# Data availability for landscape level REL: Reflections

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# What Data?

- Measurements of biocarbon stocks are a function of **area** (of each land use category) and **carbon density** (amount of carbon per unit area).

- Estimates of change (monitoring) are repeated measurements to assess changes within and between landuse and land cover categories

# Key tasks for carbon accounting

Five key tasks for carbon accounting in reference regions, project regions, and leakage regions include:

- Determination of monitoring areas.
- Determination of reference emissions (including non-$CO_2$ emissions from fires) – baseline.
- Determination of deforestation areas.
- Determination of carbon stocks.
- Determination of non-$CO_2$ emissions from fires.

# Accounting for C stocks from land use sectors

$$\Delta C = \sum_{ij} A_{ij} [\Delta C_{ij\ LB} + \Delta C_{ij\ DOM} + \Delta C_{ij\ SOILS}] / T_{ij}$$

*LUC* *Biomass* *Necromass* *Soil*

**ΔC** = annual change in C stocks in the landscape, ton C $yr^{-1}$

**Aij** = **area** of land use type *i* that change to *j*, ha

**ΔCij LB** = change in C stocks in **living part (biomass)** from changes of land use type *i* to *j* , tonnes C ha-1

**ΔCij DOM** = change in C stocks in **dead part (organic matter)** from changes of land use type *i* to *j* , ton C $ha^{-1}$

**ΔCij SOILS** = change in C stocks in **soils** from changes of land use type *i* to *j* , ton C $ha^{-1}$

**Tij** = time period of the transition from land use type *i* to land use type *j*, yr.

# Accounting for C stocks from land use sectors

$$\Delta C = \sum_{ij} A_{ij} [\Delta C_{ij\ LB} + \Delta C_{ij\ DOM} + \Delta C_{ij\ SOILS}] / T_{ij}$$

Remote Sensing Data

Image interpretation

Land use change quantification

# What data is available in Cameroon?

Mitig Adapt Strat Glob Change (2008) 13:157–178
DOI 10.1007/s11027-007-9084-7

ORIGINAL PAPER

## A data support infrastructure for Clean Development Mechanism forestry implementation: an inventory perspective from Cameroon

Peter A. Minang · Michael K. McCall ·
Margaret M. Skutsch · Jeroen J. Verplanke

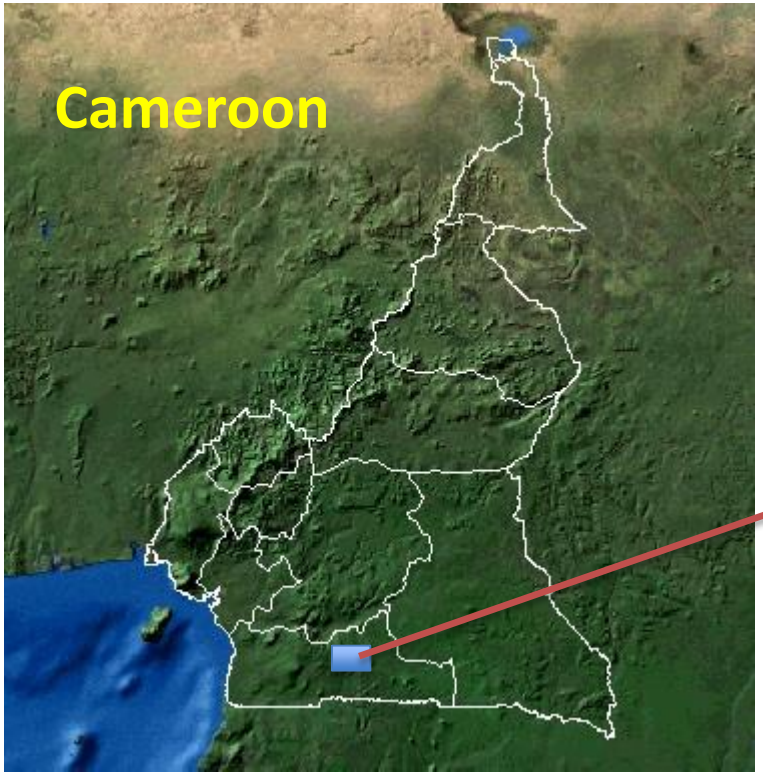
**Table 2** CDM Meso and Macro (National) level information availability

| Data Type | Paper data | Digital data | Department/Agency involved | Ministry of |
|---|---|---|---|---|
| Criteria for determining poor communities | N | N | – | – |
| Indicators for Impact assessment | N | N | – | – |
| Indicators for Sustainable Development | Y | Y | 'Comite Natonal MDP Cameroun' [a] | Environment and Nature Protection (MINEP) |
| Allometric equations for tree species | P | P | Agence National d' Appui au Developpement Forestier (ANAFOR), World Agroforestry Centre (ICRAF) | Forests and Fauna (MINFOF) |
| Soil bulk density index by region | N | N | – | – |
| Carbon accumulation factors | Y | Y | Institut de Recherche pour L'Agriculture et le Developpe ment—(IRAD), ICRAF | Scientific Research (MINRESI) |
| Remote sensing data | Y | Y | Centre de Télédétection et de Cartographie Forestière (CETELCAF), Institut Nationale de Cartographie (INC), Global Forest Watch (GFW) | MINFOF (Centre de Savoir); MINRESI |
| Forest Cover and Land use | P | P | CETELCAF, GFW | – |
| Deforestation data | – | – | – | – |
| Afforestation | P | P | ANAFOR | |
| Reforestation | N | N | – | – |

# Summary for Cameroon

- Data Scarce environment
- Fractured and unsystematic data
- GIS and RS data has improved tremendously since 2008- however, clouds, saturation remains problem, technical capacity, cost f high resolution data etc
- Soils data a little more available from AFSIS project (ICRAF)
- **Defining the boundary** – what is the appropriate way of delimiting the area referred to as a landscape?
  - Issues of cross-jurisdictional forest resources (Abardare Ranges of Kenya which cuts across many counties in Kenya)
  - Each jurisdiction could also have its own approaches to activities in the landscape which may influence the REL. (e.g. in Kenya counties are semi-autonomous and make decisions on their own). Historical contexts also vary including resource governance protocols.
  - Should we say landscapes should be delimited along jurisdictional boundaries, ecological boundaries may defer widely which again is crucial in determining the REL.

# REALU in Efoulan Municipality, Cameroon




**EFOULAN**
**Area**: 150000
**Population**: 25000
**Livelihood**: agrarian with cocoa being the main agricultural product
**Forest area**: 5600 ha
**Drivers of deforestation**: Shifting cultivation for creating land for cocoa and other annual crops

# LUWES and REALU

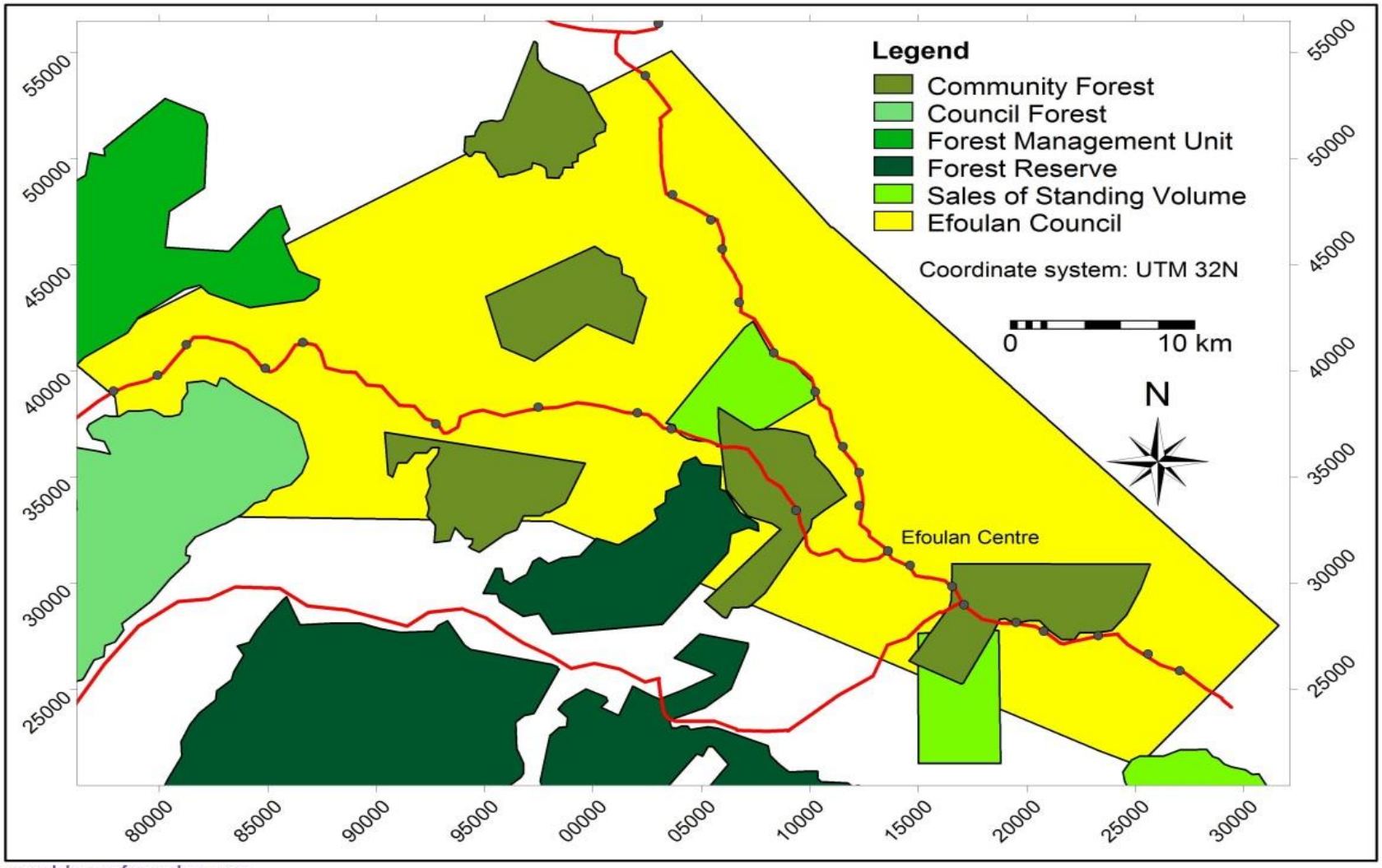
- Within the SECURED Landscapes Project implemented by ICRAF, we assessed changes in C stock using the LUWES (Land Use Planning for Low Emission Development Strategy) tool.

# Basic steps in LUWES

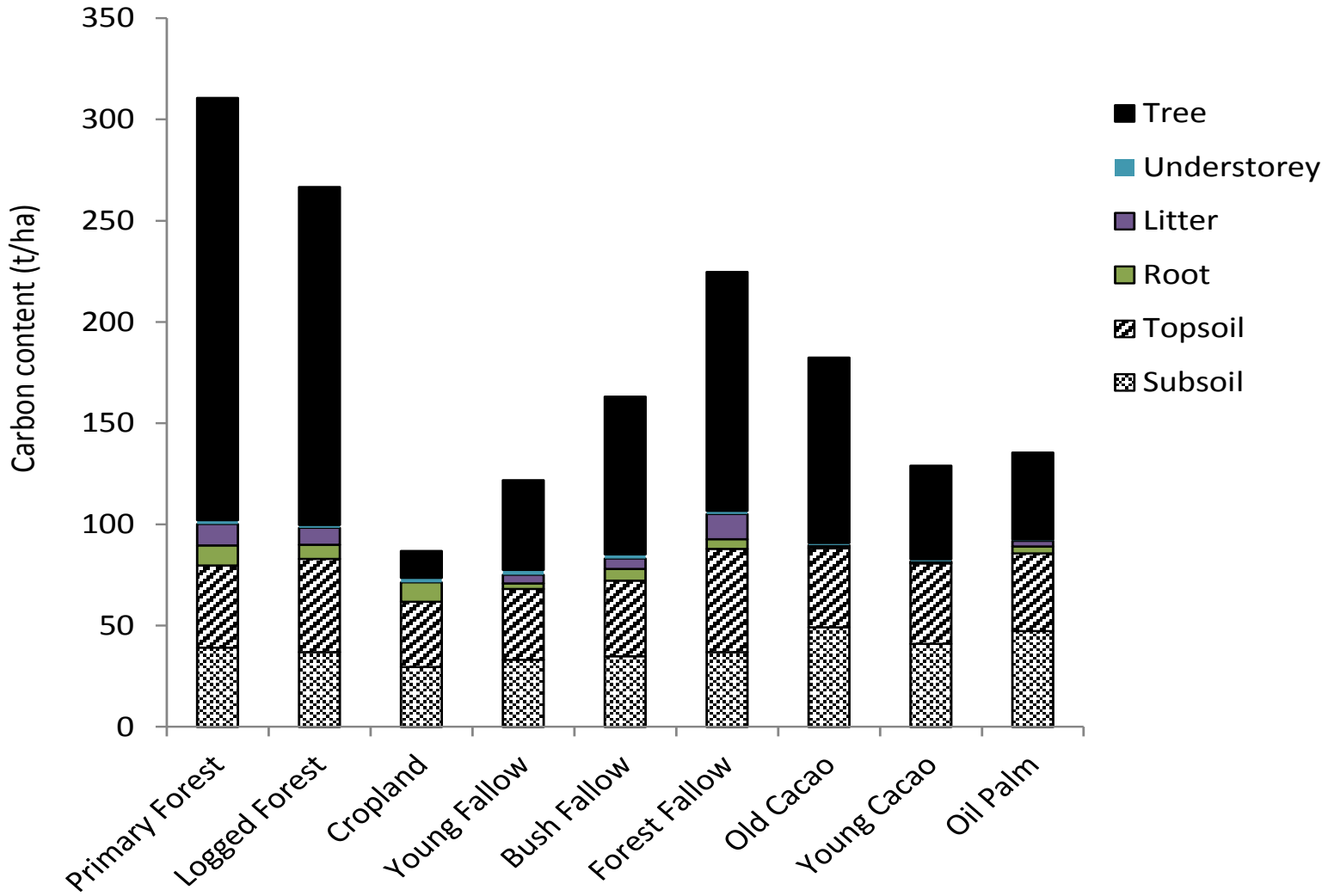
1. Identify **planning units** using multi-stakeholder discussions, spatial analysis, etc.
2. **Historical land use change** and their implications for **carbon storage**
3. **Baseline Scenario** development of LULC change and estimation of Reference Levels of Emissions
4. **Scenarios of emission reduction** and projected emissions using projected land use/cover
5. **Trade-off analysis-** scenario selection by examining the opportunity cost vs the reduced emissions in a negotiated process.
6. Formulation of **action plans** to implement the selected options e.g. incentives, enabling conditions, etc.

*Source: Dewi et al (2011)*

# Efoulan Municipality, Cameroon



# Carbon stocks in different land uses



# Efoulan municipality land use/ cover dynamics

| Land use type | Time average carbon stock (t C/ha) | Spatial coverage (ha) | | Relative change (ha/yr) | Net impact of land use change on carbon stock (t) |
|---|---|---|---|---|---|
| | | 2001 | 2007 | | |
| Mixed crop field | 87 | 1198 | 1512 | 44.86 | 27318 |
| Crop field created by clearing primary forest | 225 | 599 | 830 | 33.00 | 51975 |
| Cocoa farms | 156 | 4755 | 5771 | 145.14 | 158496 |
| Oil palm plantation | 136 | 268 | 338 | 10.00 | 9520 |
| Young/bush fallow lands | 142.5 | 2031 | 2199 | 24.00 | 23940 |
| Logged forest | 267 | 8126 | 7683 | -63.29 | -118281 |
| Undisturbed forest | 311 | 64136 | 62780 | -193.71 | -421716 |

*Source: Yemefack et al (2013)*

# Possible land-based development pathways in the landscape

| Planning Units | Scenario 1: Business as Usual (BAU) | Scenario 2: Cacao extension | Scenario 3: Sustainable Forest management | Scenario 4: Mix of sustainable forest management and properly managed Cacao extension |
|---|---|---|---|---|
| **Community Forest** | No measures are taken to reduce emission | 2000 ha of this unit converted into cacao plantation | Illegal exploitation avoided and forests managed well | 2000 ha community forest converted to cacao farm with applicable intensification pathways |
| **Communal Forest** | Same as above | 1000 ha of this unit converted into cacao plantation | Illegal exploitation avoided and forests managed well | 1000 ha are converted into cacao plantation with applicable intensification pathways |
| **Concessions of Forest Production** | Same as above | Only selective logging and no total conversion takes place here. | Illegal exploitation avoided and forests managed well | Limited areas of concession forests converted into cacao plantation with applicable intensification pathways |
| **Shifting Cultivation landscape** | The expansion of shifting cultivation continues. | 2000 ha converted into cacao plantation | The cleared land is used property without causing further damage | 2000 ha converted into cacao plantation with applicable intensification pathways |

# Emission Scenarios

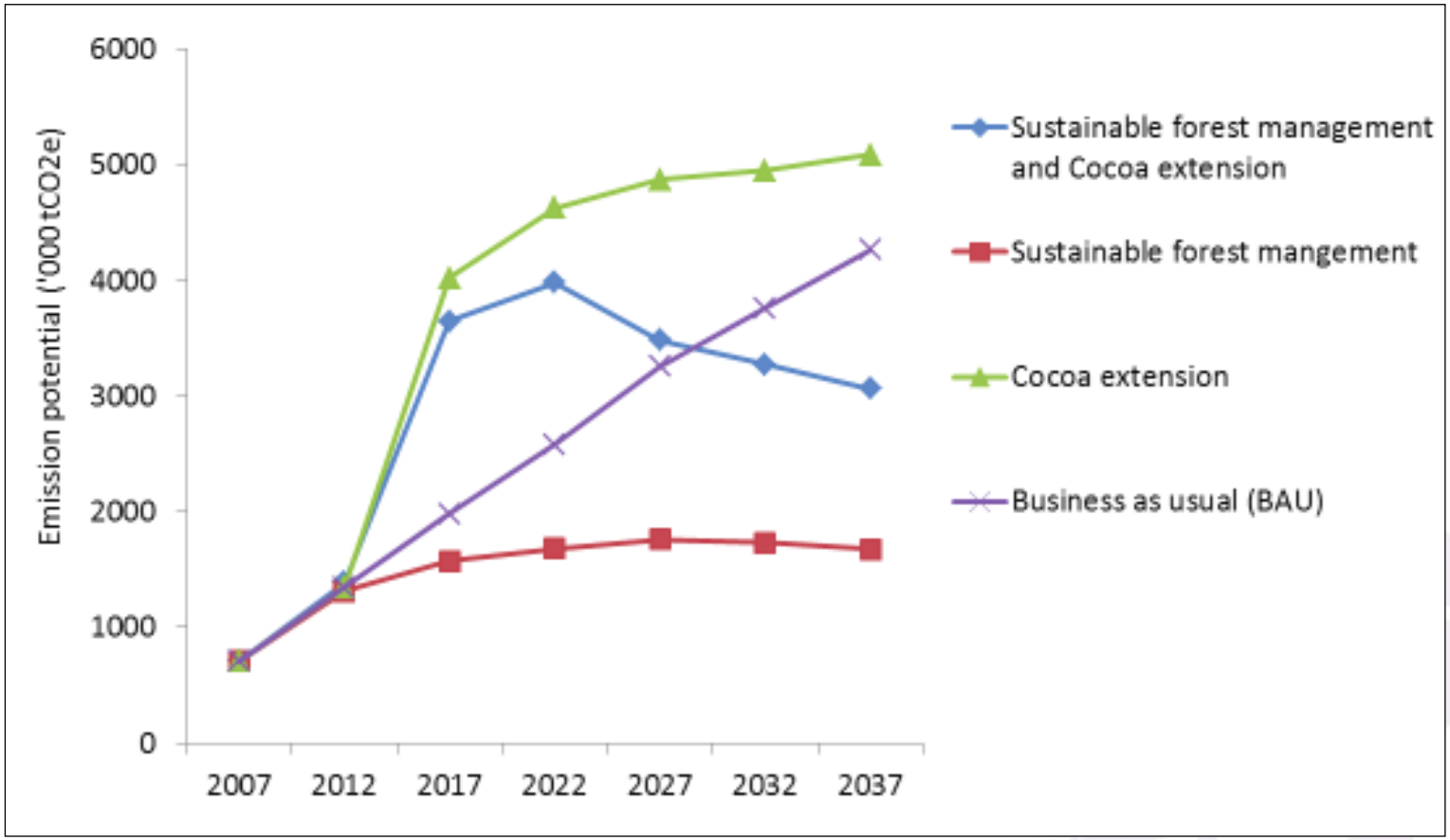
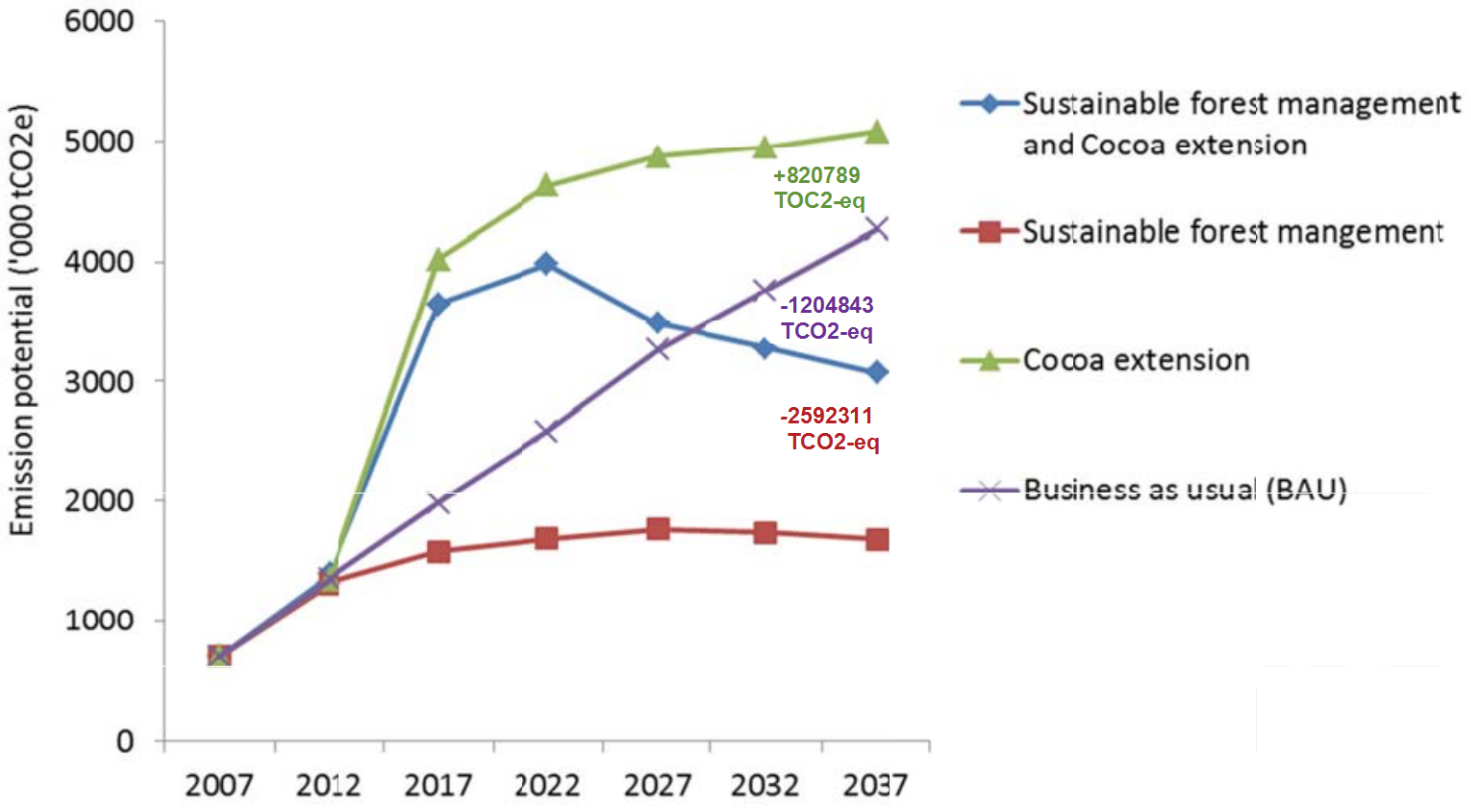



*Figure 3. Greenhouse gases emission potentials (CO2e) from the various development scenarios simulated over 30 years period*

# Emissions Estimates



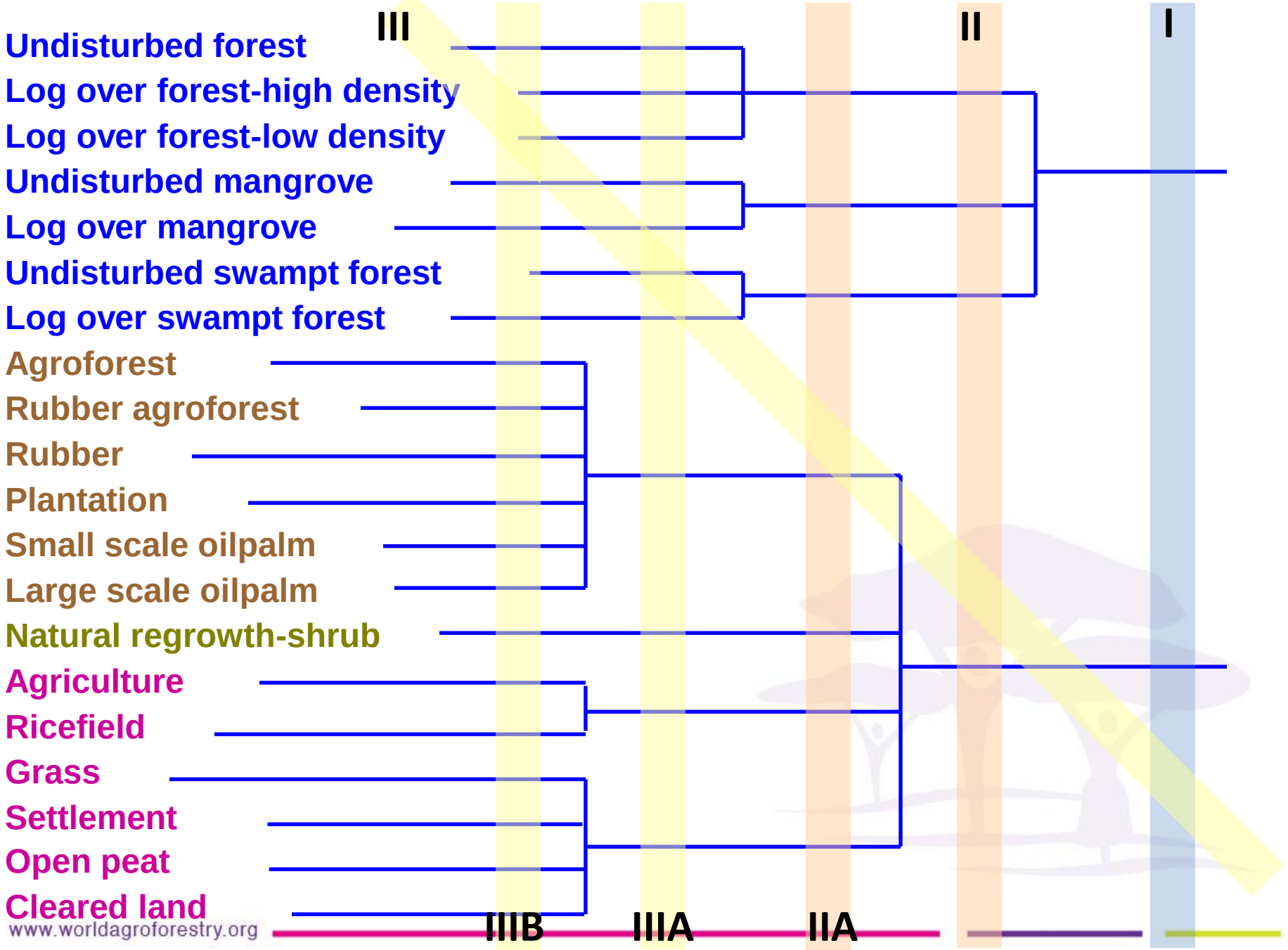

Estimated cumulative emissions in three decades under various development pathways in Efoulan Municipality, Cameroon

# Sources of uncertainties

- **Technical**: **Data** (satellite imageries) quality and resolution, pre-**processing** error (georeferencing, atmospheric correction), interpretation error (inconsistency, semantic extraction, information recognition), classification method, extrapolation
- **Operational**: lack of budget for ground truthing, monitoring, purchasing data with proper resolution & powerful software, lack of time & capacity, lack of coordination …
- **Political**: definition of forest, scope of REDD, gaps between expectation and reality, …

# What Legend?

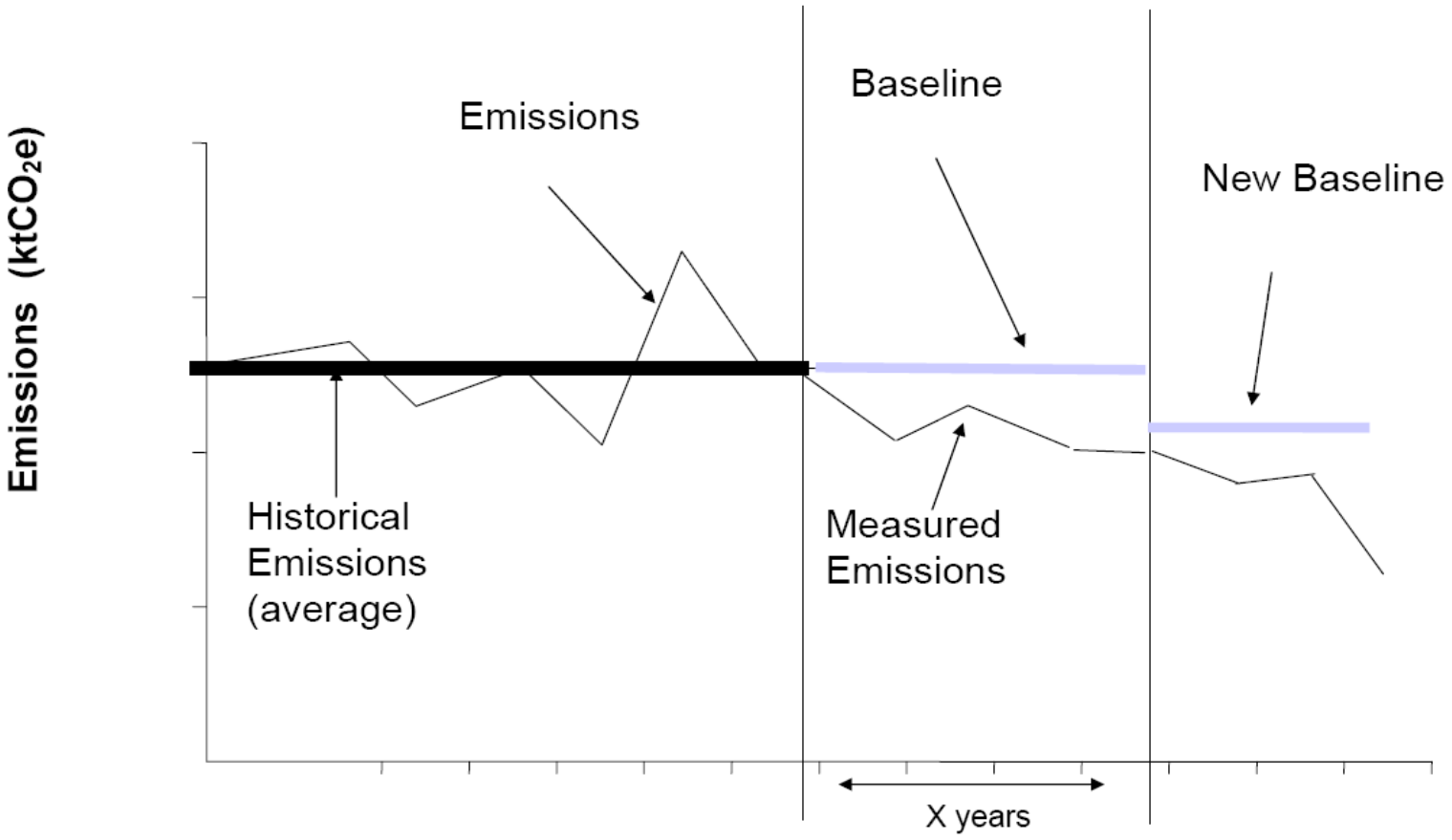
- Classification of land uses and or activities remains a huge problem within and across landscapes?
- Multiple maps, multiple legends for different agents and data sources?
- Ministries have different land classifications?
- Can a one-map project help?
- Cascaded, hierarchical claissification?


III
II
I
Undisturbed forest
Log over forest-high density
Log over forest-low density
Undisturbed mangrove
Log over mangrove
Undisturbed swampt forest
Log over swampt forest
Agroforest
Rubber agroforest
Rubber
Plantation
Small scale oilpalm
Large scale oilpalm
Natural regrowth-shrub
Agriculture
Ricefield
Grass
Settlement
Open peat
Cleared land
IIIB
IIIA
IIA
www.worldagroforestry.org

# Information resolution

- **3 levels of forest classification**: general (I), ecozone specific (II), and management (III), are combined with:
- **2 sublevels of non-forest classification**: woody (tree) vs non-woody (non-tree) vegetation differentiation (A) and type of woody vegetation (B)
- **Subsets of the combination explored**: I, II, IIA, III, IIIA, IIIB

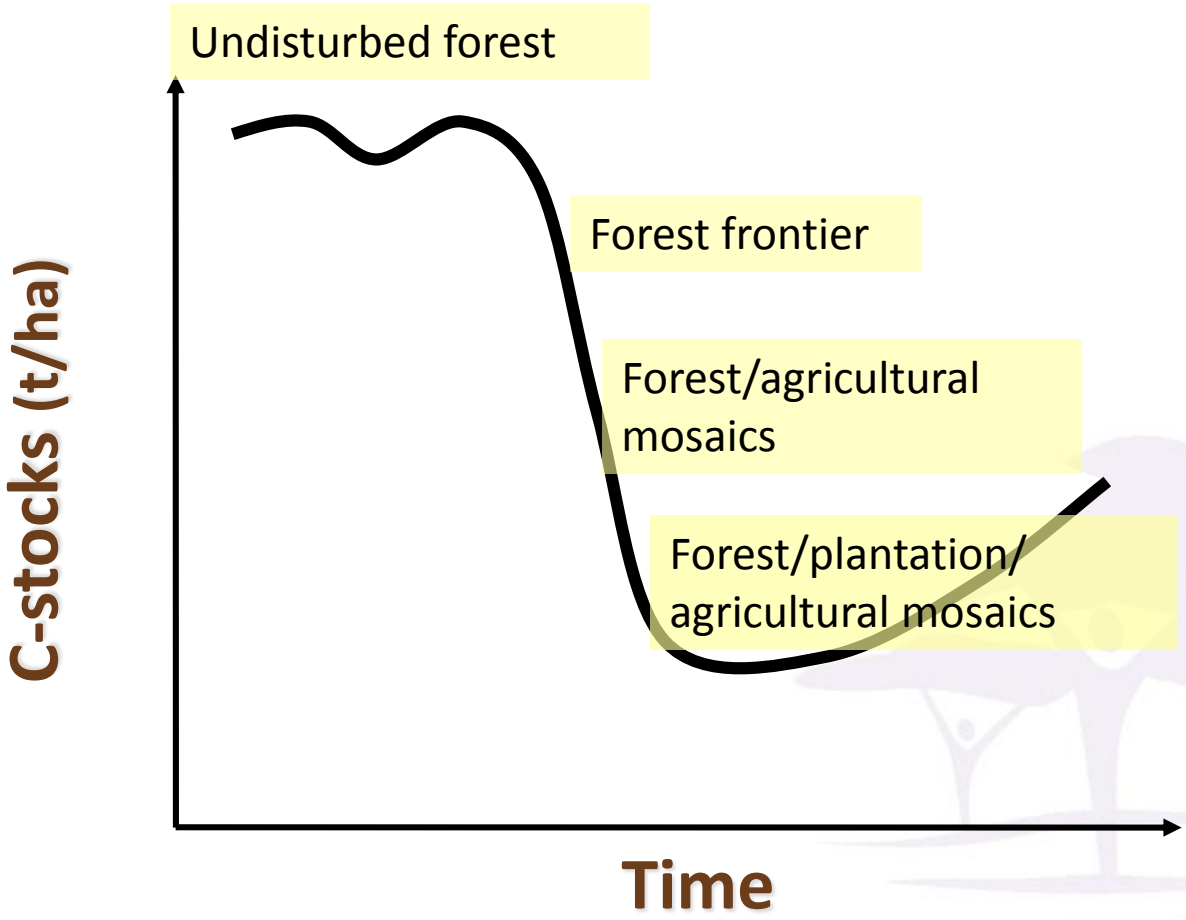
# One Approach to MRV




Reference Emission Levels (REL) / Reference Levels (RL)

*from Moutinho (2007)*

# Forest transition



# Information Resolution: Summary

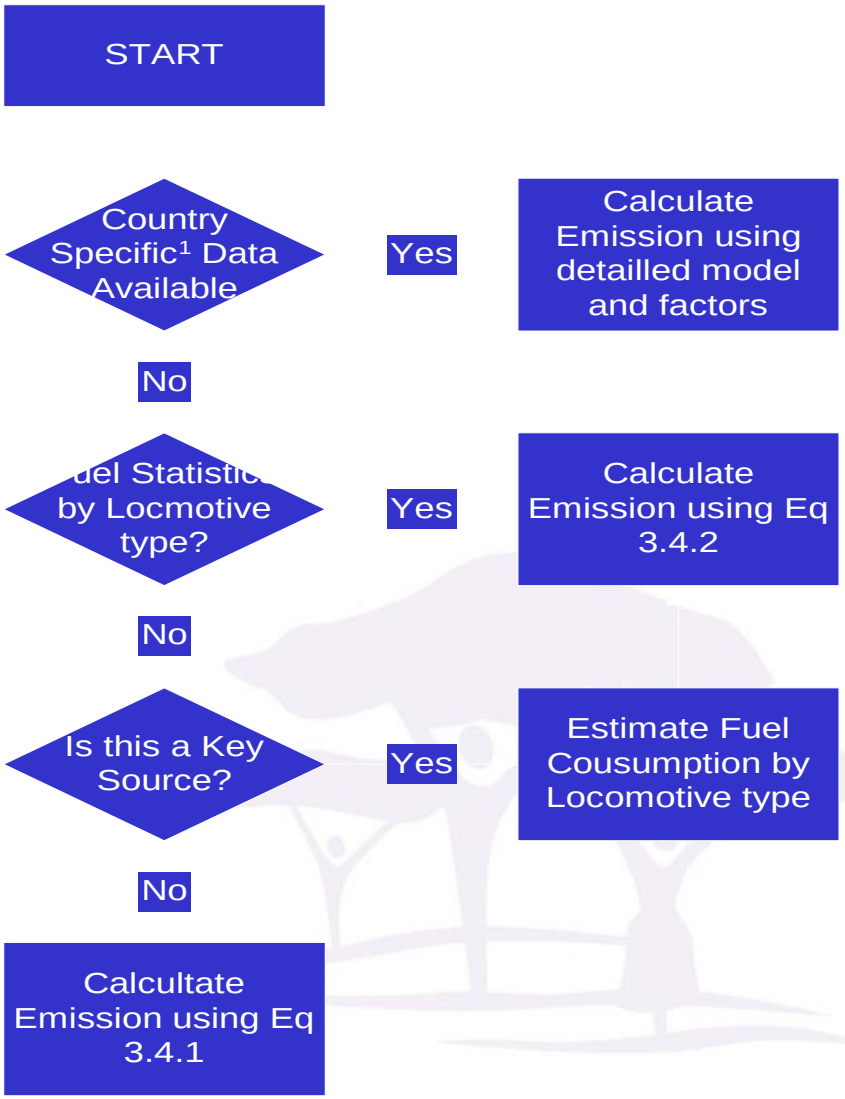
- In early FT, when forest degradation is more marked than forest conversion, discriminating forest based on types, quality and management are inevitable in assessing C-stock changes at landscape level
- In the intermediate FT, when forest conversion and plantation development take place, discriminating between tree-based systems with other non-forest areas is important
- In the advanced FT, when agricultural intensification is active and there are conversion from one tree-based systems to others and also to croplands and others, differentiating vegetation type within the tree-based systems leads to a noticeable difference

# Temporal resolution: Summary

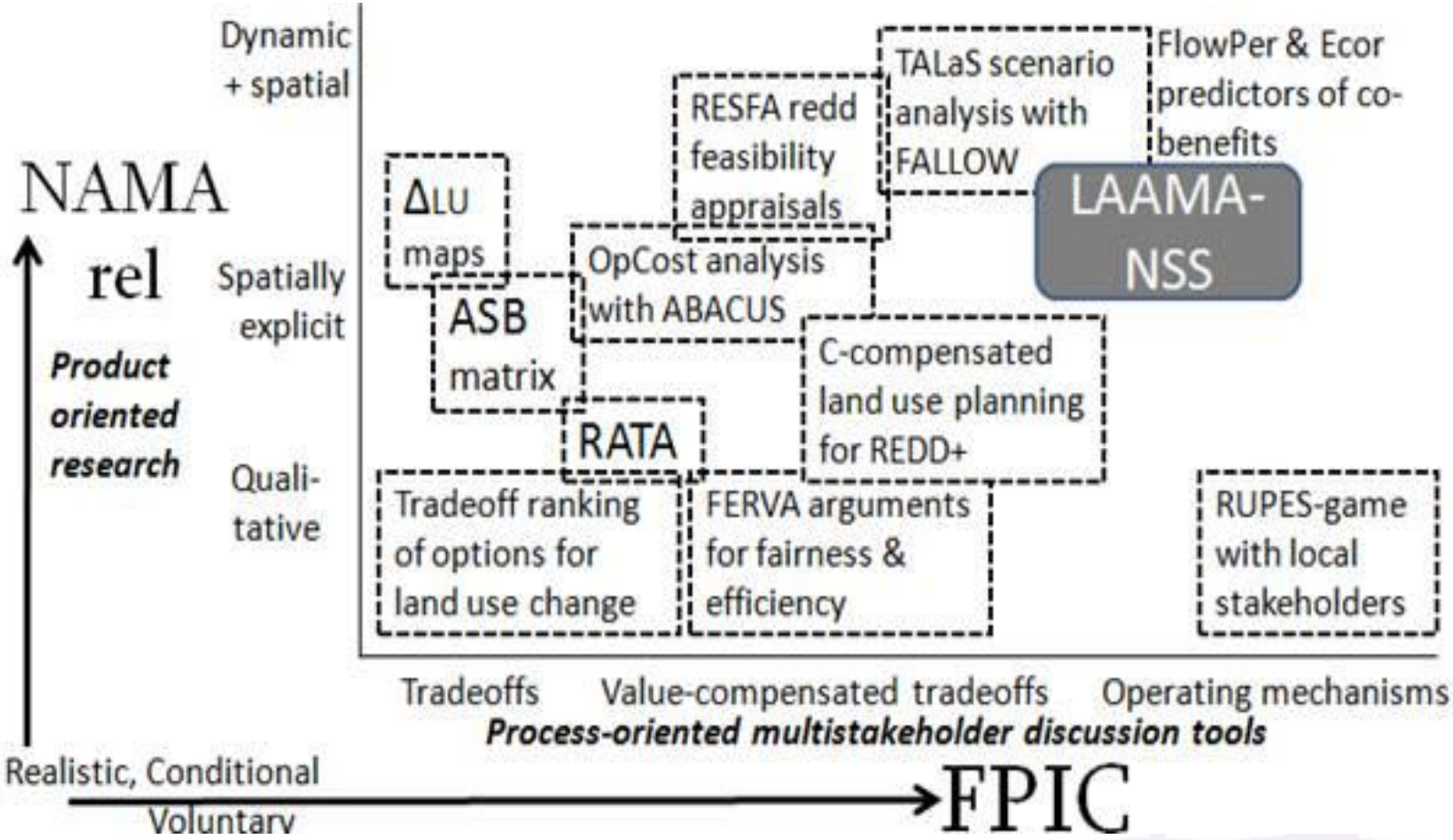
- Reference period matters when setting reference level
- In the most advanced stage of FT, having more frequent assessment does not really make a difference since annual emission has been stabilized
- In the intermediate stage of FT, where annual emissions have declined from period 1 to period 2, rate of declines matters in setting up how much further declines of annual emissions are eligible for compensation compared to BAU rate of decline, otherwise the reduction of emission in the future will be overestimated
- In the early stage of FT, annual emissions have increased from period 1 to period 2; in setting reference line one has to consider the reduction of rate of increase from BAU rate for compensation, otherwise the emission reduction will be underestimated

# Data choice

- Guided by Key source analysis
- Decision trees in GPG 2000 and 2003
  - Tier 1 are simple methods with default values
  - Tier 2 are similar but with country specific emission factors and other data
  - Tier 3 are more complex approaches, possibly models. However should be compatible with lower tiers.



# Accuracy vs Precision (FOR WHOM?)



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# THANK YOU- MERCI –GRACIAS

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