Exploration of Landscape Dynamics in the Buffer Area of Lamandau River Wildlife Reserve and its neighboring area, Central Kalimantan, using the FALLOW model

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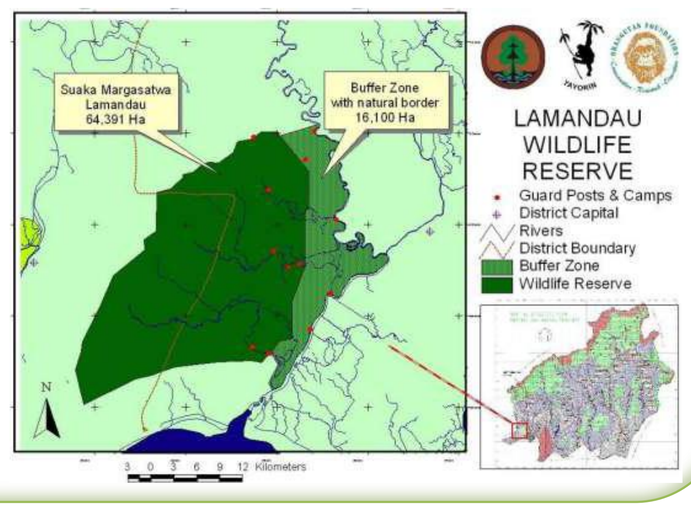
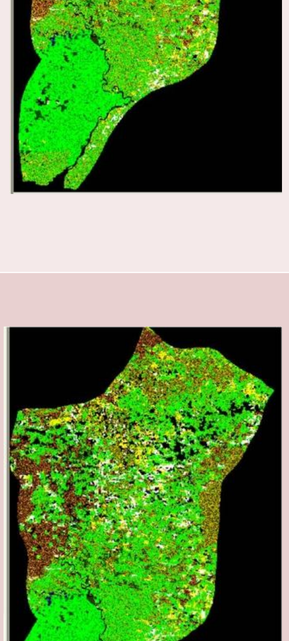
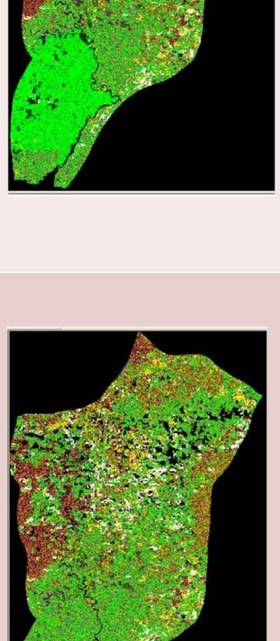
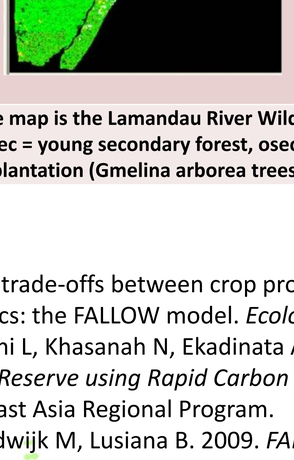
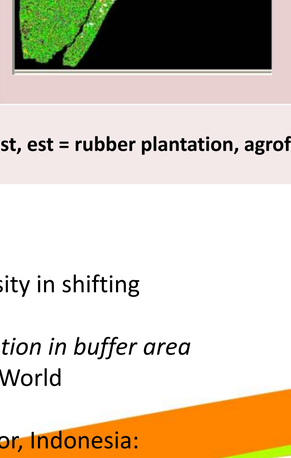
Background

The buffer area (23 600 ha) to the east of the Lamandau River Wildlife Reserve (LRWR) in Kota Waringin Lama subdistrict, Central Kalimantan, is a logged-over production forest that was earmarked for conversion to non-forest use but is now a candidate target for forest landscape restoration as part of early action on REDD+.

As part of a feasibility study, the FALLOW (Forest, Agroforest, Low-value Land Or Waste?) modelling method developed by Van Noordwijk (2002) and Suyamto and others (2009) was used for exploring future landscape mosaics and the consequences of such for the economic and ecological performance not only of the buffer area but also for the LRWR and the two sub-districts of Arut Selatan and Kota Waringin Lama. The wider area study can help us understand the issues of leakage and additionality in relating human use of the landscape to carbon-stock changes.



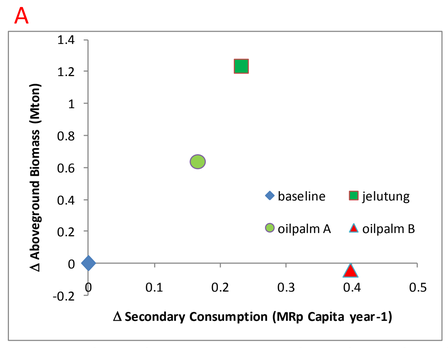
Scenario	Brief description	Final land-cover mozaic at year 30	Scenario	Brief description	Final land-cover mozaic at year 30	Legend
Initial map (year 0)			**Logging**	In this scenario, logging was made de facto possible in all forestry plots except the forest reserve (i.e. LRWR and its buffer area). This scenario represents the abolishment of current illegal logging control and is included to test the short-term economic benefits foregone by current forest protection policies.		
Baseline (current trends)	Five commodities are of a primary concern for farmers in the area: rubber (plantation); timber (Gmelina arborea); rubber agroforest; rice as agriculture; and *jelutung* (Dyera costulata) as non-timber forest product (NTFP) and no logging activity.		**Oil Palm A (outside buffer area)**	Oil palm was introduced as an alternative commodity for farmers in the simulated area, outside the LRWR and its buffer area. This assumes forms of 'smallholder oil palm' that start to emerge. No immigration of labour.		
Increased use of *jelutung*	Promoting *jelutung* trees in young secondary forest were assumed, extending *jelutung* production beyond the old secondary forest, as in the baseline. The yield is assumed to be the same as in the old secondary forest, i.e. 0.99 ton ha^{-1}.		**Oil Palm B (incl. buffer area)**	Here oil palm plantations can establish inside the LRWR and its buffer area. No immigration of labour.		

The green area in the lower part of the map is the Lamandau River Wildlife Reserve and its buffer area.
DEFINITIONS: Pfor = pioneer forest, ysec = young secondary forest, osec = old secondary forest, prim = primary forest, est = rubber plantation, agrofor = agroforestry (rubber dominated), timber = timber plantation (Gmelina arborea trees), op = oil palm.

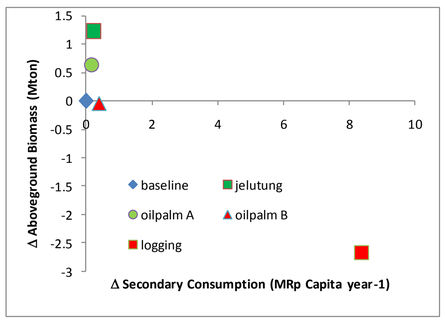
Results

Based on the RACSA carbon-stock study (Rahayu et al 2010) and an analysis of livelihood strategies, five scenarios were defined. Note that the 'red' landscape occurred under the logging scenario and the LRWR and its buffer area were mostly converted to oil palm plantation under Oil Palm B scenario.

A



B



Predicted economic and ecologic levels compared to the baseline scenario.
Mton = Mega ton, MRp = million rupiah

The baseline ('business as usual') scenario, with full protection of remaining forest across the two sub-districts, predicted that gross emissions would come to a halt in 2005–2035 and that the gross sequestration of 2.5 Mg CO_2-eq yr^{-1} would be approximately the net sequestration rate . The other scenarios are expressed by difference to this baseline, based on 'additionality'.

The *Jelutung* scenario is expected to increase above-ground biomass by around 1.2 Mton and secondary consumption around 0.3 MRp capita^{-1} year^{-1} because fewer plots were converted for other livelihood options. Introducing oil palm plantations attracts farmers to clear plots in the area and this increases the economic level to around 0.17 MRp capita^{-1} year^{-1} and a net increase in the level of carbon stock because fewer plots were opened for other livelihood options.

However, the 'green' scenario with Oil Palm A was turned into 'red' with Oil Palm B. Despite the increase of the economic level by 0.4 MRp capita^{-1} year^{-1} (around double compared to Oil Palm A), the biomass value was less than the baseline because of massive opening of the LRWR and its buffer area (considered as forest reserve in other scenarios). Legal or illegal logging remains a very attractive option from a short-term local livelihood perspective.

Location	Year	Net emission	Emission	Sequestration
		(Mg CO_2-eq ha^{-1} yr^{-1})		
Buffer area: measured LU dynamic	1990–2000	7.30	7.30	0.00
	2000–2005	5.86	5.86	0.00
2005–2035 Buffer area	Baseline	-2.49	0.02	2.51
	Jelutung	-2.58	0.01	2.59
	Logging	-2.52	0.03	2.55
	Oil palm A	-2.54	0.02	2.55
	Oil palm B	0.54	2.09	1.55
2005–2035 Non-buffer area[1)]	Baseline	0.36	2.02	1.64
	Jelutung	-0.89	1.20	2.09
	Logging	0.84	1.50	0.66
	Oil palm A	-0.005	1.75	1.76
	Oil palm B	0.15	1.84	1.69

1) The rest of the area in two sub-districts, not including LRWR.

Protecting the buffer area significantly raised the sequestration rate in this area in any scenario. In contrast, permitting oil palm plantations inside the buffer area significantly increased the net emission rate. Planting *jelutung* trees significantly increases the sequestration rate, not only in the buffer area, but also outside the buffer area.

Conclusion and Recommendations

The recent rate of land conversion and emission within the buffer area has been much lower than that in the surrounding area. This high emission in the surrounding area points to the significant risks of 'leakage': activities to protect the carbon stock in the buffer zone can contribute to an increase of emissions elsewhere, unless labour is absorbed in the area, alongside carbon-stock protection.

The logical links between use of the buffer zone and the surrounding landscape need to be explored to interpret such patterns. The FALLOW model suggests two quite different approaches.

1. Support for *jelutung* as NTFP in the buffer area can be expected to absorb labour and provide returns to labour above the average for the landscape as a whole.
2. Planting oil palm on degraded, non-peat soils outside the buffer area can absorb labour and reduce the pressure on relatively carbon-rich land-cover types.

The first approach is likely to be considered in a REDD project design for the buffer area; the second requires a wider context of spatial planning. Combinations of these approaches are feasible, but require a more detailed parameterization.

References

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