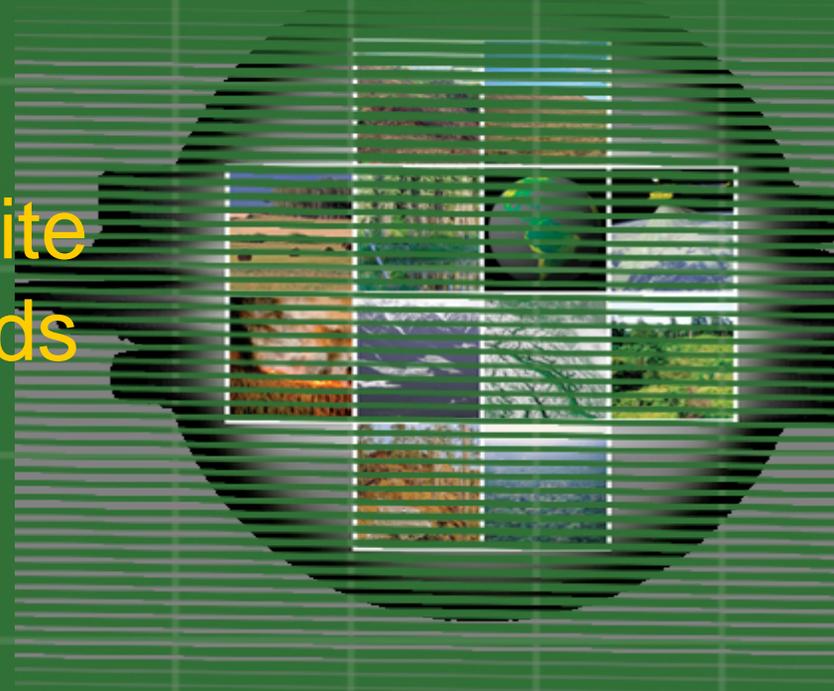


GOFC-GOLD

Global Observation of Forest and Land Cover Dynamics



Accuracy assessment and
area estimation from satellite
derived activity data – needs
from LULUCF and REDD



M. Herold, F. Achard, G. Grassi, C. Woodcock

Fine-scale land/forest change

- Existing experiences:
 - National/regional monitoring programs
 - UNFCCC Kyoto reporting on LULUCF/AFOLU by Annex 1 countries
- Incentives to increase climate change mitigation by reducing emissions/stabilizing tropical forest carbon (REDD)
 - *Establish national carbon accounting capacities in dev. countries*
- Projects with global/large scale focus:
 - *FAO-Forest Resources Assessment 2010*
 - *EU/JRC: TREES 3 (sampling approach)*
 - *UMD/SDSU: combined MODIS/Landsat approach*
- Tools for estimating, accounting, reporting:
 - *IPCC Good Practice Guidelines and Guidance (LULUCF/AFOLU)*
 - *GOFC-GOLD REDD sourcebook*
- Rather clear expectations for accuracy assessment?



Outline of new Chapter 2.5 – Estimation of uncertainties

Chapter in the new sourcebook	Main elements	in current sourcebook
2.5.1 Why estimating uncertainties?	<ul style="list-style-type: none">- IPCC: “estimates should be systematically neither over nor under the true value, so far as can be judged, and uncertainties should be reduced so far as is practicable”. <p>Appropriate methodologies to quantify the uncertainties should be used in order to help <i>prioritize future efforts</i> to improve the inventory.</p> <ul style="list-style-type: none">- Possible <i>application in accounting context</i>	-



Need for accuracy assessment

- Interest in activity data / area change!
- Accuracy assessment using a sample of higher quality data as integral part of national monitoring/accounting
 - *Estimates should be real, transparent, demonstrable, verifiable ...*
- IPCC GPG: uncertainties should be quantified and reduced as far as practicable
- 2 different objectives:
 - *Assess accuracy of land/use (change) map (to improve system)*
 - *Adjust area estimates (if validation shows bias)*
- For REDD - accuracy assessment as process
 - *using best efforts and continuous improvement while working towards a robust assessment in the future*
 - *Understand and reduce errors*
 - *for future commitment periods: robust accuracy assessment in place*



Understanding sources of error

Different components of the satellite-based monitoring system affect the quality of the outcomes:

- the quality and suitability of the satellite data (i.e. in terms of spatial, spectral, and temporal resolution)
- the interoperability of different sensors or sensor generations
- the radiometric and geometric preprocessing (i.e. correct geolocation)
- the cartographic and thematic standards (i.e. land category definitions and MMU)
- the interpretation procedure (i.e. classification algorithm or visual interpretation),
- the post-processing of the map products (i.e. dealing with no data values, conversions, integration with different data formats e.g. vector versus raster)
- the availability of reference data (e.g. in situ data) for evaluation and calibration of the system



Reducing sources of error

Many error sources can be properly addressed during the monitoring process using widely accepted data and approaches:

- Suitable data characteristics: spatial and temporal
- Data quality: Suitable preprocessing
- Consistent and transparent mapping:
 - same cartographic and thematic standards and accepted interpretation methods should be applied in a transparent manner using expert interpreters to derive the best national estimates,
 - account for no data
 - make all data and products available



Practical considerations

- Robust approach may not be achievable or practicable i.e. monitoring historical land changes in developing countries
- Verification should build confidence, improve knowledge of potential errors and is used for continuous improvements
- If no thorough accuracy assessment is possible or practicable, recommendation to:
 - apply the best suitable mapping method in a transparent manner
 - consistency assessment allow some estimation of the quality
 - work backwards from most recent time (more reference data)
- Information without a proper statistical sample can be useful in understanding the basic error structure:
 - Confidence values provided by interpretation or classification
 - Qualitative examinations/comparison with other maps
 - Systematic review and judgments by local and regional experts
 - Comparisons with non-spatial and statistical data

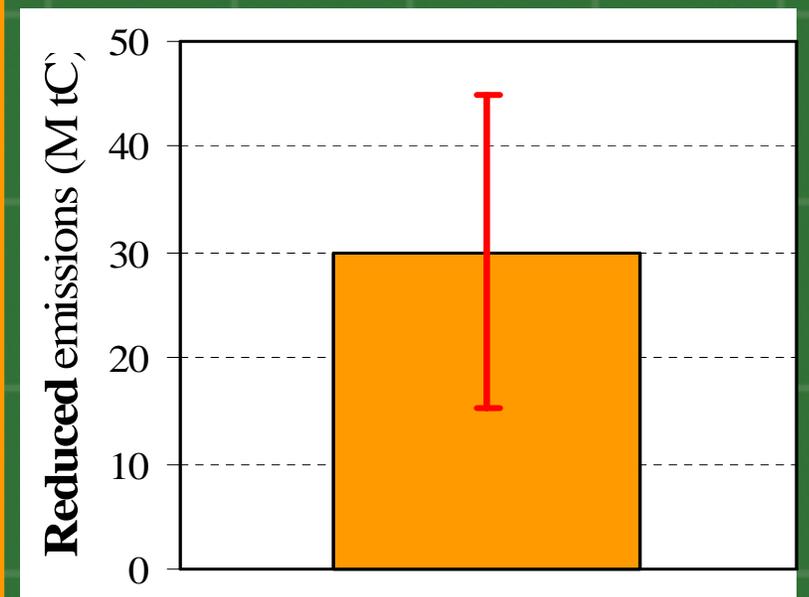
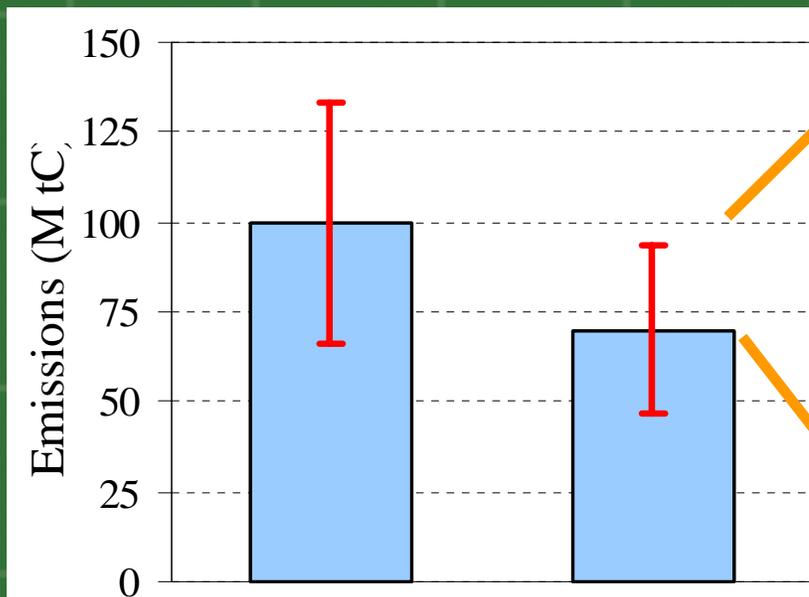


ACTIVITY DATA

EMISSION FACTOR

$$\text{Emissions} = \text{area deforested} \times \text{C stock change}$$

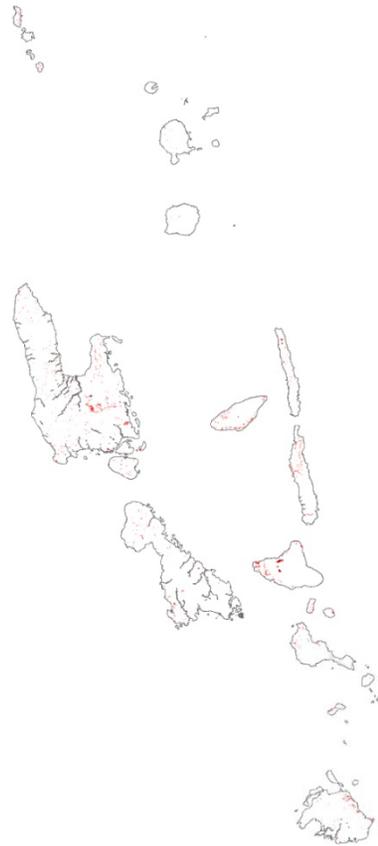
	Refer. period	Assess. period	Uncertainty (95% CI)
Activity data (Mha/yr)	1.0	0.7	10
Emission factor (t C/ha)	100	100	30
Emissions (M t C/yr)	100	70	32



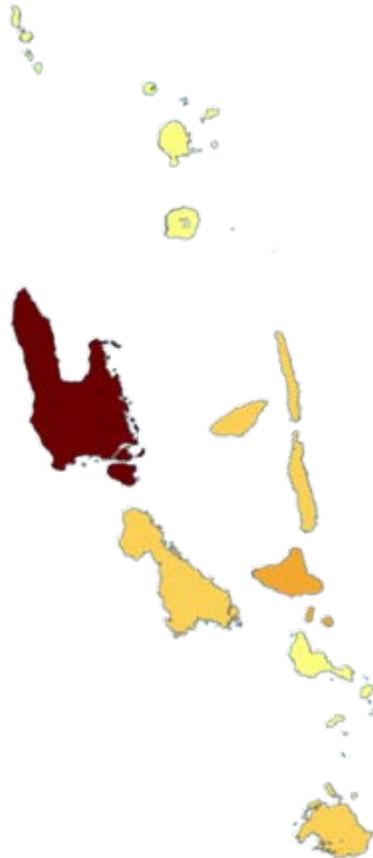
In the REDD context, what is relevant is the uncertainty of the emissions reduction (**uncertainty in the TREND**)

In line with IPCC assumptions, in REDD context we consider very likely that uncertainties of Emission Factors are **CORRELATED** between periods, and thus do not affect the % uncertainties of the trend

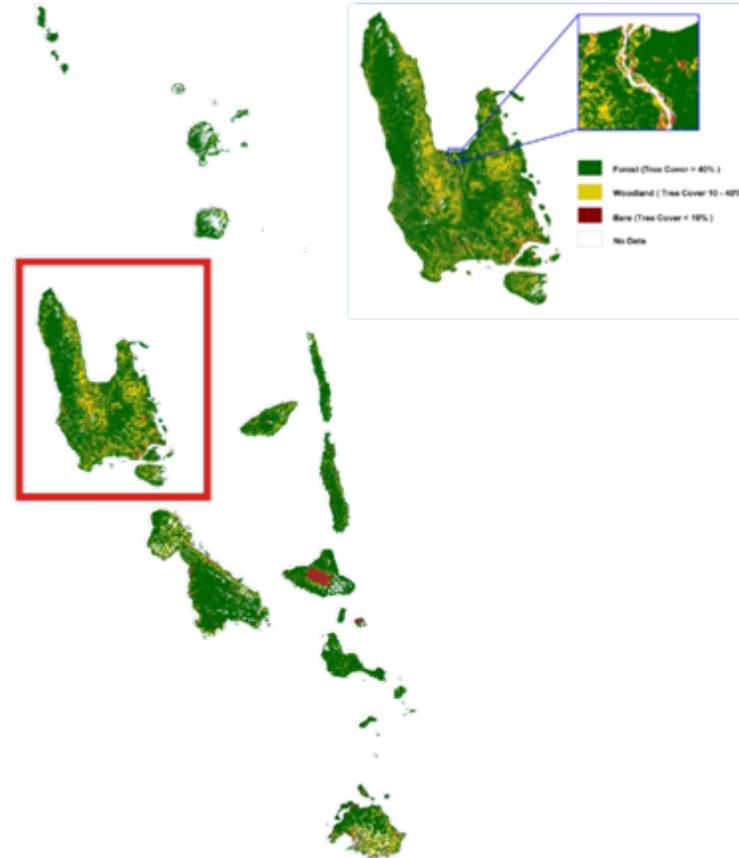
Hot spots



Forest loss [ha]



Tree canopy cover [%]



Accuracy assessment approach

➤ Objective:

- Assess uncertainty of RS deforestation (area) estimate
- Involve national and regional actors and agencies

➤ Lack of reference data of higher quality for 1990-2000:

- Suitable mapping method applied in transparent manner to derive best estimate
- Build upon local knowledge to verify deforestation mapping

➤ Implementation steps:

1. Sample design: stratified random sample for three main islands with most deforestation action

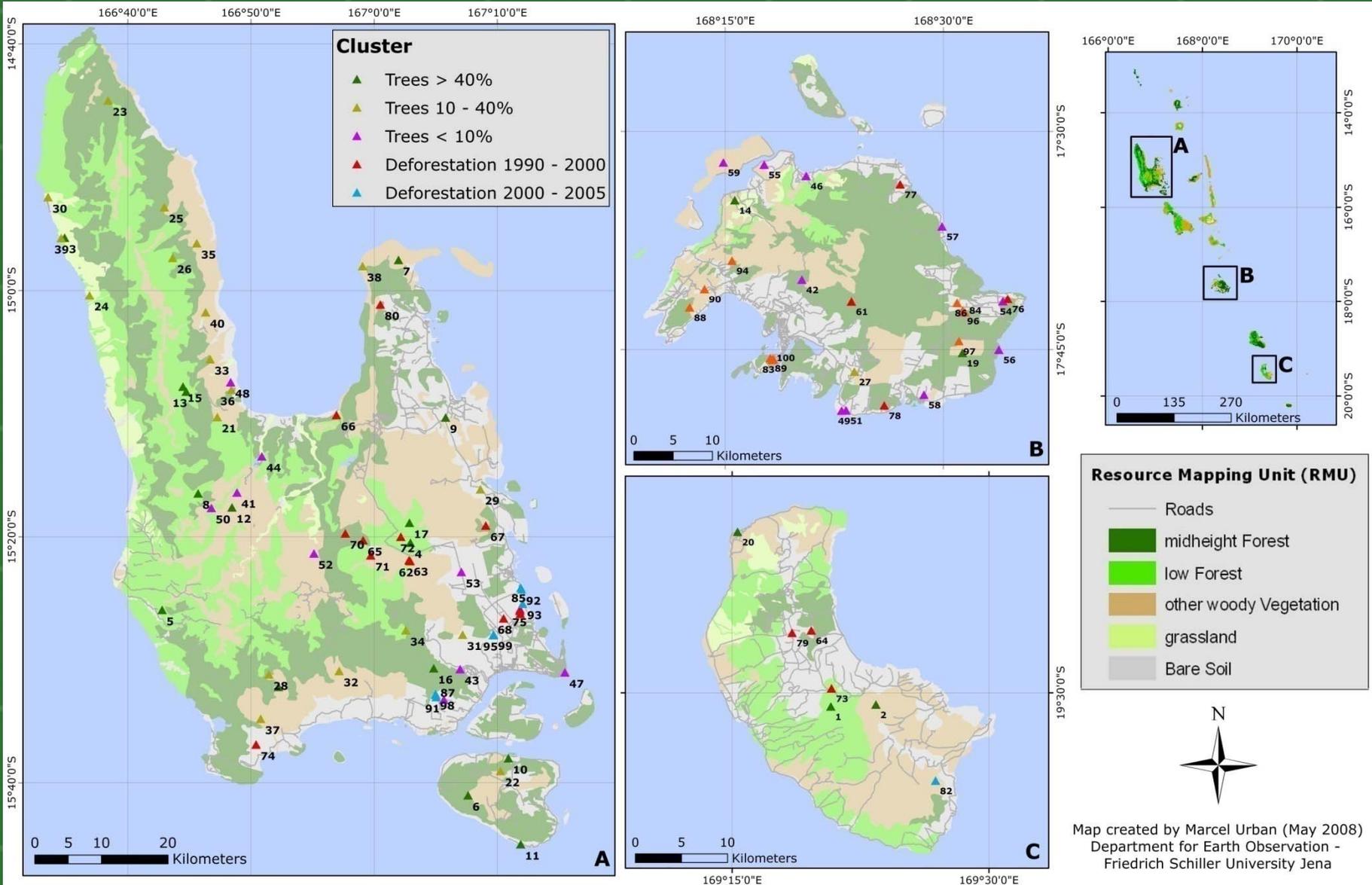
2. Response design:

- 4 weeks field survey visiting 59 of 100 sample locations with forestry department, local foresters and int. experts
- 90% of deforestation points visited and discussion of deforestation history in-situ
- Independent reinterpretation of satellite data

3. Analysis design: using Card 1982 procedure



Accuracy assessment - sampling



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Field work, communication and training

Presentation at Forestry Department



Discussion with local communities



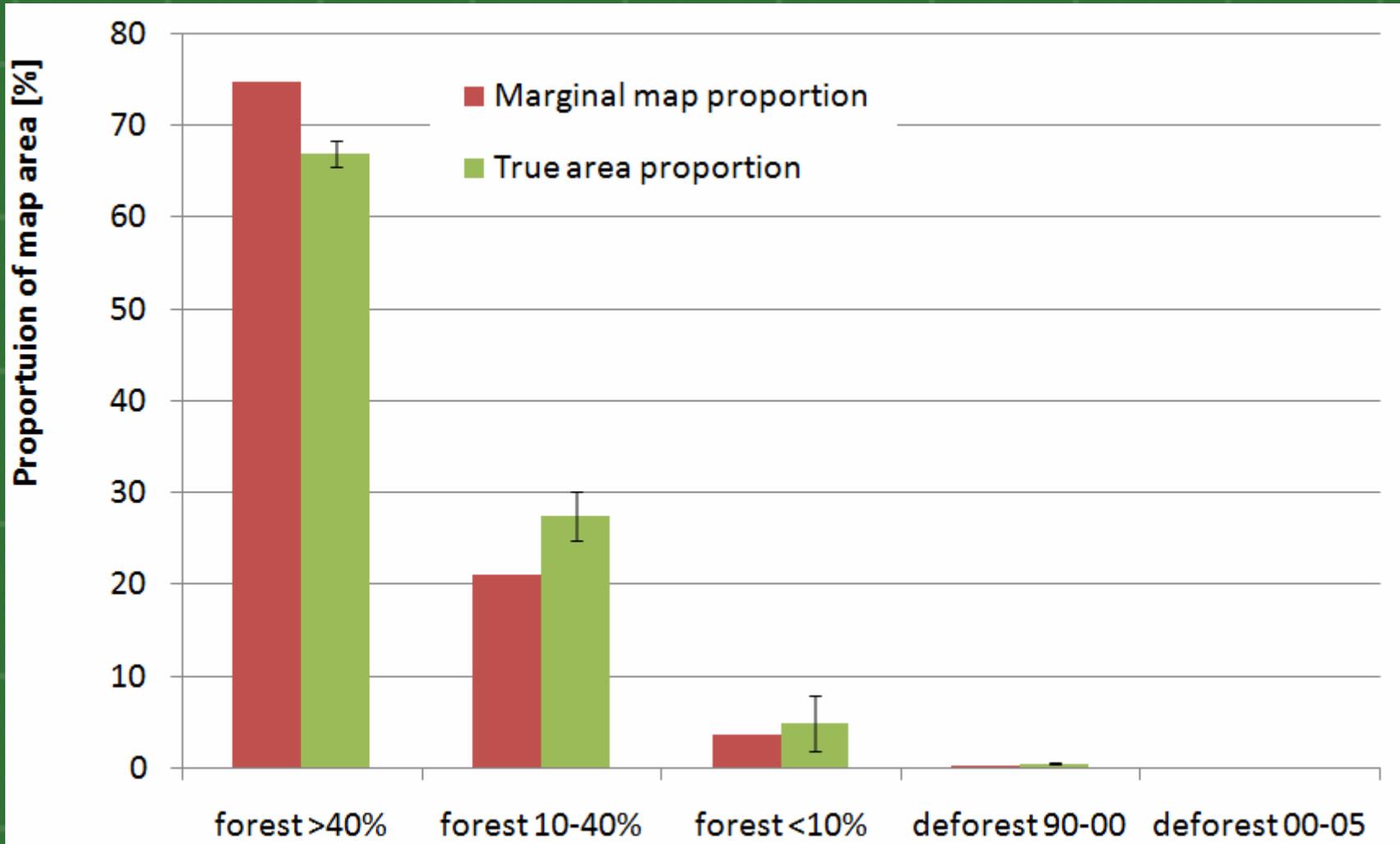
GPS training

Interpretation of satellite data and deforestation history at sample locations



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Accuracy assessment- area estimates



Concluding remarks

- Estimation activity/area change data for LULUCF/REDD
- IPCC GPG: uncertainties should be quantified and reduced as far as practicable
- Standard methods for accuracy assessing of land cover change and area estimates – need for *“best practices”*
- Limitations in developing countries to implement statistically robust validation procedures: - need for recommendations of *“good practices”* or *“minimum requirements”* or *“things not to do”*
 - Area change may not be driven by reference
- Key issues to be discussed:
 - Principle of Conservativeness
 - Uncertainty in trend (link to accounting)

