Resilience, Rights and Resources: Two years of recovery In coastal zone Aceh

Land suitability for agricultural crops in West Aceh district

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Introduction

The tsunami disaster on 26 December 2004, devastated agricultural lands, including the tree based agricultural areas. However, the tree based agricultural areas, as one of the most important land use in the area were less severely affected. The coastal areas densely covered by trees seem to be less affected compared to the relatively 'open' areas.

In response to the disaster, ICRAF and its partners consisted of Lembaga Riset Perkebunan Indonesia (LRPI), Indonesian Soil Research Institute (ISRI), University of Hohenheim (Germany), is conducting a joint effort to support the reconstruction of the green infrastructure in the west coast of Aceh, especially in West Aceh District. One of the research components undertaken by ISRI is evaluation of land suitability and recommendation of land use, focusing on perennial tree crops. By using the map of land use recommendation from this activity, it is expected that the reconstruction of the green infrastructure could be conducted according to the land suitability in such a way that the crops can produce optimally and in sustainable manner. Although the emphasis of this research is on perennial tree crops, but evaluation for a few key annual crops are included to anticipate the need of local institutions.

Methods

Land suitability evaluation was conducted through interpretations of base maps, satellite images, and reconnaissance soil map for developing of land unit map. The land unit map was used as a guide in the field survey, soil sampling and, in turn, developing a more detailed soil map following a re-interpretation of field observation and soil analysis. Land suitability evaluation for each soil mapping unit was conducted by matching of land characteristics and plant growth requirements using the Automated Land Evaluation System (ALES).

The maps of land suitability then were overlaid with the existing present land use map with consideration of field conditions to produce the recommendation of land use. Example of stepwise procedure of land suitability evaluation is summarized in Table 1 and its convergence to land use recommendation is given in Table 2. The outputs of this research are maps of land suitability and land use recommendation for selected crops. There are two kinds of maps produced: (1) detailed map of 1:25,000 scale for Aceh Barat District based on survey in mid 2006 and secondary data interpretation, and (2) smaller scale (1:100,000) map covering 4 Districts of coastal zone (Aceh Besar, Kota Banda Aceh, Aceh Jaya, and Aceh Barat) based on earlier survey in 2005 by ISRI. The printed outputs of these maps, however, are presented on one A0 size paper at 1:100,000 and 1: 250,000 scales, respectively.

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Results

a. West Aceh District (1:25,000 scales)

The results of land suitability evaluation showed that rubber is suitable for most areas in West Aceh District. The local farmers, based on informal interviews, also expressed their preference to this crop because of easy management and marketing. Cacao is the second most favorite crop and its suitability extend in large areas of the district. Coconut is suitable and has been widely grown in the area, especially near homesteads. Like rubber, oil palm also has an extensive suitability in the area, but this crop is only wanted in Meureubo Sub-district because of closeness to Nagan Raya District where oil palm plantation exist and thus easy marketing.

The biophysical limiting factors in the area include the coarse soil texture in the subsoil (at >30 cm depth), poor drainage, low soil fertility, and the deep peat in the peat dome areas.

b. Aceh Besar, Banda Aceh, Aceh Jaya and Aceh Barat Districts (1:100,000 scale)

The tidal mud flat areas in general are not suitable for agriculture, because of influence of tides causing the brackish water, high salinity, unripe/non develop soil, as well as poor drainage. This area then is recommended for conservation with mangrove *(nypa fruticans and Rhizophora*). The shallow (<2 m) peat soil is conditionally suitable for rubber, oil palm, and coconut because of occasional inundation and poor drainage. The beach ridges and alluvial interfluves are suitable for coconut, cacao, and fruit trees (durian, rambutan). The dissected flat and alluvial zones formed lagoons and ponds and unsuitable for agriculture.

Conclusion

In general, the suitability of the research area for tree crops could be divided as follows:

- The marine ecosystem: (i) the coast line sandy beach (recent) is suitable for coconut and (coastal) spruce trees (ii) the *old beach ridge*s is suitable for nutmeg, rambutan, mango, coconut, cacao, and rubber (iii) the swales is suitable for paddy field.
- The alluvial ecosystem is suitable for coconut, cacao, nutmeg, mango, and duku (lanseum).
- The valley and *backswamp* is suitable for paddy field and selected annual food crops.
- The peat dome's suitability varies depending on its depth: (i) the shallow to medium (<2m) peat is suitable for rubber and oil palm, (2) The deep (>2 m) peat is recommended for conservation area.
- The undulating to rolling tectonic areas is suitable for rubber, oil palm, and rambutan.

Table 1. Example of stepwise evaluation of land suitability for coconut

Land characteristics	Crop requirement				Observed value	Suitability class		Final suitability Class
	S1	S2	S3	N		Item	Evln	
Temperature (tc)							S2	
Mean Temperate (°C)	25 - 28	28 - 32	32 – 35	> 35	28,8	S2		
		23 - 25	20 – 23	< 20				
Water availability (wa)							S2	
Rainfall (mm)	2000 - 3000	1300 - 2000	1000 – 1300	< 1000	3.109	S2		
		3000 - 4000	4000 - 5000	> 5000				
Number of dry month	0 - 2	2 - 4	4 - 6	> 6	0	S1		
Oxygen availability (oa)							S3	
Drainage	Good, fair	Somewhat	poor,	Very poor	somewhat	S3		
		Poor	Fast	Very fast	excessively			
Rooting media (rc)							S3	
Texture	Fine-loamy	Somewhat	Very fine	coarse	SandyLoam / Loamy sand	S3		
		coarse						
Coarse material (%)	< 15	15 - 35	35 - 55	> 55	0	S1		
Soil depth (cm)	> 100	75 - 100	50 -75	< 50	> 100	S1		
Peat							S1	
Thickness (cm)	< 60	60 - 140	140 - 200	> 200	0	S1		
Thickness if any of mineral	< 140	140 - 200	200 - 400	> 400				
inter-layer (cm)								S3
Ripeness	sapric	sapric,hemic	hemic,fibric	Fibric				
Nutrient retention (nr)							S2	
CEC clay (cmol/kg)	-	-	-	-	> 16	S1		
Base saturation (%)	> 20	<= 20	-	-	< 50	S2		
pH $_{H20}$	5,2 - 7,5	4,8 - 5,2	< 4,8	-	5	S2		
Organic C (%)	> 0,8	<= 0,8	-	-	1,7 – 2,1	S1		
Toxicity (xc)							S1	
Salinity (dS/m)	< 12	12 - 16	16 - 20	> 20	< 0,5	S1		
Sodicity (xn)								
Alkalinity /ESP (%)	-	-	-	-	-			
Erosion hazard (eh)							S1	
Slope (%)	< 8	8 - 16	16 - 30	> 30	1 – 3	S1		
Erosion hazard	Nor or low	Low to moderate	high	Very high				
Flood hazard (fh)							S1	
Flooding	F0	-	F1	> F1	F0	S1		
Land preparation (lp)							S1	
Surface stoniness (%)	< 5	5 – 15	15 - 40	> 40	0	S1		
Rock outcrops (%)	< 5	5 – 15	15 - 25	> 25	0	S1		

Table 2. Example of land use recommendation for coconut

Commodity	Land suitability	Current land use	Recommended landuse crop commodity	Availability for coconut intensification
Coconut	Suitable	Paddy field	Paddy field	Unavailable
		Annual upland	Annual upland	Unavailable
		Oil palm	Oil palm	Unavailable
		Rubber	Rubber	Unavailable
		Coconut	Coconut	Unavailable
		Shrub	Kelapa	Available
		Forest	Kelapa	Available
		Homestead	Homestead	Unavailable

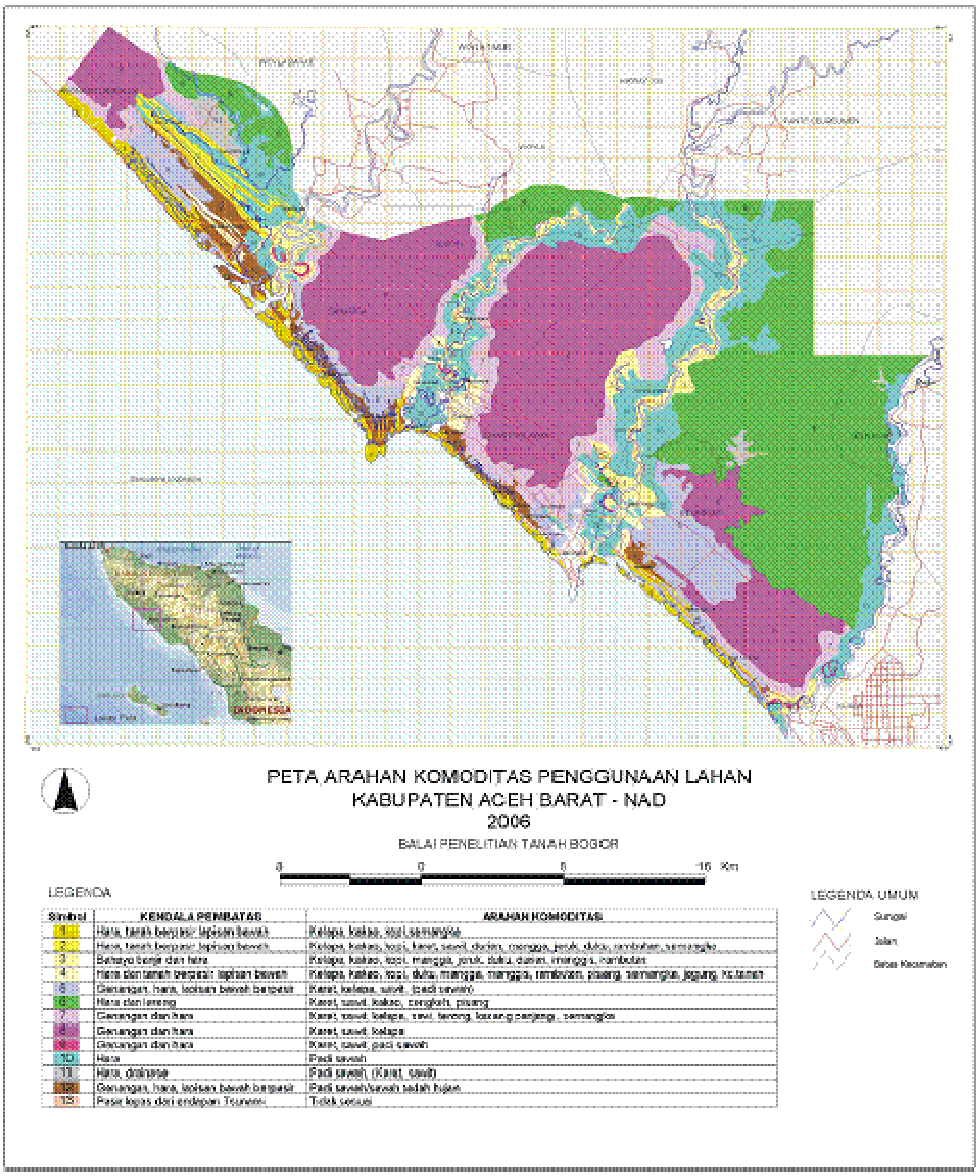
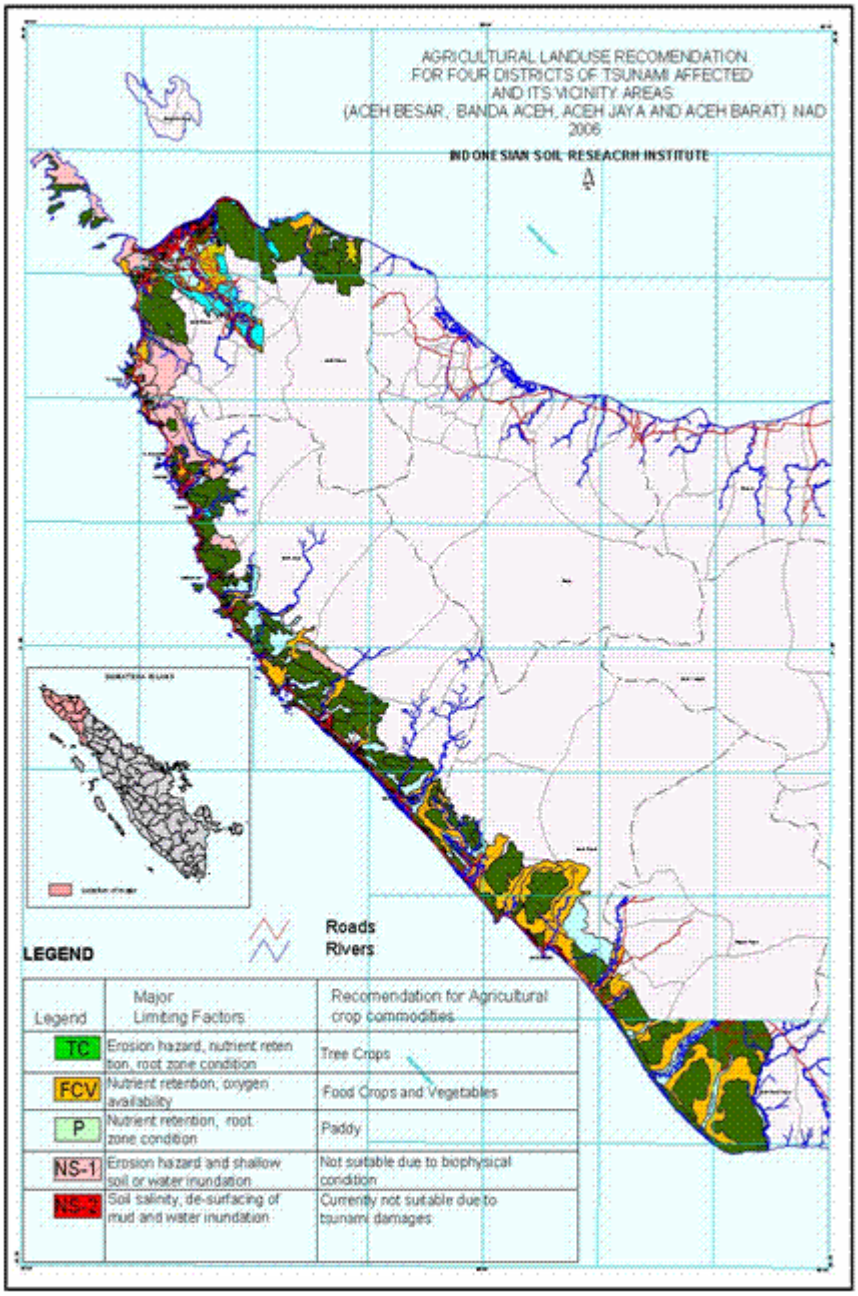


Figure 1. Suitable commodities/ land use map

Table Appendix 1. Continuation of Figure 1 legend

Legend	Major Limiting Factors	Recommendation For Agricultural Crop Commodities
1.	Low nutrient, sandy texture of subsoil	Cacao, coconut, coffee, water melon
2.	Low nutrient, sandy texture of subsoil	Cacao, coconut, coffee, rubber, oil palm, duku (lanseum), rambutan, durian, tangerine, mango, water melon
3.	Water inundation, low nutrient	Cacao, coconut, coffee, rambutan, mango, tangerine, duku, manggosteen, durian
4.	Low nutrient, sandy texture of subsoil	Cacao, coconut, coffee, duku, mango, manggosteen, rambutan, banana, water melon, maize, peanut
5.	Water inundation, low nutrient, sandy texture of subsoil	Rubber , oil palm, paddy
6.	Low nutrient, slope	Rubber, oil palm, cacao, banana
7.	Water inundation, low nutrient, shallow peat	Rubber, oil palm, coconut, mustard, egg plant
8.	Water inundation, low nutrient, moderately to deep peat	Rubber, oil palm and coconut
9.	Water inundation, low nutrient	Rubber and oil palm, paddy
10.	Low nutrient	Paddy
11.	Low nutrient, soil drainage	Rubber, oil palm, paddy
12.	Water inundation, low nutrient, sandy texture of sub-soil	Paddy
13.	Loose sand of tsunami disaster	Not suitable for agriculture

KEY MESSAGE



World Agroforestry Centre (ICRAF) is one of 15 organizations under the CGIAR (Consultative Group on International Agricultural Research) umbrella. ICRAF aims to stimulate and conduct innovative research, development and capacity building to promote and support agroforestry for both human and environmental benefits. ICRAF has its headquarters in Kenya and six regional offices in the tropics and now cover 21 countries in Africa, Asia and Latin America.

The research bulletins are summary results of collaborative activities of ICRAF and partners in the "Recovery and Resilience of Livelihood and Natural Resources", mainly in West Aceh, after the Tsunami of 26th December 2004. These bulletins were prepared, first in Indonesian language, for a workshop in Meulaboh on 30 November 2006. The primary objective was to share relevant result findings and observations among government and non-government organisations and individuals involved in the post-tsunami recovery in West Aceh. The workshop and preceding research activities were supported by Ford Foundation Indonesia, EU Asia Pro-Eco Program and CGIAR.

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