



Considering drivers and data uncertainties for developing reference emission levels

Martin Herold*, Arild Angelsen, Louis Verchot

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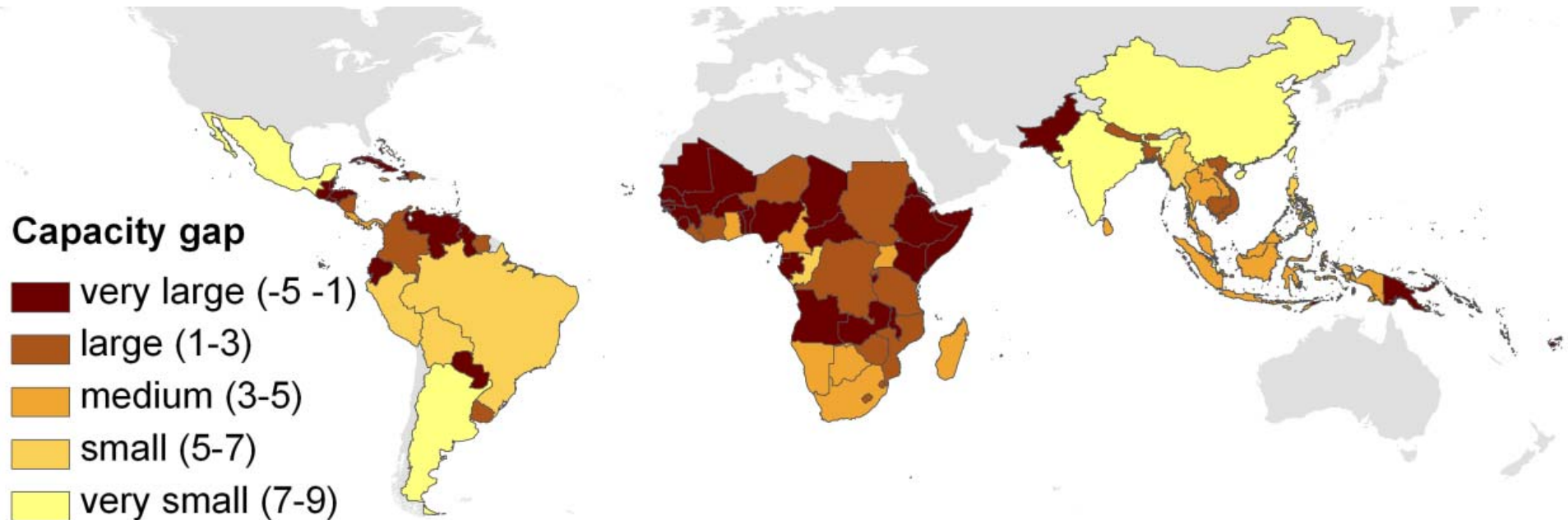


WAGENINGEN UNIVERSITY
WAGENINGEN UR

*martin.herold@wur.nl



Country forest monitoring capacity gaps



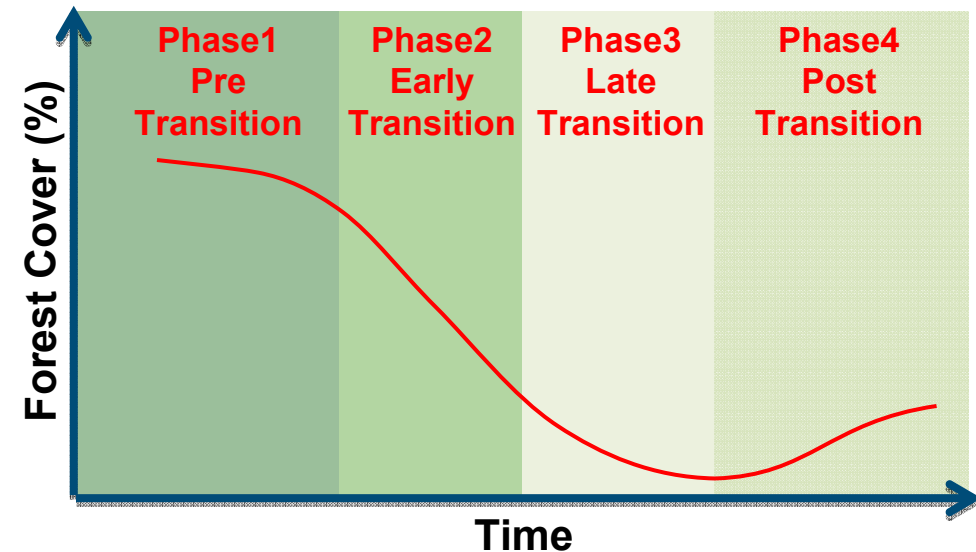
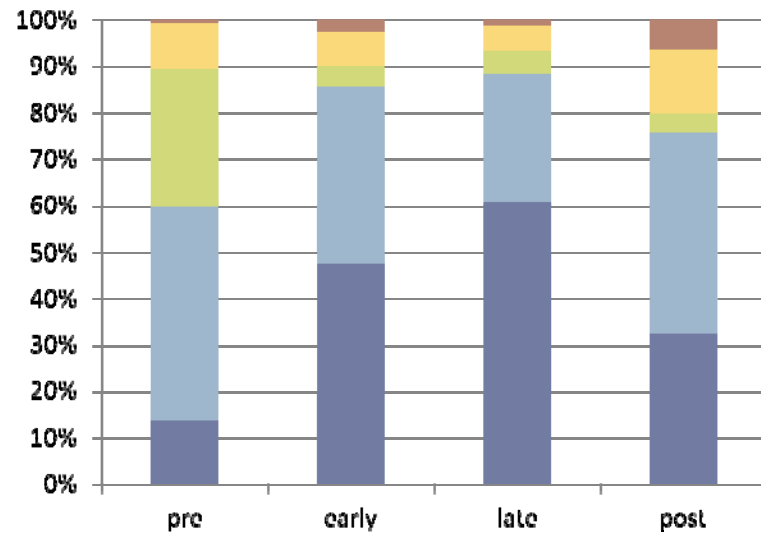
Consideration of factors for capacity assessment:

1. Requirements for monitoring forest carbon on national level (IPCC GPG)
2. Existing national capacities for national forest monitoring
3. Progress in national GHG inventory and engagement in REDD
4. REDD particular characteristics: importance of forest fires, soil carbon, deforestation rate
5. Specific technical challenges (remote sensing)

Source: Herold, 2009 http://princes.3cdn.net/8453c17981d0ae3cc8_q0m6vsqxd.pdf

Changes of Deforestation Drivers

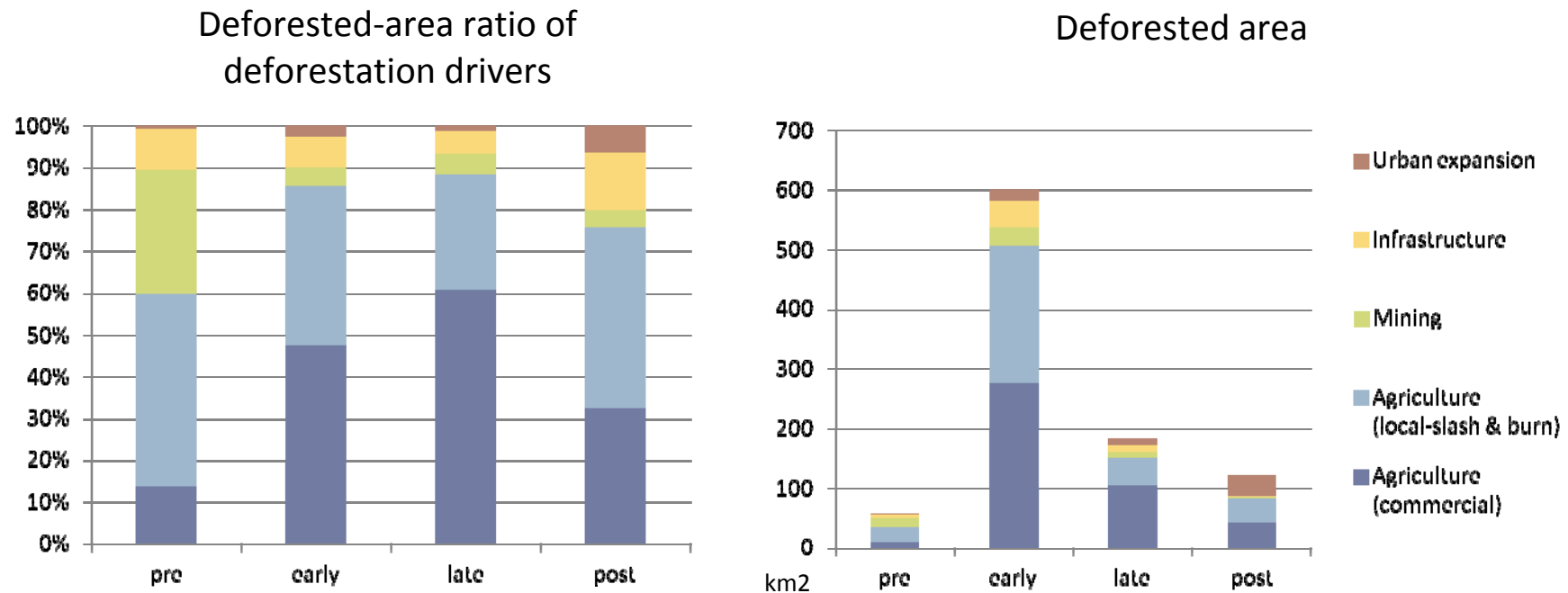
Deforested-area ratio of deforestation drivers



- Synthesizing national data from 46 countries REDD-related data and publications
- Agriculture (commercial) is 45%, agriculture (local/subsistence) 38%, mining 7%, infrastructure 8%, urban expansion 3% and only agriculture make up 83% of total
- Ratio of mining is decreasing and urban expansion is relatively increasing over time

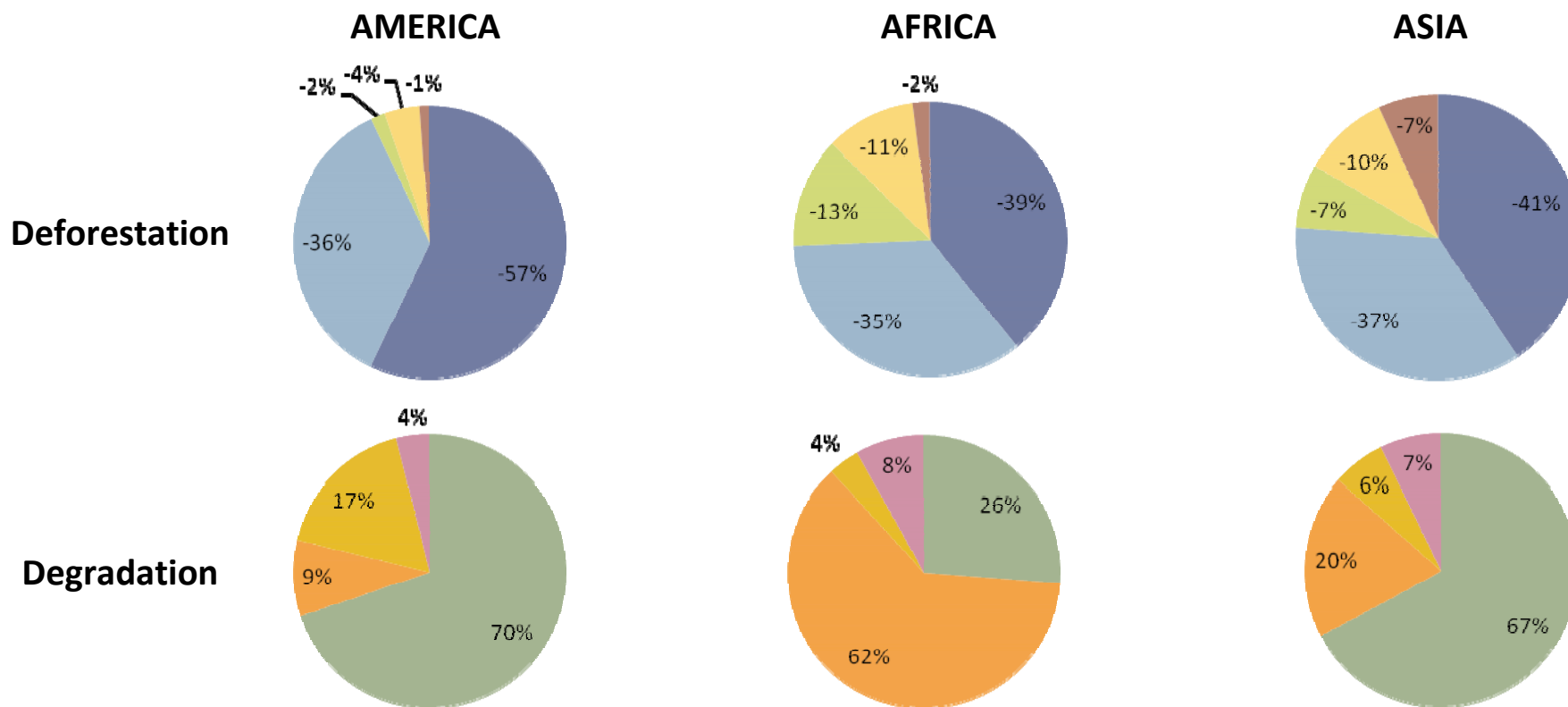


Changes of Deforestation Drivers



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Deforestation/degradation drivers for each continent



Deforestation driver

- Agriculture (commercial)
- Agriculture (local-slash & burn)
- Mining
- Infrastructure
- Urban expansion

Forest degradation driver

- Timber/Logging
- Fuel-wood/Charcoal
- Uncontrolled fires
- Live-stock grazing in forest

Proposing a Tier-ed approach for REL development

1. Guidance suggests to use historical data; adjusted for national circumstances
2. Data driven approach: the less data a country has the more it should rely on data – need to manage uncertainties
3. Why a tier-ed approach:
 - Data availability and quality varies
 - IPCC GPG LULUCF use Tiers as mechanisms to deal with uncertain & incomplete data for estimation on national level
 - Match data availability and uncertainty and allow for broad country participation
 - Motivation to reduce uncertainties over time

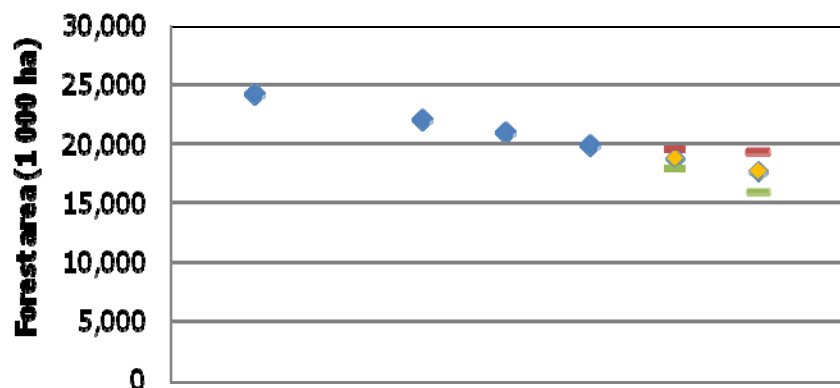


Proposing a Tier-ed approach - TIER 1

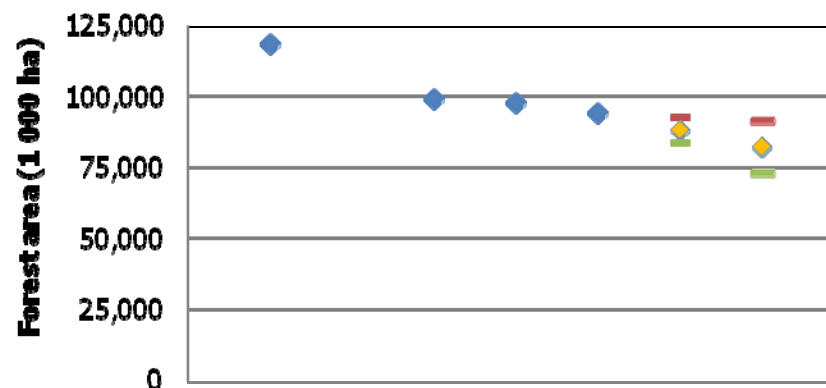
- Simple extrapolation using historical forest area estimates – assumes no change in trend
- May use IPCC approach 1 data (FAO FRA)
- No consideration of driver information
- Importance of consistency and transparency
- Uncertainty: +/- 75% of prediction + accuracy based on available trend data (bias?) – *corridor approach*
- Good for exploration and international comparison
- Can be applied to all developing countries

Tier 1 case for 4 countries using FAO FRA data

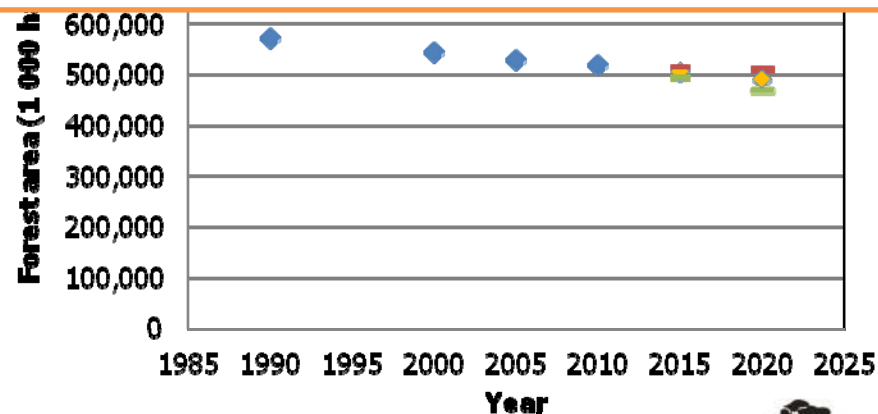
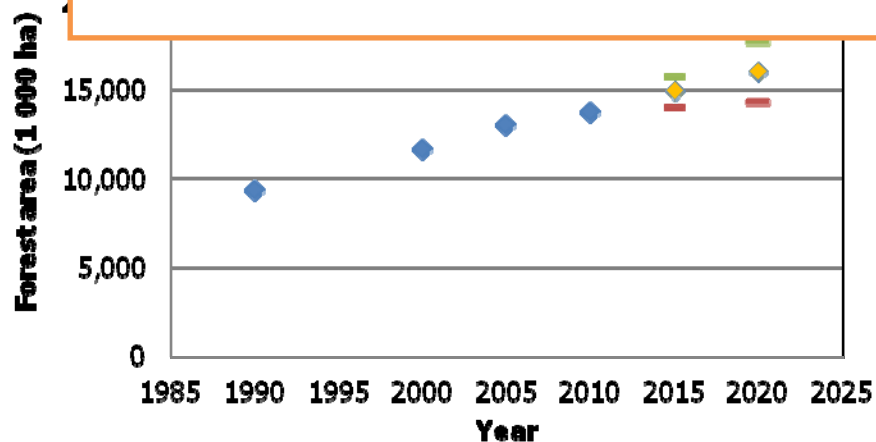
Cameroon



Indonesia

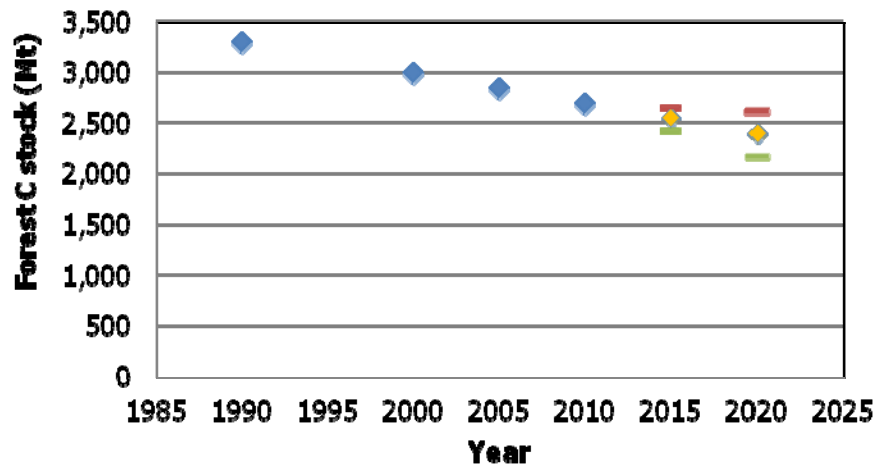


- Analysis using data 86 developing countries (FAO FRA)
- Prediction of future forest area (2010) based on FAO FRA can be explained by 78% using historical data (1990, 2000, 2005)

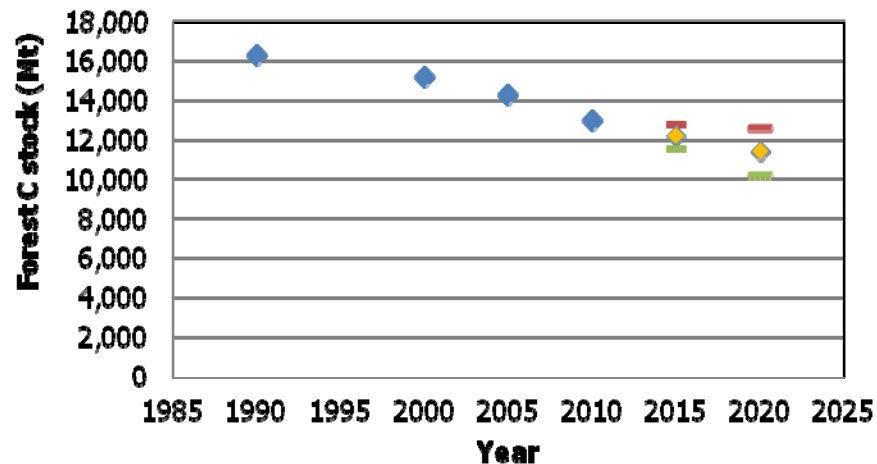


Tier 1 case for 4 countries using FAO FRA data

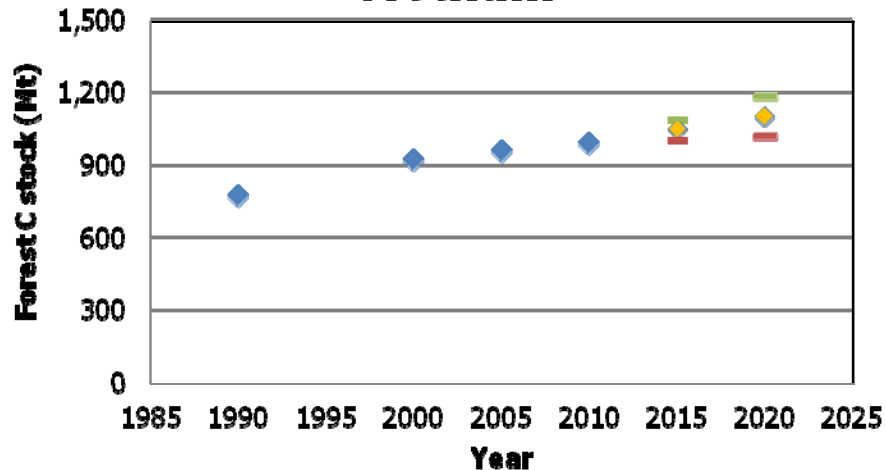
Cameroon



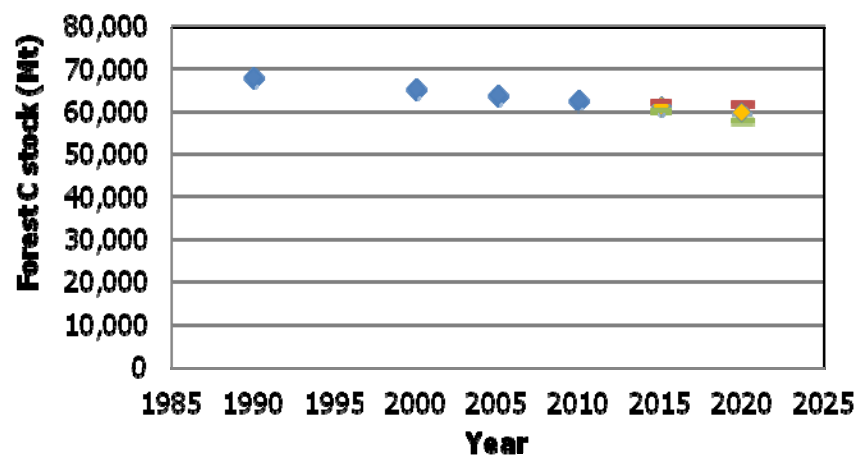
Indonesia



Vietnam



Brazil



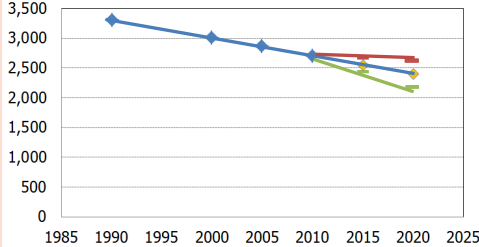
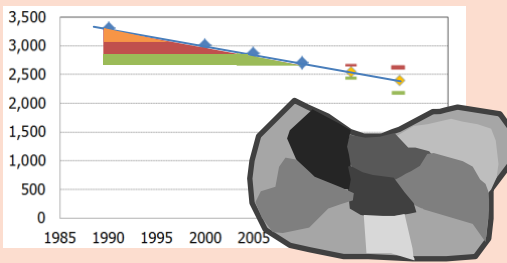
Overview of Tier-ed approaches for RELs

	Tier 1																																
Concept	<table border="1"> <caption>Estimated data from the line graph</caption> <thead> <tr> <th>Year</th> <th>Blue Series</th> <th>Red Series</th> <th>Green Series</th> </tr> </thead> <tbody> <tr> <td>1990</td> <td>3,300</td> <td>3,300</td> <td>3,300</td> </tr> <tr> <td>2000</td> <td>3,000</td> <td>3,000</td> <td>3,000</td> </tr> <tr> <td>2005</td> <td>2,800</td> <td>2,800</td> <td>2,800</td> </tr> <tr> <td>2010</td> <td>2,600</td> <td>2,600</td> <td>2,600</td> </tr> <tr> <td>2015</td> <td>2,500</td> <td>2,600</td> <td>2,400</td> </tr> <tr> <td>2020</td> <td>2,400</td> <td>2,600</td> <td>2,200</td> </tr> <tr> <td>2025</td> <td>2,300</td> <td>2,600</td> <td>2,100</td> </tr> </tbody> </table>	Year	Blue Series	Red Series	Green Series	1990	3,300	3,300	3,300	2000	3,000	3,000	3,000	2005	2,800	2,800	2,800	2010	2,600	2,600	2,600	2015	2,500	2,600	2,400	2020	2,400	2,600	2,200	2025	2,300	2,600	2,100
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Higher tier approaches for REL development

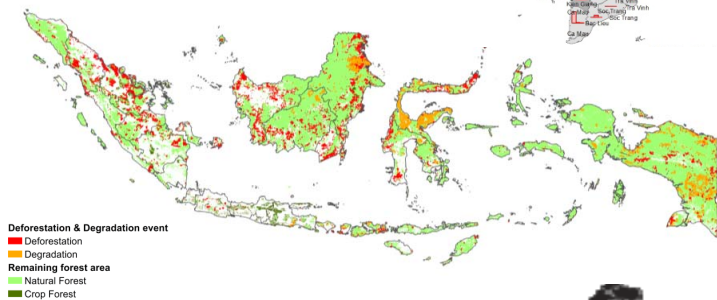
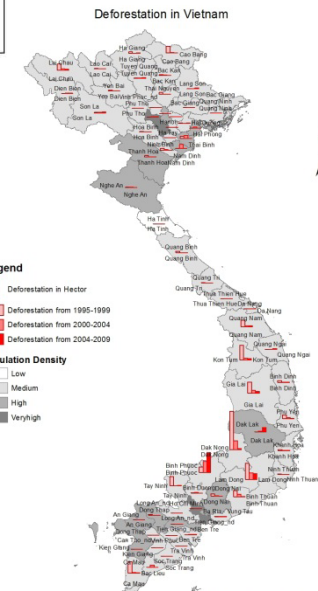
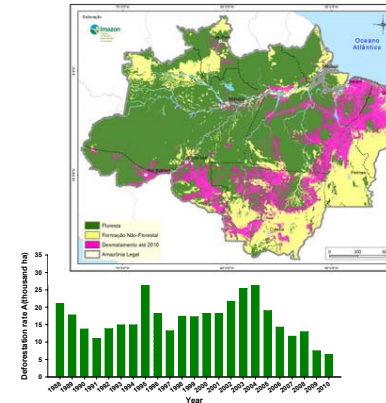
- Retain predictive power of historical trend data but move to more driver-based assessment and predictions
- Include data-driven reasoning for deviations from historical trend (i.e. national circumstances)
- Higher tiers use national data:
 - Deforestation and emissions and understanding of historical processes using data on drivers and activities causing forest carbon change
 - Establish relationships with underlying causes (proxies)
 - Justification why and how deforestation varies from historical trend on the level of drivers and activities

Overview of Tier-ed approaches for RELs

	Tier 1	Tier 2
Concept		
Data on drivers and factors of forest change	No certain driver data available	Drivers on national level known with quantitative data for key activities
Approaches for as guidance for developing reference level	Simple trend projection using national statistics on historical data	Historical data and modelling approach using drivers, administrative/sub-national statistics and relationships with underlying causes
Adjustments/ deviating from historical trend	Simple rules	Tested assumptions for key drivers/activities
Uncertainty assessment	No robust uncertainty analysis possible (+- 75% as default for projection?) to define corridor	Available national data sources should be checked, modelling to accommodate uncertainties and testing using available data

Data sources and sample selection

- Global analysis (86): FAO, WB, IMF & UN (1990 – 2010)
- Brazil: municipal analysis (719) using PRODES+public inst. data (2000 – 2009)
- Vietnam: province analysis (64) from various sources (1995 – 2009)
- Indonesia: district level (372): MOFOR (2000-2009)



Testing deforestation estimation

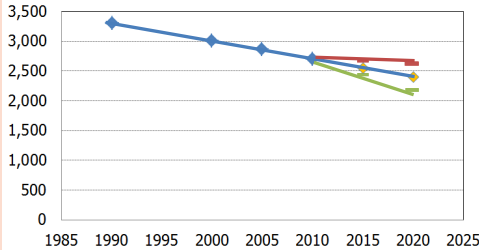
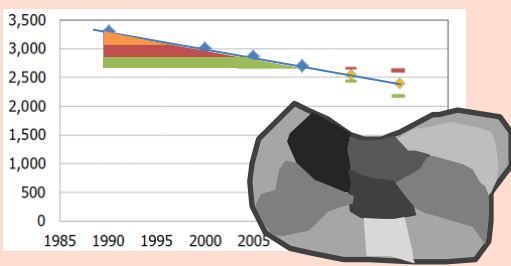
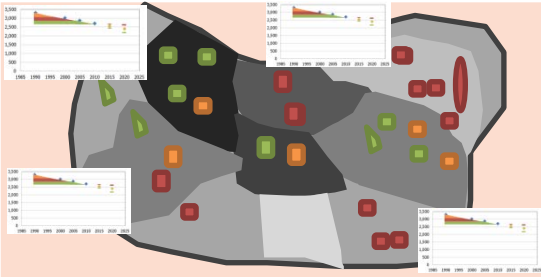
Predictor	Global	Brazil	Vietnam	Indonesia
Historical deforestation	0.7-0.8	0.5-0.8	0.5-0.6 (or higher)	0.1-0.6 (or higher)
Forest cover/ forest transition	?	?	+	+
GDP	?	+	?	na
Agricultural drivers	?	+	?	+

+/-: positive/negative impact on predicted deforestation rates

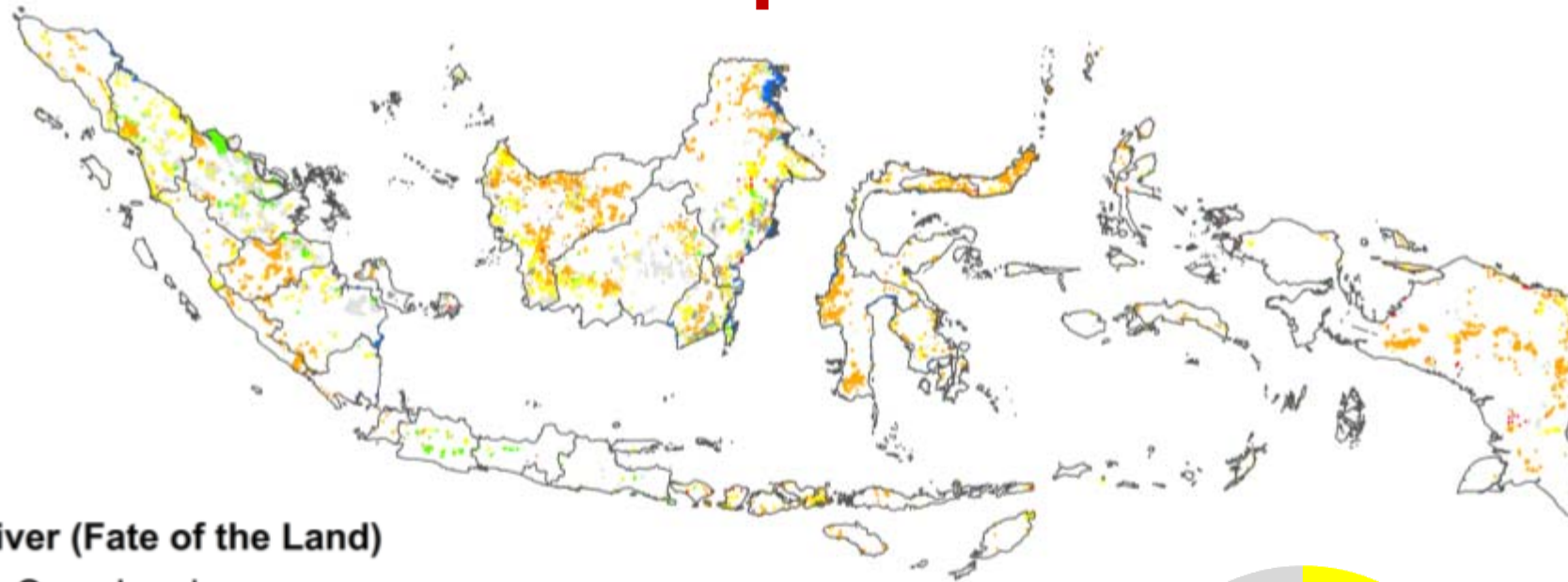
?: no significant results

na: no data available

Overview of Tier-ed approaches for RELs

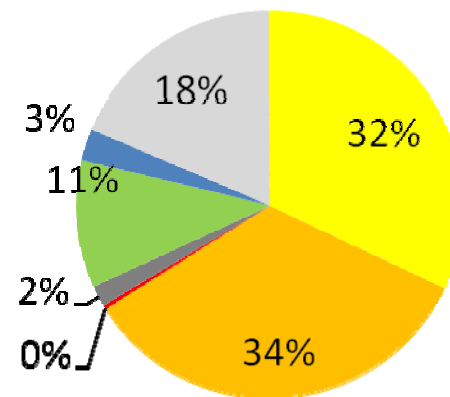
	Tier 1	Tier 2	Tier 3
Concept			
Data on drivers and factors of forest change	No certain driver data available	Drivers in national level known with quantitative data for key activities	Quantitative spatial assessment of drivers/activities causing forest and spatial analysis of factors
Approaches for as guidance for developing reference level	Simple trend projection using national statistics on historical data	Historical data and modelling approach using drivers, administrative / sub-national statistics and relationships with underlying causes	Historical data and spatially explicit modelling and considering both drivers and factors of forest change and understanding of underlying causes
Adjustments/ deviating from historical trend	Simple rules	Deviation assumptions for key drivers/activities	Future modelling by drivers and activities
Uncertainty assessment	No robust uncertainty analysis possible (+- 75% as default for projection?) to define corridor	Available national data sources should be checked, modelling to accommodate uncertainties and testing using available data	Independent quantitative uncertainty analysis possible for data sources and model sensitivity/verification using historical data

Higher tier approaches for REL development



Driver (Fate of the Land)

- Open Land
- Commercial Agriculture
- Local and Subsistence Agriculture
- Urban and Infrastructure
- Mining
- Reforestation / Regeneration
- Aquaculture



Some remarks on the tier-ed approach

- Use of data driven approach but data on forest change, emissions and drivers vary by country
- Proposed Tier 1 provides a starting point for all countries – the less data the more simple the projection approach:
 - Consistency and transparency as key issues
- Higher Tiers:
 - Requires national data on drivers and activities (encouraged by UNFCCC negotiations program)
 - Allow for better understanding, prediction and reasoning for specific national circumstances
 - Rewards/motivation to decrease uncertainties over time
- Need for historical data is essential

Options for monitoring historical forest degradation

Herold et al., 2011, CBM

Activity/driver of degradation	Activity data (on national level)	Emission factors (on national level)
Extraction of forest products for subsistence and local markets (fuelwood and charcoal)	<ul style="list-style-type: none"> Limited historical data Information from local scale studies or national proxies Only long-term cumulative changes may be observed from historical satellite data 	<ul style="list-style-type: none"> Limited historical data Information from local scale studies Emission factors can be measured and consistently for historical periods
Industrial/commercial extraction of forest products such as selective logging	<ul style="list-style-type: none"> Historical satellite data (i.e. Landsat time series) analysed with concession areas Direct approach should be explored for recent years 	<ul style="list-style-type: none"> National forest inventories and harvest estimates from commercial forestry Emission factors can be measured and consistently for historical periods
Other disturbances such as (uncontrolled) wildfires	<ul style="list-style-type: none"> Historical satellite-based fire data records (since 2000) to be analysed with Landsat-type data 	<ul style="list-style-type: none"> Emission factors can be measured today and can be applied consistently for historical periods with suitable activity data

Acknowledgement

- Government of Norway and NORAD for supporting the CIFOR Global Comparative Study on REDD
- UK government (DECC/DEFRA) for stimulating and supporting a study on testing REL methods
- European Space Agency for supporting GOFCC-GOLD and the land cover project office
- FAO FRA for supporting the special study on assessing historical forest degradation