Avoided Deforestation with Sustainable Benefits: A case study of potential in 3 provinces in Indonesia

REDD: Urgent and not easy, but cost effective?

- The release of carbon into the atmosphere from forest conversion and exploitation is estimated to be 18% of global carbon dioxide emissions, and thus a significant contributor to the increase of atmospheric CO_2 (and other greenhouse gas) concentrations that is linked to global climate change (IPCC, 2007);
- If the recent estimates of total emissions of 3 Giga ton per year for Indonesia are true, per capita emissions are twice that in France and 30% above those in the UK or Germany;
- The Clean Development Mechanism (CDM) of the Kyoto Protocol supports some forms of afforestation and reforestation, but no projects have been approved for Indonesia; it excludes activities that protect existing carbon stocks and forms of 'avoided deforestation';
- There probably is a large potential in Indonesia to reduce emissions from agriculture, forestry and other land uses (AFOLU) and to generate both local and global benefits; the scope for Reducing Emissions from Deforestation and Degradation (REDD) will depend on the definitions used;
- Indonesia has an institutional and a vegetation concept of forest, and therefore includes "forests without trees" and "non-forests with trees"; mixed and multristrata agroforestry (intermediate land uses) can store significant quantities of carbon, maintain flows of ecosystem services, generate good economic returns and reduce pressure on remaining forest resources;
- Mechanisms for reducing carbon emissions through avoided deforestation will have to maintain national sovereignty, and to balance between fairness (incentives for long term protection) and effectiveness (demonstrated reductions of emissions on the short term);
- Before the institutional challenges of REDD mechanisms are tackled, we need to know the potential cost effectiveness; if current emissions would lead to large economic benefits, emission reduction would be difficult, if not, incentive systems will be feasible.

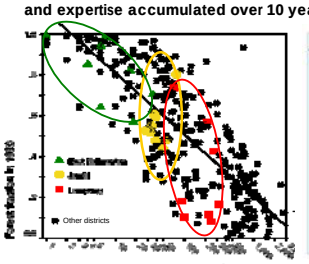
Abatement cost analysis as indicator of REDD feasibility

Abatement costs reflect the opportunity costs of activities that reduce emissions and have been analyzed for the energy sector, but not yet for AFOLU emissions in tropical forest margins. Such data can show:

- What volume of emission reduction could be possible at what cost;
- The 'easy wins' and threshold cases depending on investment in emission reduction, helping a country to integrate their economic growth with land use changes, local, national and global needs;
- Provide a basis for negotiating 'fair' compensation, that includes real benefits and transaction costs.

Case study

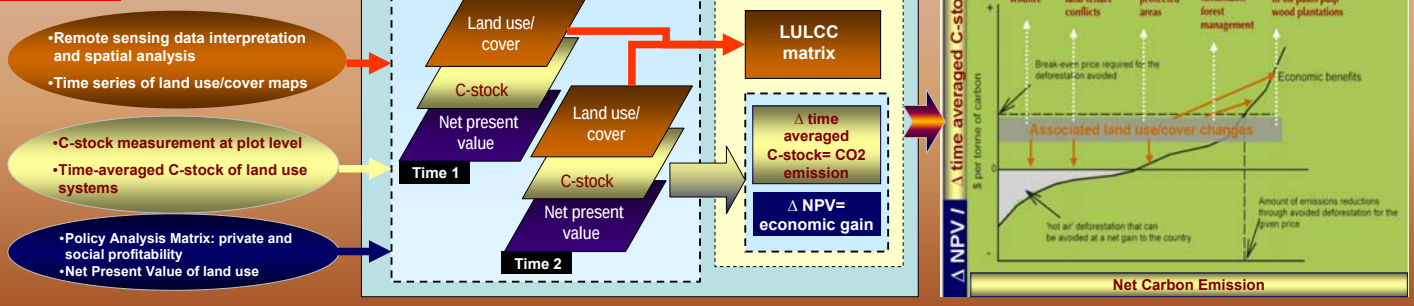
- Wall-to-wall coverage of three provinces: East Kalimantan, Jambi, Lampung;
- Between them most of the forest/agriculture/agroforestry transition stages are represented: East Kalimantan is in the early to medium stage of forest degradation, Lampung the most advanced degradation stage (early recovery?), Jambi is in between;
- The study period covered 1990 to 2005 with 2000 as an intermediate step;
- Land use/cover maps were interpreted from Landsat TM and ETM imageries using a hierarchical classification technique. Ground-truth data were compiled from previous studies; more than 4000 points were used to assist with the classification;
- More than 2000 plot level C-stock measurements were collected in previous studies, with some additional secondary data;
- Economic analysis was based on the Policy Analysis Matrix approach and used data and expertise accumulated over 10 years.



Scatter plot of population density vs forest fraction at district level; the case study represent the full range of forest cover in Indonesia

Case study area based on land use studies between 1993 and present

Method



Four main activities are needed for such abatement cost analysis:

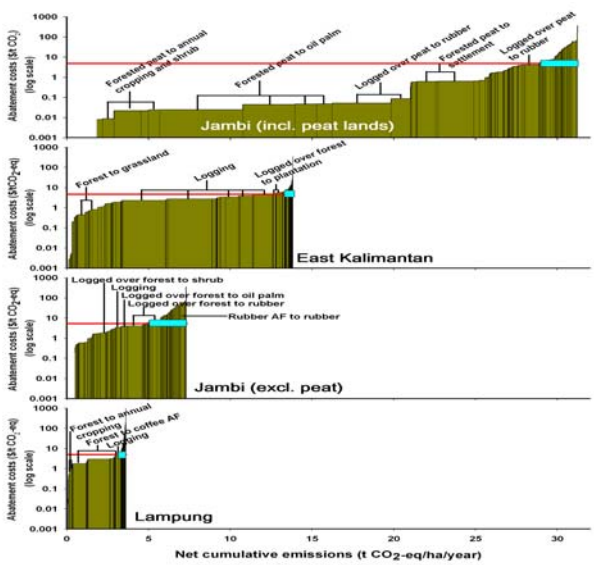
- Automatic object-based, hierarchical classification and fieldwork to collect groundtruth data to help interpreting the resulting maps. Land use/cover change analysis is conducted in the landscape of interest and at the relevant study period;
- Time-averaged C-stock at plot level are derived from C-stock measurement in the field for each of the main land uses and its rotation system;
- Economic analysis on each of the land use system is conducted to get private and social NPV;
- Upscaling and integrating pixels, plot and land use system to the whole landscape.

Three segments in the abatement cost curve:

- Fraction of emissions that could be avoided at negative total economic costs, as they generate net economic costs at the societal level;
- Emissions associated with moderate economic gain that could be offset at feasible levels of financial transfer;
- Emissions associated with substantial economic gains that can not be offset under current carbon prices;

Ranking of land use change based on the emission/economic benefit tradeoff.

Results and discussion



- The three provinces jointly cover 16.2% of the land area of Indonesia, and ranged in forest cover from 14% to 85% in 1990 and from 8% to 79% in 2005, while the average for the country was 55% and 36%, respectively;
- Patterns of land use/cover changes varied among the three provinces. East Kalimantan was dominated by logging from natural forest, while in Jambi forest (undisturbed and logged-over forest) conversion to perennial crop of high economic value, mostly oil palm and rubber, dominated. Forest opening and conversion for agricultural purposes and settlements are associated with transmigration. Lampung has very little forest left, mostly in protected areas; illegal logging, often followed by coffee planting, within the heart of the national park and the border dominated CO_2 emissions here;
- Total emissions for the 3 provinces, of 400 Mega ton CO_2-eq/year from 16% of the land area support the high estimate (3 Giga ton) for Indonesia as a whole and its 3rd rank as global emitter
- A considerable part of the emissions (excluding emissions from peatland) was linked to negative and low economic gain (< 1 $/t CO_2-eq), i.e., 13.7%, 19.6% and 6.2% respectively from East Kalimantan Jambi and Lampung; the largest share was associated with economic gains less than 5 $/ t CO_2-eq emitted;
- A fraction of 7.7%, 36.4% and 17.8% of the emissions from the three provinces was linked with 'real' economic gains (>5 $/t CO_2-eq);
- The lower end of abatement costs is mostly due to *Imperata* grassland taking over degraded forest area, perhaps due to fire, irresponsible logging, abandonment of failed timber or oil palm plantation after logging. In East Kalimantan a large area is associated with these changes;
- Jambi, with 14% of its area is on peatland, the total annual emission per ha is almost five times larger if we include emissions from peat; most emissions from peatland bring less than 5 $/t CO_2-eq in economic return;
- Comparing the periods of 1990 to 2000, and 2000 to 2005, we found different trends among the three provinces. East Kalimantan recently emitted twice as much CO_2-eq/ha/y as in the earlier period, Jambi recently emitted 75% from the earlier annual rate and Lampung emitted similar amounts in both periods. If emissions from peatland is included, Jambi's recent emission was reduced to one fifth of the earlier period. Most of the peatland emissions in Jambi in the earlier period were due to conversion to oil palm plantation;
- There is an ample opportunity for global co-investment in land use types that reduce emissions and provide sustainable benefits to the local economy. For the three provinces alone, 376 Mt CO_2-eq emissions per year can be abated with cost up to 5$ per ton; this leaves room for transaction costs and real benefits for all given recent prices of CO_2 emission reduction certificates at 23 € / t CO_2eq.
- Effective AFOLU emission reduction in Indonesia will require clarity of land and tree rights, transparency of forest management integrated with rural development and spatial planning. There is huge potential.

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