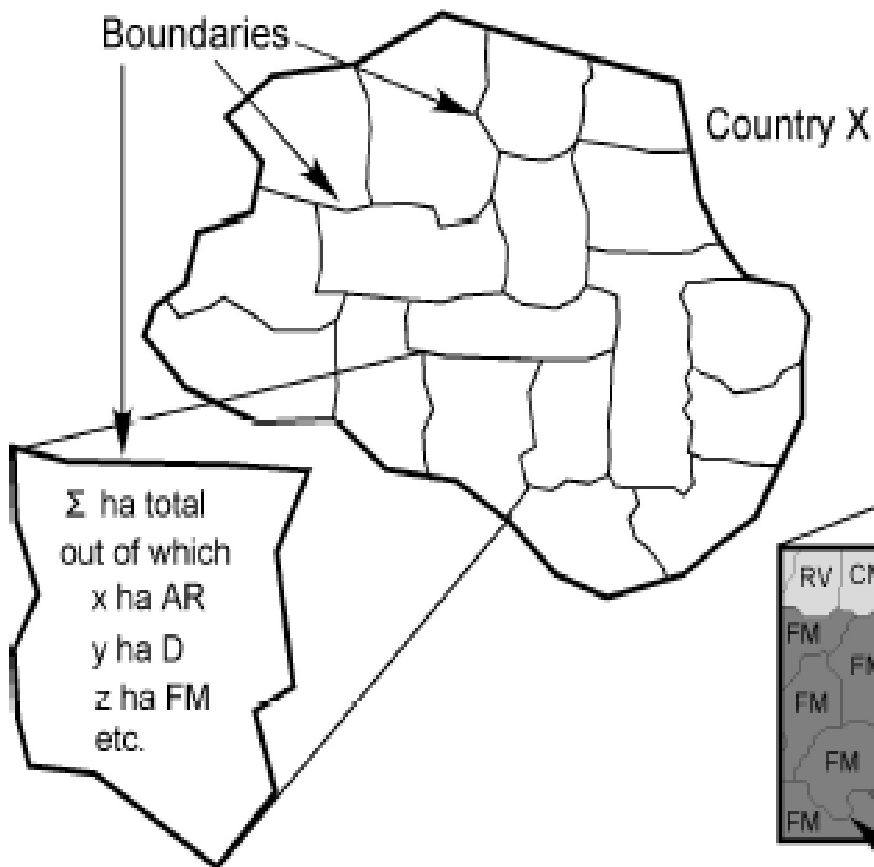
# Steps in estimating and reporting

- **STEP 1.** Define “forest”, apply definitions to national circumstances, establishing precedence conditions and/or hierarchy among selected Art. 3.4 activities
  
- **STEP 2.** Identify lands subject to activities under Article 3.3 and any elected activities under Article 3.4
  - ✓ Temporal and definitional constraints
  
- **STEP 3.** Estimate carbon stock changes and non-CO<sub>2</sub> greenhouse gas emissions on the lands identified under Step 2 above

# Two Reporting Methods for Land Subject to Articles 3.3 and 3.4 Activities

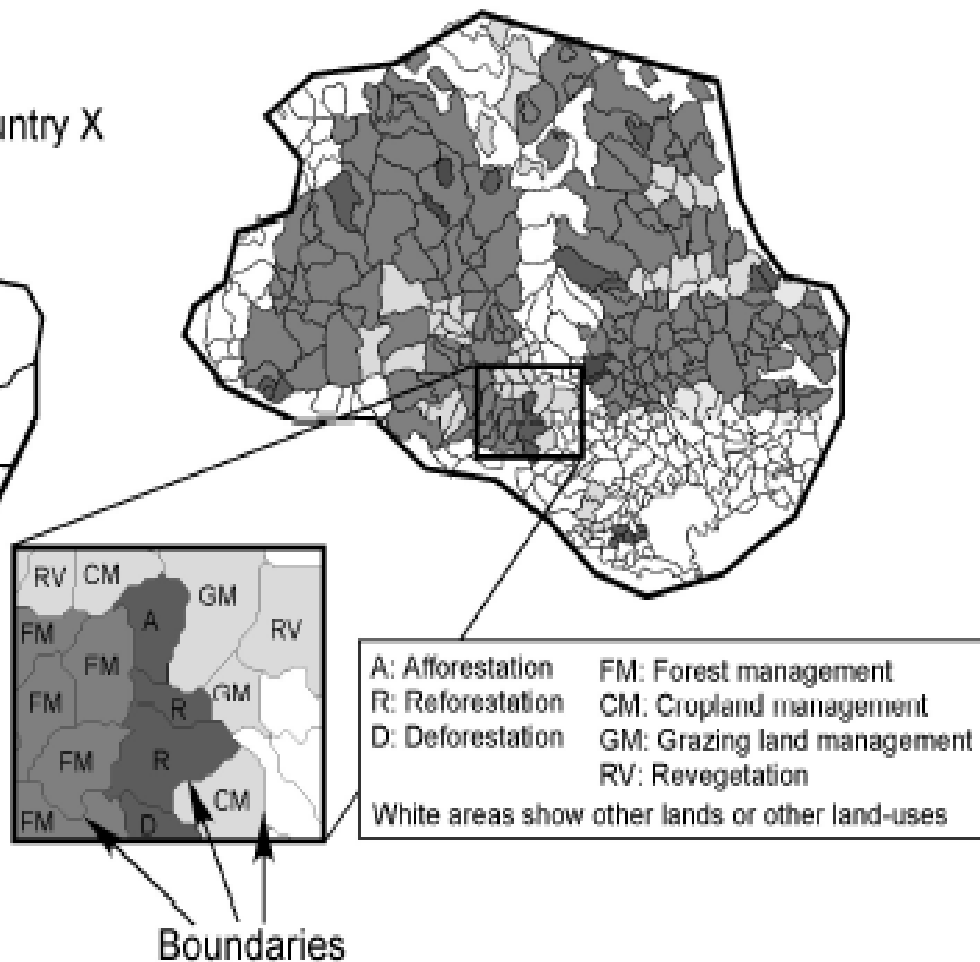
## Reporting Method 1

A geographic boundary encompasses units of land or land subject to multiple activities.



## Reporting Method 2

A geographic boundary encompasses units of land or land only subject to a single activity.



# Carbon pools

LIVING  
BIOMASS

Above-  
ground  
biomass

All living biomass above the soil;  
Understorey may be excluded

Below-  
ground  
biomass

Biomass of live roots. **Fine roots**  
are often excluded (see litter and  
SOM)

DEAD  
ORGANIC  
MATTER

Dead  
wood

all non-living woody not contained  
in the litter, above a chosen  
diameter

Litter

all non-living plant mass with  
woody biomass diameter less than  
a chosen diameter, in various  
states of decomposition above the  
mineral or organic soil in the  
forest. **Live fine roots** are  
included

SOILS

Soil  
organic  
matter  
(SOM)

Includes organic carbon in mineral  
and organic soils (including peat)  
to a specified depth. **Live fine**  
roots are included

*national circumstances may make it necessary to  
(slightly) modify the pool definitions*

# Tiers

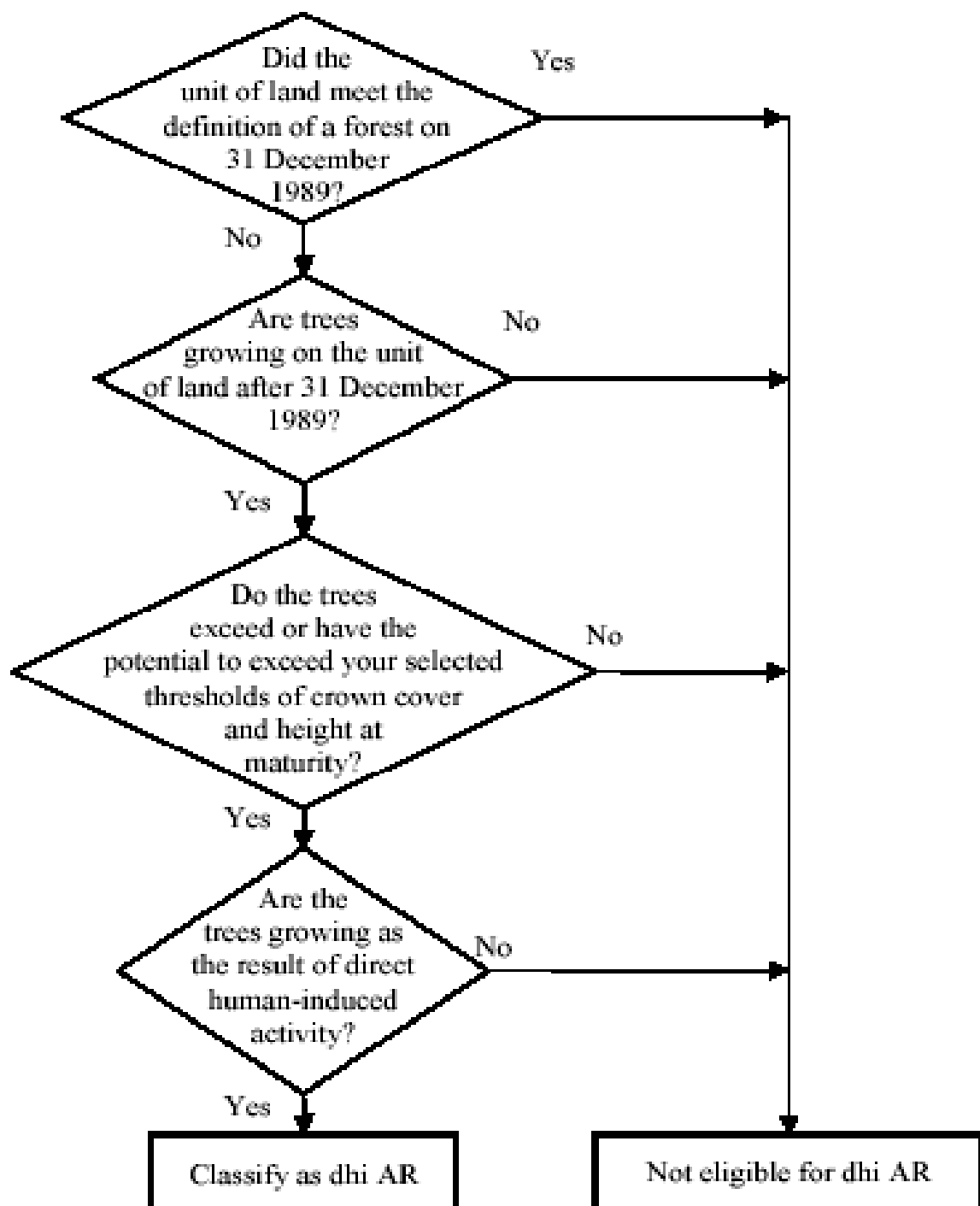
The **Tier 1** employs basic method provided in the *IPCC Guidelines*; activity data and EF/RF are spatially coarse; default data provided

**Tier 2** emission factors and activity data are defined by the country for the most important land uses/activities. Higher resolution activity data are typical

At **Tier 3**, higher order methods are driven by high-resolution activity data and disaggregated at sub-national to fine grid scales. A closer link between biomass and soil carbon dynamics established.

- Higher tiers for key categories
- Tiers are not fixed, they should be regarded as on a sliding scale; intermediate forms can occur
- Within land use type, tiers can differ per pool

**Decision tree  
to determine  
whether a unit  
of land is  
subject to direct  
human induced  
afforestation /  
reforestation**



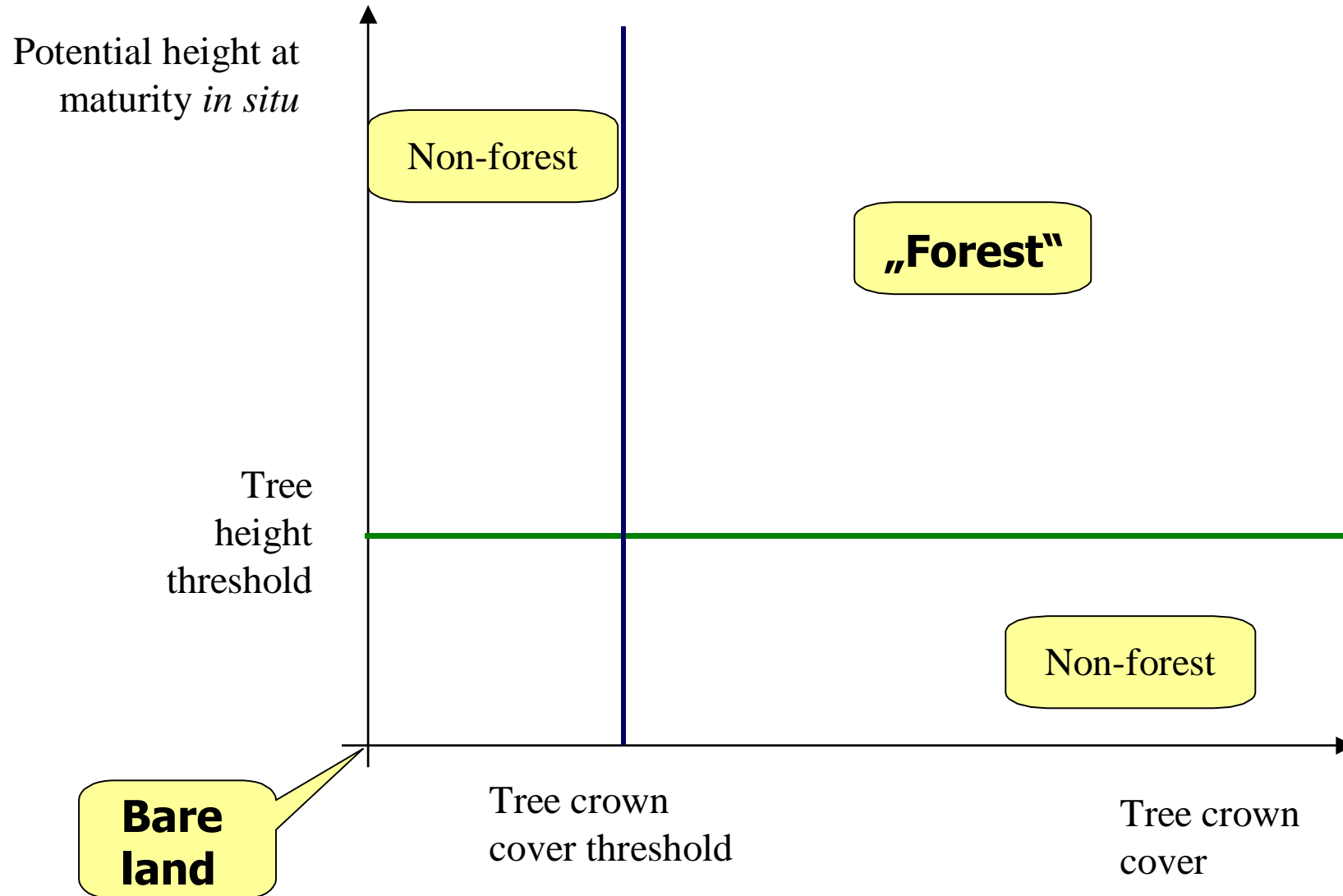
# Specific issues for afforestation and reforestation

- Forest cover maps needed for 1990 (AR “since 1990”)
- Remote sensing often not effective in detecting AR
- Forest inventories may not focus on non-forest lands, may need to be extended
- Reporting systems may work well
- Young trees (difficulties with expansion factors)
- Small changes in some pools
- Harvesting on AR lands to be recorded separately

## Definition of “forest” in MA & GPG LULUCF

- minimum area of land of 0.05-1.0 hectares covered with trees
- tree crown cover (or equivalent stocking level) of more than 10-30 per cent
- trees with the potential to reach a minimum height of 2-5 metres at maturity *in situ*
- closed forest formations
- open forest
- young natural stands and all plantations
- areas temporarily unstocked (e.g. harvest, fire)

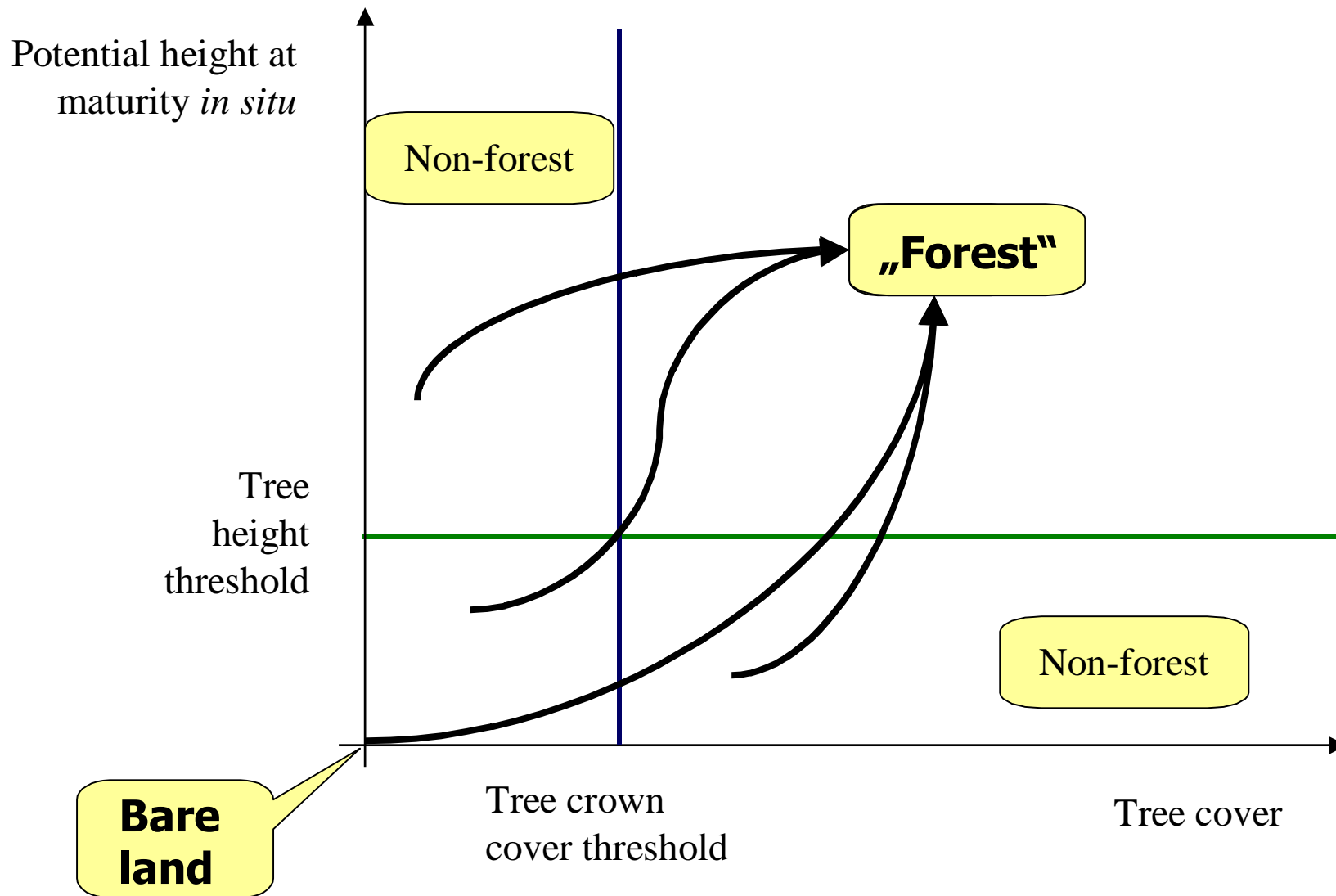
# „Kyoto Forest“ Phase Space



Wojtek Galinski



# Afforestation in „Kyoto Forest“ Phase Space

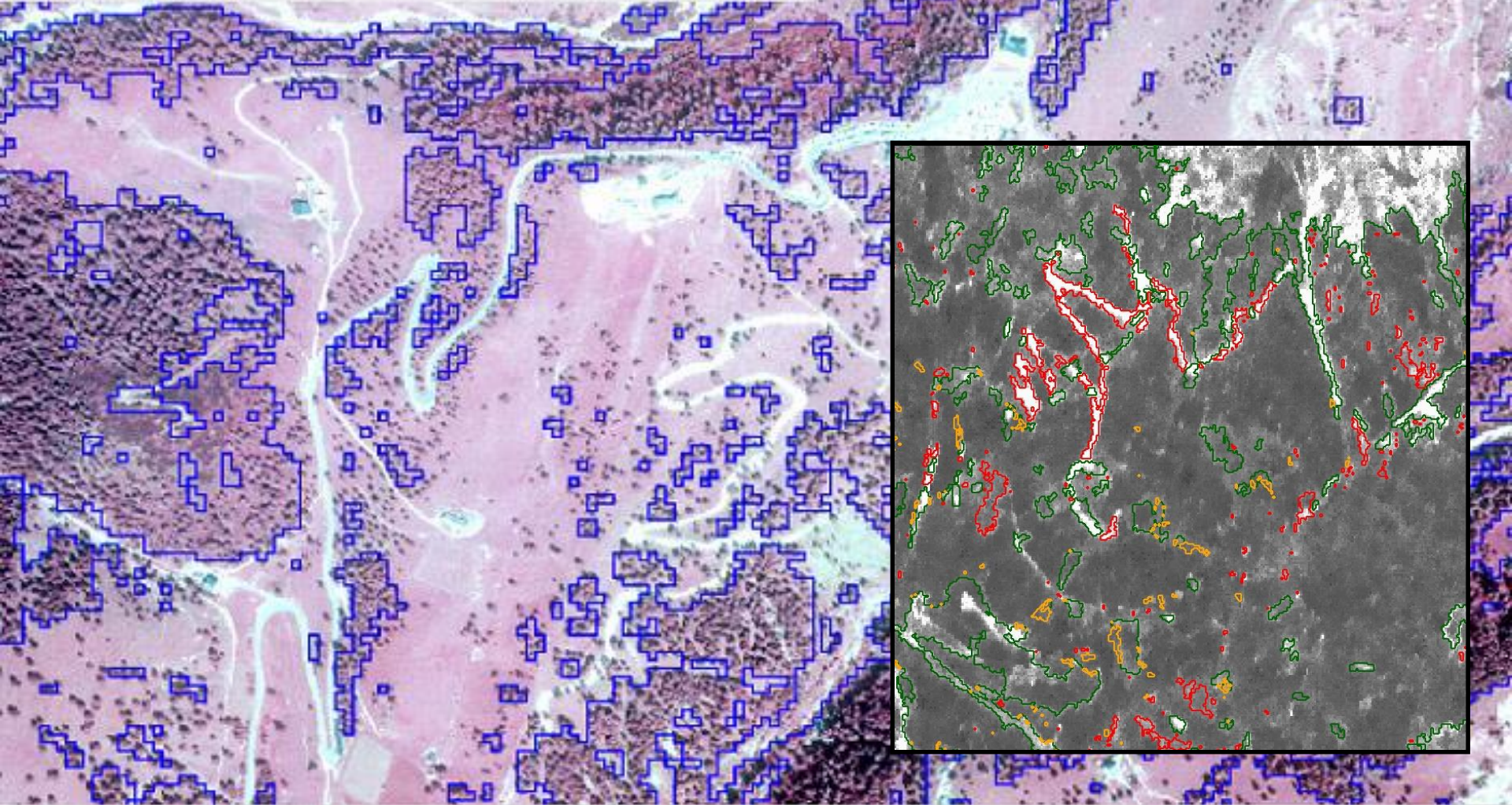


Wojtek Galinski





# FOREST BORDER FROM SPOT PAN AND TM







## Chapter 4.3: LULUCF projects

**CLA:** Sandra Brown (USA), Omar Masera (Mexico)

**LA:** Vitus Ambia (Papua New Guinea), Barbara Braatz (USA), Markku Kanninen (Finland), Thelma Krug (Brazil), Daniel Martino (Uruguay), Richard Tipper (UK), Phaniel Oballa (Kenya), Jenny Wong (Malaysia)

**CA:** Ben de Jong (Mexico), David Shoch (USA)

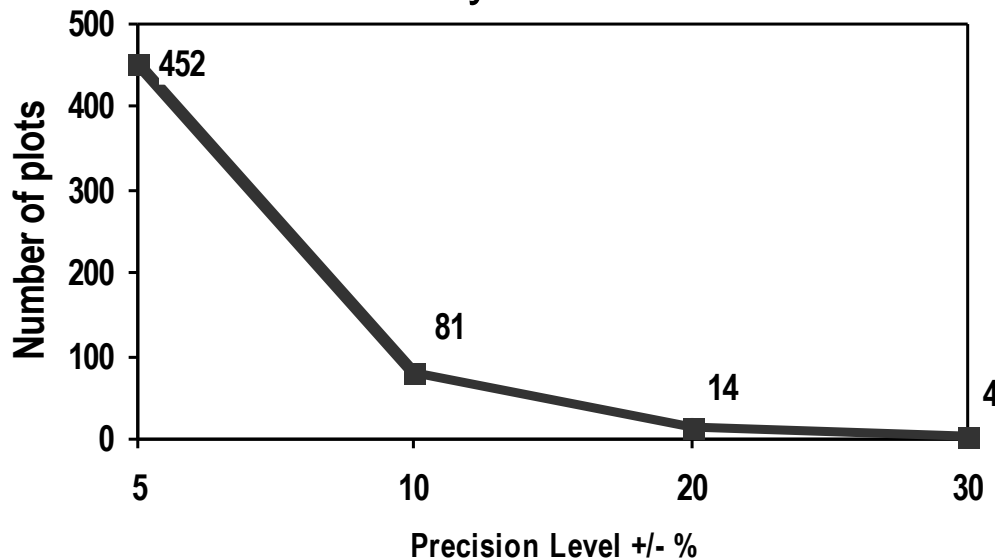
**RE:** Soobaraj N Sok Appadu (Mauritius)

# PURPOSE OF SECTION 4.3

- Provide guidance on **measuring, monitoring, and estimating** anthropogenic changes in C stocks and GHG emissions and removals for **project activities** under Articles 6 and 12.
  
- Key steps for designing and implementing a **measuring and monitoring plan**
  - ✓ **Stratify the project area** to increase the accuracy and precision of measuring and monitoring in a cost-effective manner
  - ✓ **Select carbon pools and non-CO<sub>2</sub> GHGs**
  - ✓ **Estimate C pools and non-CO<sub>2</sub> GHGs (>5 intervals)**

# DESIGN OF SAMPLING FRAMEWORK

- ✓ **Permanent plots** for trees recommended as statistically efficient way to measure change
  - For permanent plots, **sample size in each stratum based on the estimated variance and targeted precision**
  - Change in stocks and confidence interval estimated directly from measurements



Example of relationship between number of plots and precision level (+/- % of total carbon stock with 95% confidence) for a complex tropical forest



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[www.ipcc-nggip.iges.or.jp/  
lulucf/gpoglulucf\\_unedit.html](http://www.ipcc-nggip.iges.or.jp/lulucf/gpoglulucf_unedit.html)

# **Workshop**

## **Land-use Related Choices under the Kyoto Protocol**

**Obligations, Options and Methodologies for  
Defining “Forest” and for  
Selecting Activities under KP Article 3.4**

# Land-use Related Choices under the Kyoto Protocol

- **Choice of numerical values for the definition of “forest”**
- **Choice of Article 3.4 activities**
  - Carbon benefits
  - Uncertainties
  - Risks
  - Range of incentives needed for implementation; costs
  - Monitoring costs
  - Ancillary benefits