Multi-attribute evaluation of land / forest use in the tropical forest margins

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Summary: Main Issues Relevant to Evaluation

1. Defining terms and the scope of evaluation: beyond protected areas
2. Dimensions of evaluation: importance of emission reductions with sustainable benefits
3. Temporal approach: merits of contemporary, retrospective and prospective approaches
4. Scales: need to build from plot / farm to watershed to regional and national scales

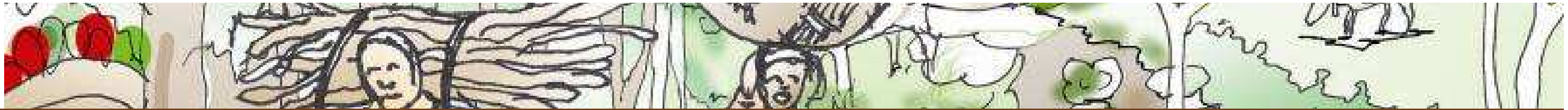
Outline

Introduction to the ASB Partnership for the Tropical Forest Margins

Examples of ASB evaluations:

- tradeoffs
- opportunity costs
- watershed impacts
- drivers of forestry transition

Drawing out implications for REDD evaluation – scope, dimensions, temporal approach, scales



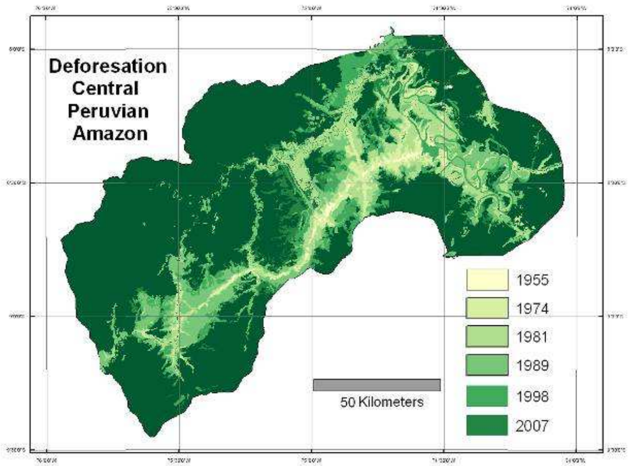
Alternatives to Slash and Burn Consortium (ASB)

- Began in 1994
- Major finance from GEF, Norway, W. Bank, Netherlands
- Global network of research organizations working in sites in the margins of the humid tropical forests
- Coordination by World Agroforestry Centre (ICRAF)

Goal: enhancing the welfare of people living in the tropical forest margins without increasing deforestation or degrading essential environmental services

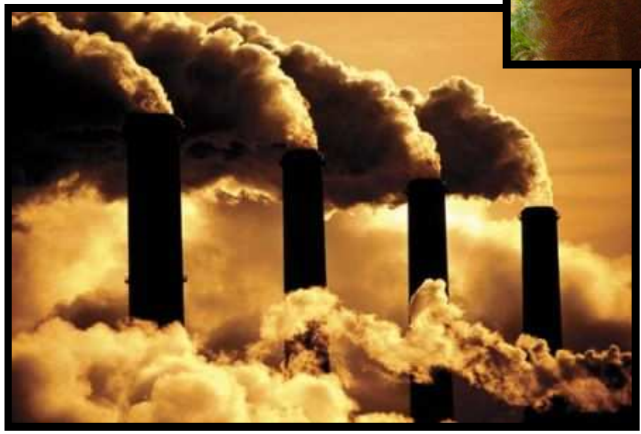
Plot perspective: including a range of forestry, agroforestry and other tree crop systems

Landscape perspective: mosaics of agric. & forests, with lateral flows of biodiversity & water & reverse flows of influence



Regional perspective: UK-sized areas for REDD planning and implementation

Considering objectives of multiple stakeholders



Contemporary Evaluation: using the ASB Matrix to link plot level indicators and land uses

Meta Land Uses	Global Environmental Concerns	Agronomic Sustainability	Smallholders' Socioeconomic Concerns	Policy & Institutional Issues
Natural Forest				
Forest Extraction				
Complex, Multistrata Agroforestry Systems				
Simple Treecrop Systems				
Crop/Fallow Systems				
Continuous Annual Cropping Systems				
Grasslands/Pasture				

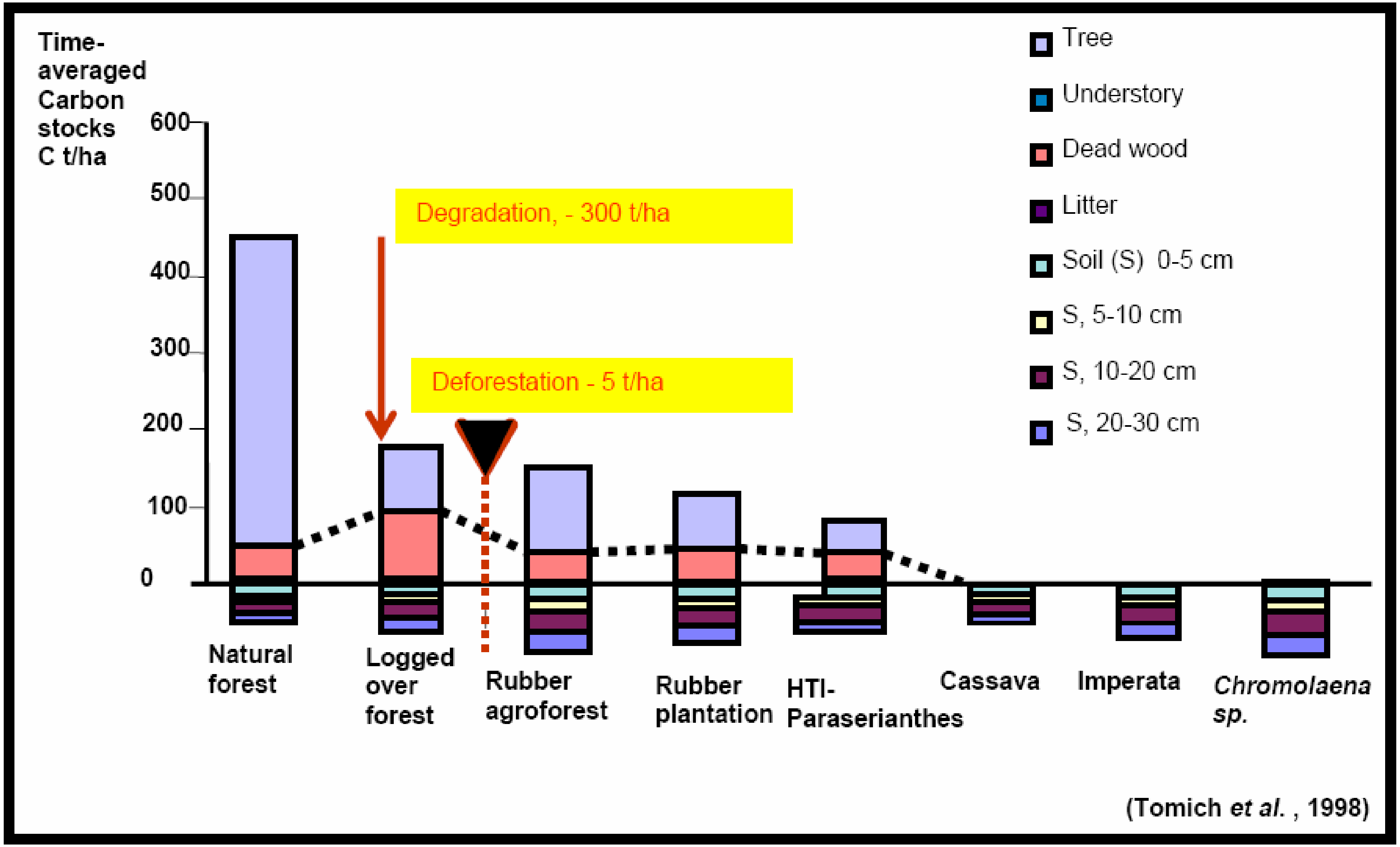
Plot level indicators of global environmental impacts and opportunities for sustainable benefits for local populations

- time-averaged carbon stocks
- biodiversity: V-index of vascular plant functional diversity
- agronomic sustainability of farming practices
- financial returns to land
- contributions to national economy through employment
- local adoptability

Summary Matrix: Sumatra, Indonesia

	GLOBAL ENVIRONMENTAL CONCERNS		*AGRONOMIC SUSTAINABILITY*[b]			NATIONAL POLICYMAKERS' CONCERNS		SMALLHOLDERS CONCERNS / ADOPTABILITY BY SMALLHOLDERS	
LAND USE SYSTEMS	*Carbon storage*	*Biodiversity*	Plot-level production sustainability			*Potential profitability*[c]	*Labor require-ments*	*Returns to Labor*[c]	*Household food security*[d]
	Aboveground tC/ha (time-averaged)[a]	*Aboveground (plants) #species per standard plot*	*Soil Structure*	*Nutrient Export*	*Crop Protection*	*Returns to Land (private prices) $/ha*	*Labor person-day/ha/yr*	*$/ person-day (private prices)*	*Entitlement Path (Operational Phase)*
Forest	306	120	0	0	0	0	0	0	na
Community-based forest management	120	100	0	0	0	5	0.2 to 0.4	4.77	$ + consumption
Commercial logging	94	90	-0.5	0	0	1080[e]	31	0.78	$
Rubber agroforest	79	90	0	0	-0.5	0.70	111	1.67	$
Rubber agroforest with clonal planting material	66	60	-0.5	-0.5	-0.5	878	150	2.25	$
Oil palm	62	25	0	-0.5	0	114	108	4.74	$
Upland rice/bush fallow	37	45	0	-0.5	-0.5	-62	15 to 25	1.47	consumption
Continuous cassava/imperata	2	15	-0.5	-1.0	-0.5	60	98 to 104	1.78	$ + consumption

Figure 1.1 - Land use change and C stock at the ASB site in Jambi, Indonesia, 1995)



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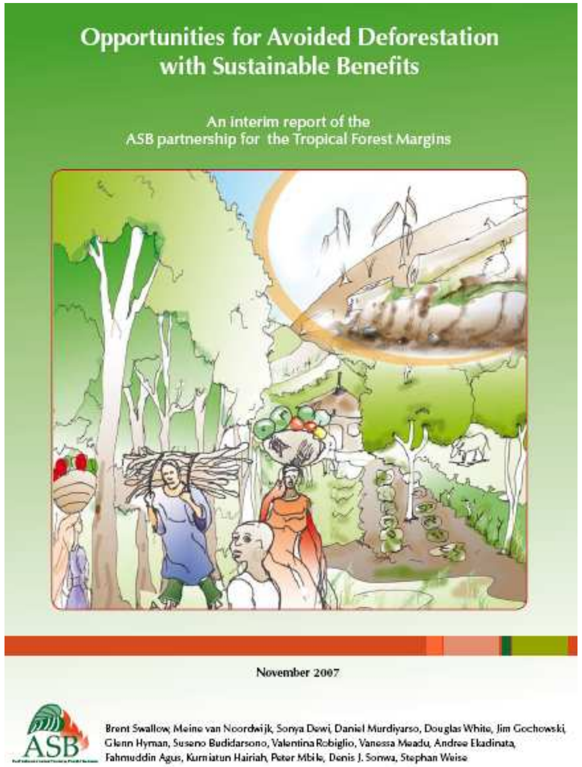
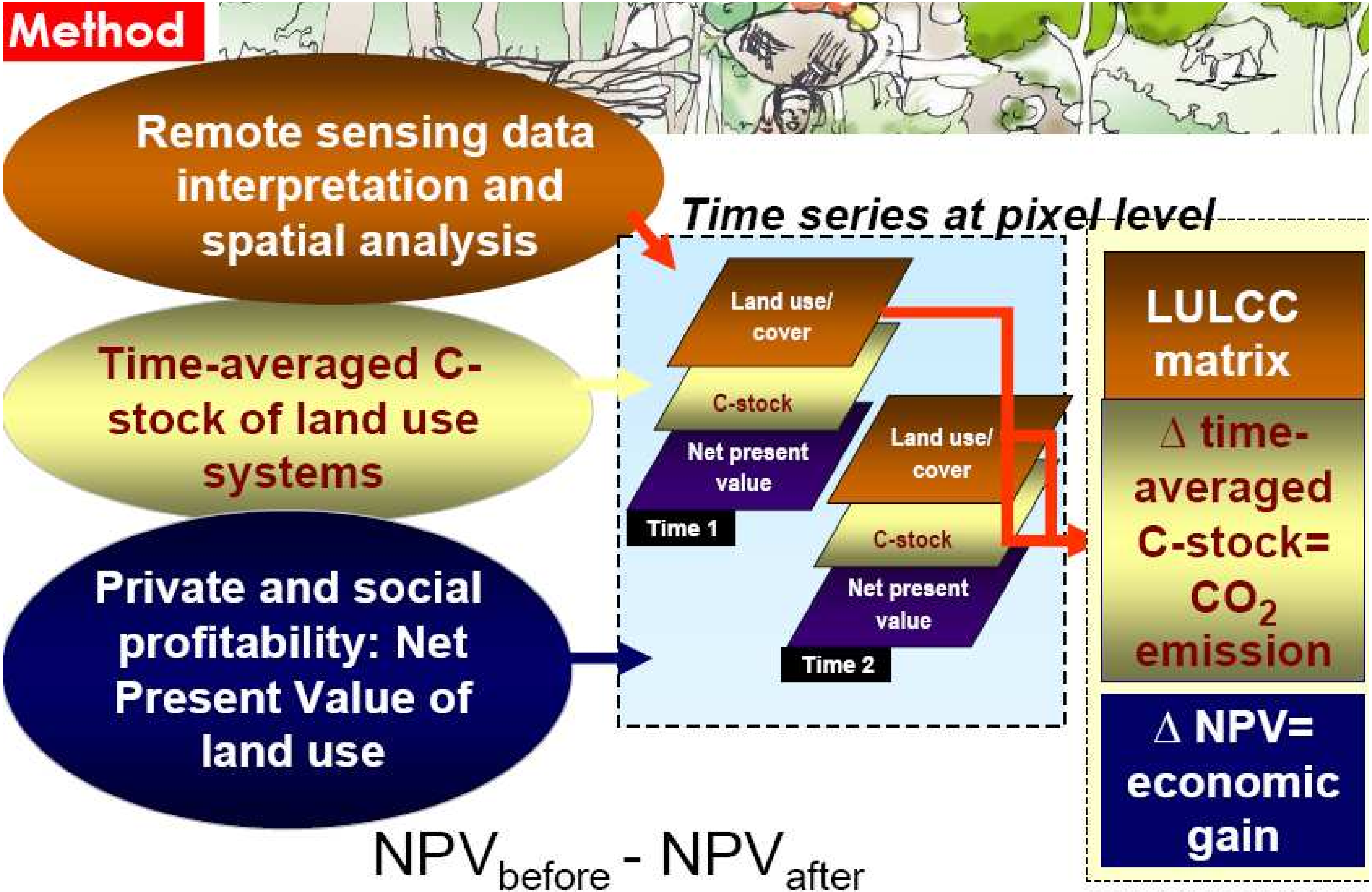
PARTNERSHIP FOR THE TROPICAL FOREST MARGINS

Retrospective evaluation: Opportunity Costs of Emission Reductions through Avoided Land Use Change

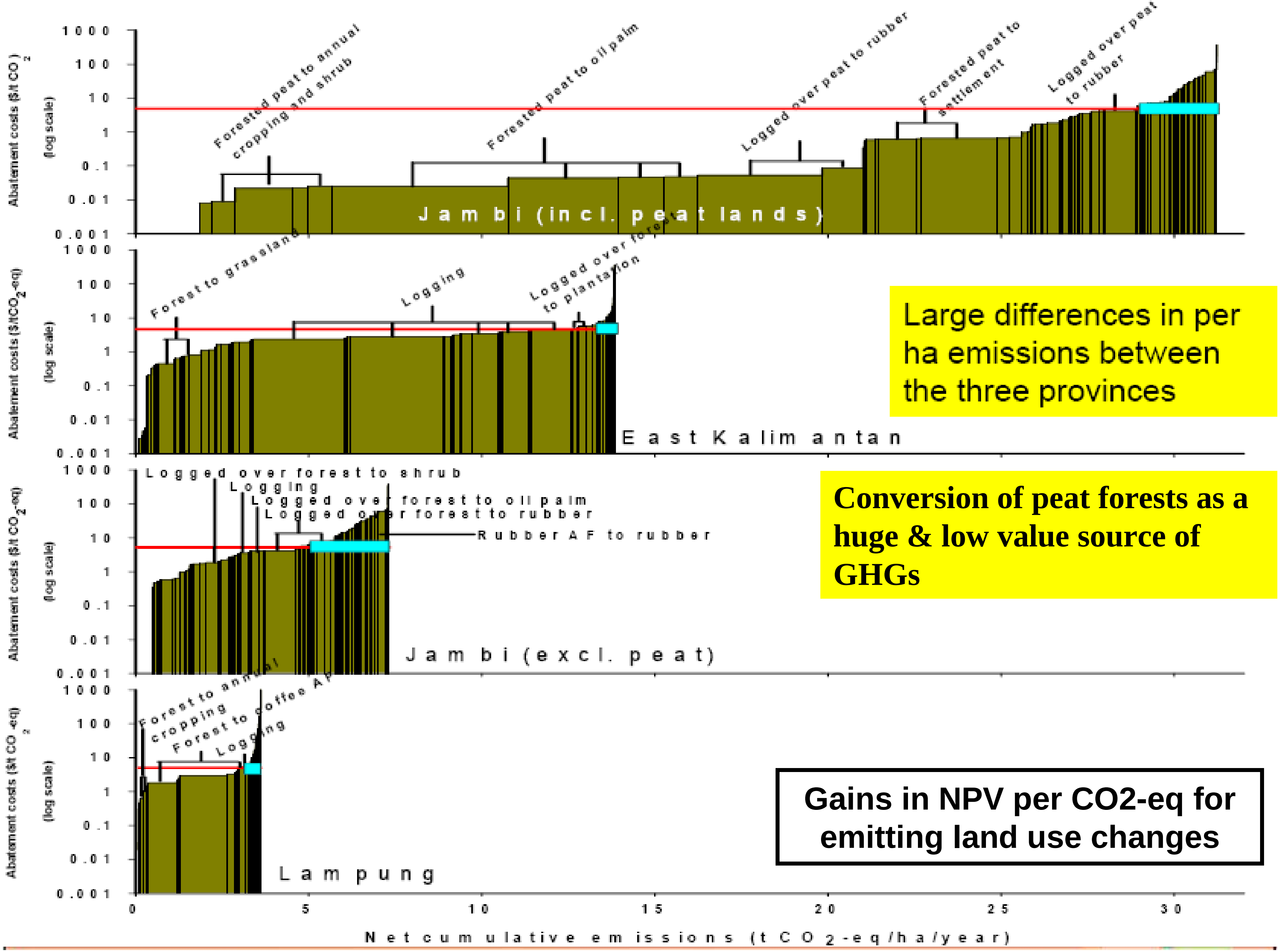


- Estimate opportunity costs of avoided deforestation for large multi-functional landscapes in the humid tropics
- Present results in the form of pollution abatement cost curves for comparison with other (net) emission reduction activities
- Help climate change negotiators and investors at national and international levels to have a more realistic understanding of the potential and challenges of REDD

Method



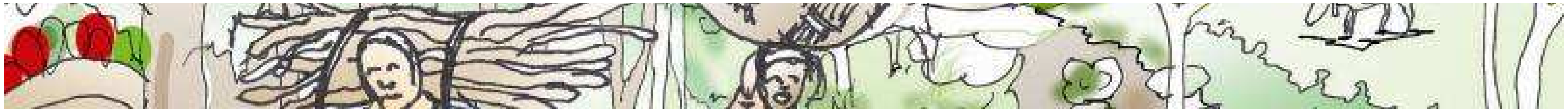
$$3.67 * \frac{NPV_{before} - NPV_{after}}{Cstock_{after} - Cstock_{before}} \text{ in } \$ / t\ CO_2eq$$



Large differences in per ha emissions between the three provinces

Conversion of peat forests as a huge & low value source of GHGs

Gains in NPV per CO2-eq for emitting land use changes

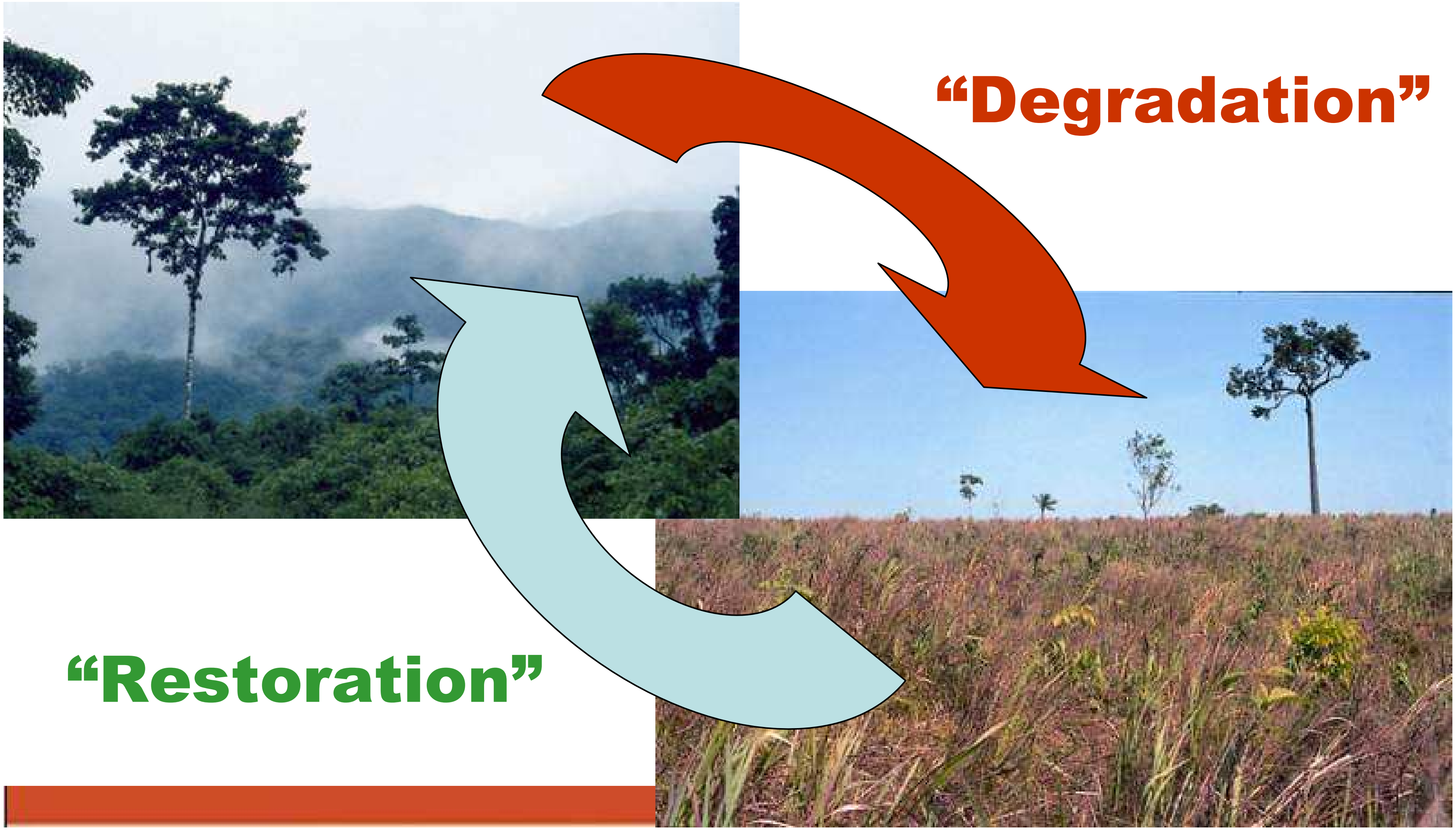


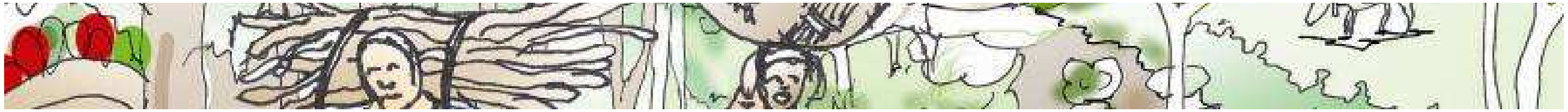
ASB Prospective Evaluations:

- Impacts of deforestation, reforestation and ‘agro-forestation’ on watershed functions and landscape connectivity for biodiversity conservation (ASB8 & 9)

- Effects of commodity prices, policies, population pressure and incentive payments on farmers’ land and forest use decisions (Vosti et al. for Brazil)

Challenges of prospective studies: 1. Direction of change matters





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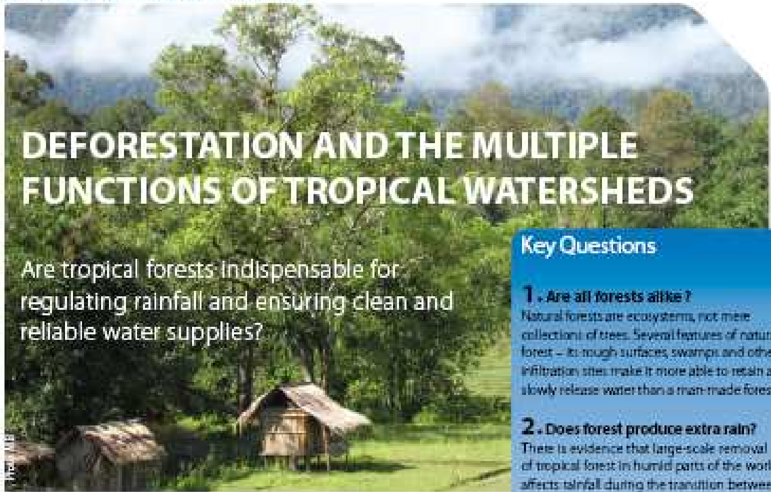
Forests and Watersheds



DEFORESTATION AND THE MULTIPLE FUNCTIONS OF TROPICAL WATERSHEDS

Are tropical forests indispensable for regulating rainfall and ensuring clean and reliable water supplies?

Key Questions

1. Are all forests alike?
Natural forests are ecosystems, not mere collections of trees. Several features of natural forest – its rough surfaces, swamps and other infiltration sites make it more able to retain and slowly release water than a man-made forest can.

2. Does forest produce extra rain?
There is evidence that large-scale removal of tropical forest in humid parts of the world affects rainfall during the transition between rainy and dry season. However, effects on annual rainfall are modest (5-10%) relative to inter-annual variability.

3. Does forest affect annual water yield?
Removal of forest initially increases annual water yield. The type of vegetation that follows and the degree of soil compaction determines the water yield in subsequent years.

4. Does forest reduce flooding?
The presence or absence of forests in upland watersheds is not a key contributing factor to the major floods that draw most policy and media attention. However, there is ample evidence that forest cover does affect timing and intensity of floods in small catchments.

5. Does forest reduce erosion, landslides and stream sedimentation?
Forest conversion to other land uses without proper soil conservation measures increases hillslope soil erosion and the risk of shallow landslides.

TROPICAL FORESTS serve several major 'watershed functions' essential to human survival and local livelihoods. They hold soil in place and help maintain the productivity of the land. They also regulate the quantity and timing of water flows, control sediment loads and protect water quality. Cutting down tropical forests undermines these valued functions.

But hydrological patterns on the land vary widely from one catchment area to another and between sites or plots within the same catchment. They depend not only on the extent of natural tree cover, but also on a host of other factors. These include rainfall, topography (especially slope), geology, soil type, the area and distribution of food and forage crops, leaf litter over soil, the extent of compaction from livestock and machinery, and the presence of impervious surfaces such as roads and buildings. Some non-forested landscapes have no major problems with watershed functions - so strictly speaking they don't need 'forest' for their waterflows.

Thus, a web of human and other factors determines how land will process rainfall and whether the net result will present hazards for local people. To blame local water-related hazards solely on deforestation, while ignoring other key parameters, is to severely limit one's options in the search for balanced solutions. Reforestation schemes, an area in

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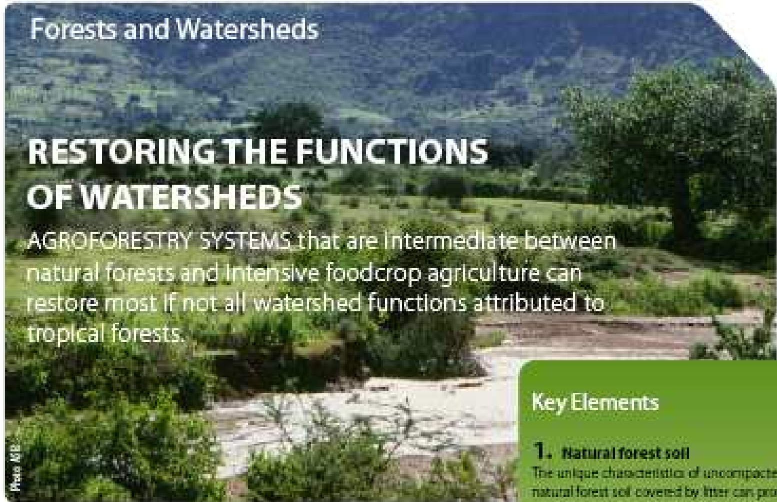


Forests and Watersheds

RESTORING THE FUNCTIONS OF WATERSHEDS

AGROFORESTRY SYSTEMS that are intermediate between natural forests and intensive foodcrop agriculture can restore most if not all watershed functions attributed to tropical forests.

Key Elements

1. Natural forest soil
The unique characteristics of uncompacted natural forest soil covered by litter can provide a point of reference for restoring watershed functions.

2. Rapid degradation - slow recovery
It is important to correctly identify what type of degradation prevails in a given location before formulating solutions predicting the timeframe for potential recovery.

3. Agroforestry solutions
Agroforestry systems combine the use of trees and other elements of the natural forest with areas dedicated to intensive food crop production providing at the same time environmental services and better livelihood opportunities for larger populations than could be supported by natural forests.

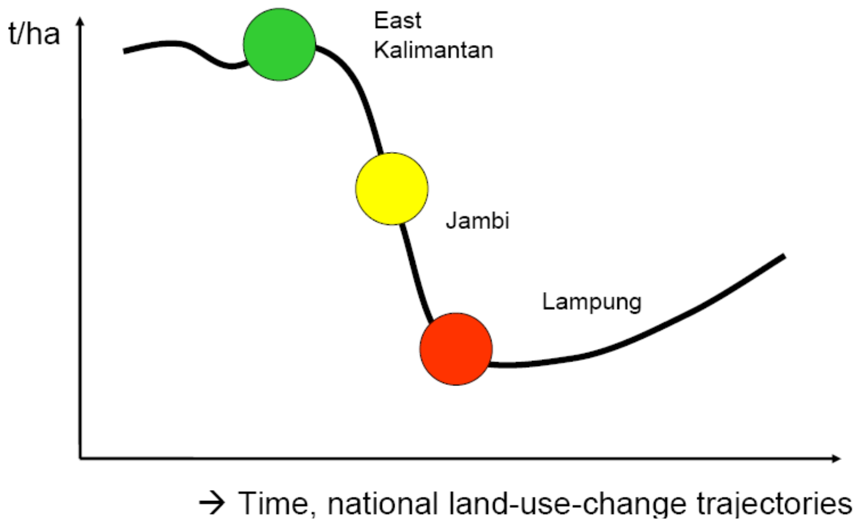
4. Modeling tools
ASB and its partners have developed a set of modeling tools to improve decisions about the adaptation of agroforestry to a range of watershed contexts, at spatial scales from plot to river basin.

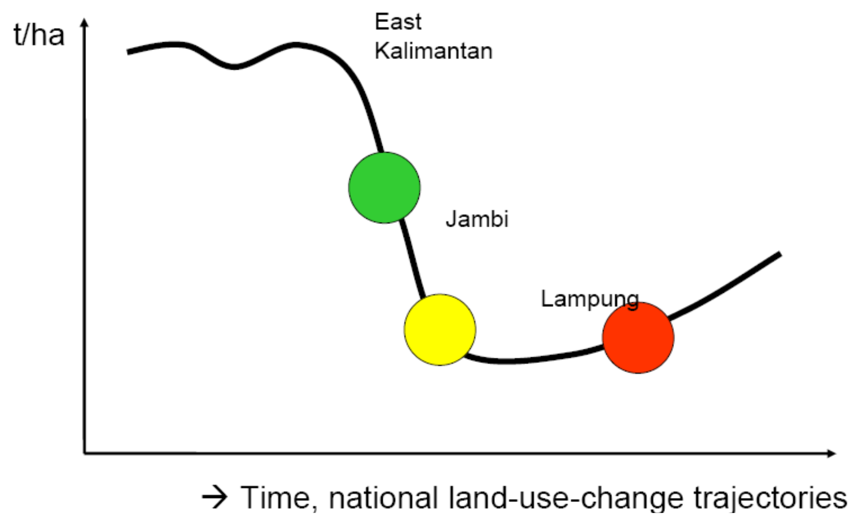
Watershed functions are determined by a complex mix of natural factors – quantity and timing of rainfall, lay of the land, geology, soil types, and so on. But is should be equally clear that human interventions on the land can also affect those functions. For example, if water cannot percolate deep into the ground in some areas because the soil has been compacted by livestock or machinery, then stream flow during the dry season may be adversely affected. Or, if too much space is devoted to roads and paths, which serve as rapid drainage channels, then excessive rain run-off may cause flooding during the rainy season or block culverts and irrigation channels with sediments. In addition, the proportion, species mix and distribution of vegetation – whether field crops or trees planted by land users – will also affect water yield and patterns of flow.

1. Natural forest soil

Natural forest soil has a protective litter layer (brown cover), is subject to minimal compaction, contains a wealth of macro and microorganisms that structure the soil, and supports the constant production and decomposition of tree roots. The resulting high porosity of forest soil enables it to absorb and distribute large amounts of water. Some is consumed by trees and other plants, some flows laterally offsite through the soil, and some penetrates to aquifers. The considerable surface roughness, or natural unevenness, of the forest landscape allows for temporary storage of surface water. And the absence of man-made (typically straight) chan-

Challenges of prospective studies: 2. Forestry transitions occur, with different drivers in different places



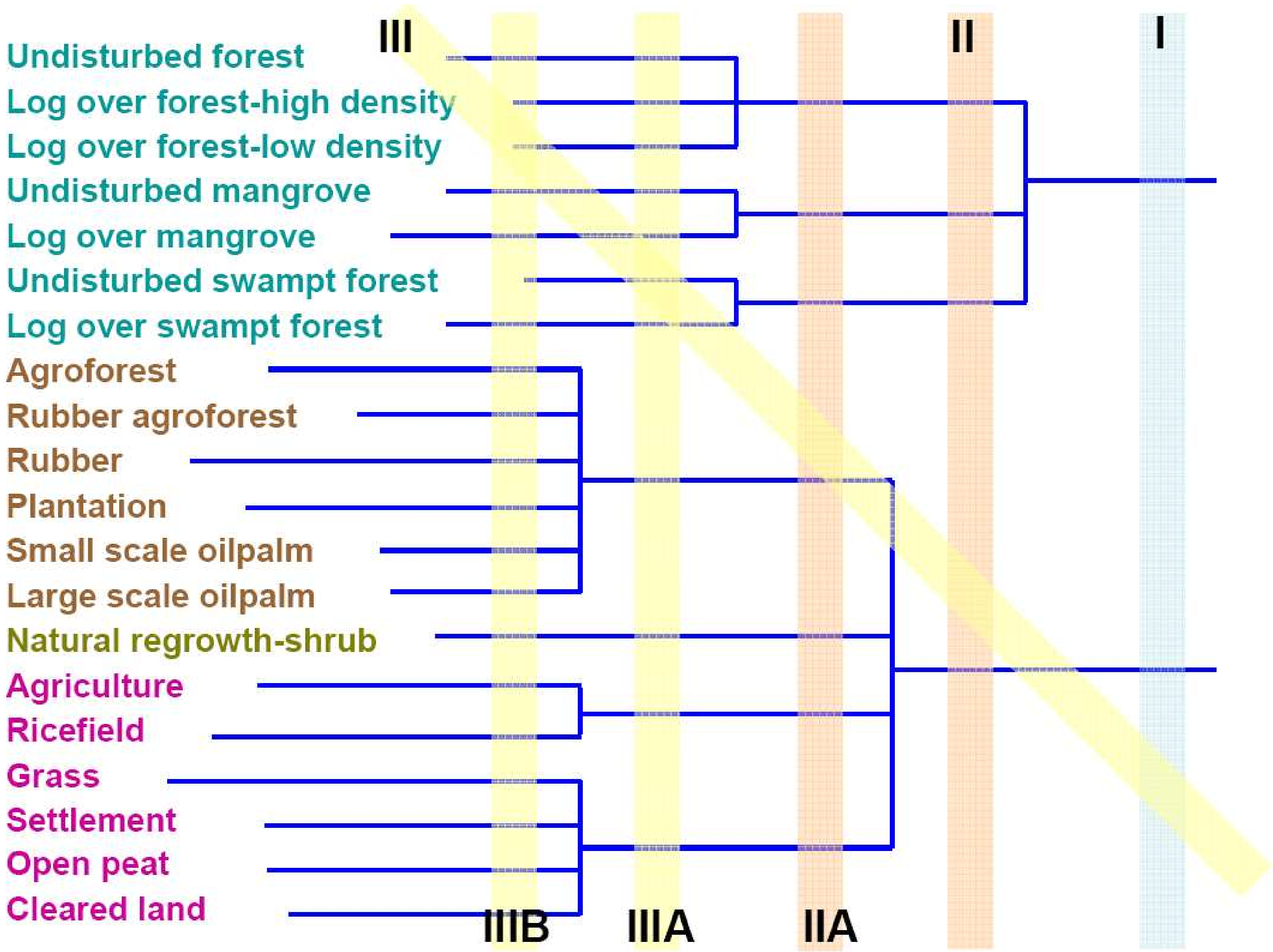


1990 → **2005**

Summary: Main Issues Relevant to Evaluation

1. Defining terms and the scope of evaluation

a. Benefits of multiple categories of forests and agroforests for understanding carbon dynamics


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

Summary:
Main Issues Relevant to Evaluation

1. **Defining terms and the scope of evaluation**

b. **Need demonstration projects with sufficient scope to internalize the most important sources of leakage**

Back to the Summary: Main Issues Relevant to Evaluation

2. <u>Dimensions of evaluation:</u> minimum of emission reductions (ER) with sustainable benefits (SB)

- Real ER necessary to mitigate GHG emissions
- Real SB (current income, future opportunity) to ecosystem stewards necessary for fairness and to minimize risks
- Most other dimensions (eg biodiversity, watershed function) more location-specific and difficult to measure

Back to the Summary: Main Issues Relevant to Evaluation

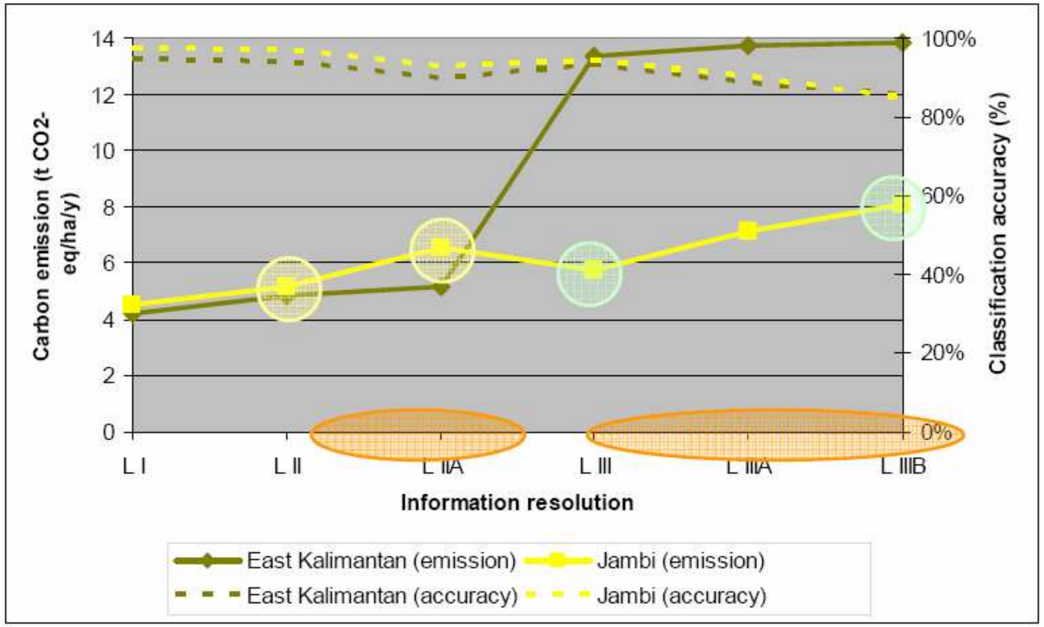
3. Temporal approach: merits of contemporary, retrospective and prospective approaches

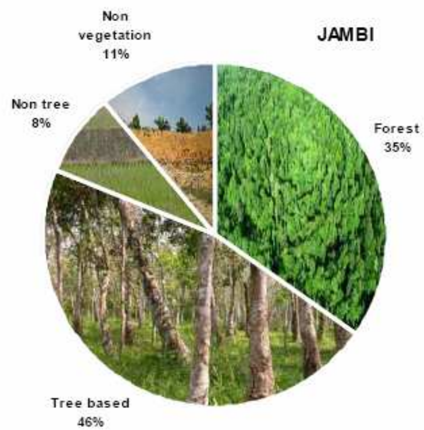
- Many prospective studies build upon ASB's contemporary and retrospective analyses
- Prospective studies necessary for understanding effects of new commodity price regimes and the productivity dilemma

Back to the Summary: Main Issues Relevant to Evaluation

4. Scales: need to build from plot / farm to larger scales. Important information lost with coarse categorization.

Jambi





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