HIGHLIGHTS OF ONGOING RESEARCH OF THE WORLD AGROFORESTRY CENTRE IN INDONESIA

van Noordwijk, M. and O'Connor, T. (Eds.)

Southeast Asia

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Further information please contact: World Agroforestry Centre Transforming Lives and Landscapes
ICRAF Southeast Asia Regional Office Jl. CIFOR, Situ Gede, Sindang Barang, Bogor 16680
PO Box 161, Bogor 16001, Indonesia Tel: 62 251 625415, fax: 62 251 625416
Email: icraf-indonesia@cgiar.org ICRAF
Southeast Asia website: <http://www.icraf.cgiar.org/sea> or <http://www.worldagroforestrycentre.org/sea>

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ICRAF Southeast Asia Working Paper 2006_13

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AGENDA

EPMR site visit to Indonesia

Dr. Ken Brooks

- Monday 23 – Wednesday 25 January: Sumber Jaya (Lampung) to visit ASB/RUPES site
- Thursday morning January 26 (8.30 - 12.30) Bulangan room CIFOR building

Simulation and appraisal tools connecting trees, plots, farmers and landscapes

8.45 - 9.00	Introduction and overview	Meine van Noordwijk
9.00 - 9.45	Tree establishment and growth in agroforests	Laxman Joshi
	<ul style="list-style-type: none">- The SEXI-FS Spatially explicit individual-tree-based agroforest simulator applied to rubber agroforests (Degi Harja)- Forest tree regeneration in rubber agroforests in Jambi: influences of landscape context? (Saida Rasnovi)- Mycorrhiza requirements of Dipterocarp trees for agroforests: shifting paradigms (Hesti Tata)	
	=> Discussion	
9.45 - 10.00	Coffee break	
10.00 - 10.45	Agroforestation of grasslands	Jim Roshetko
	<ul style="list-style-type: none">- Tree-site matching analysis as part of the Smallholder Agro-Forestry on Degraded Soils (SAFODS) project in Indonesia and the Philippines (Betha Lusiana)- WaNuLCAS validity tests on SAFODS data and exploration of scenarios for converting Imperata landscapes to tree-based systems (Ni'matul Khasanah)- FALLOW explorations of baselines and leakage for Clean Development Mechanism proposals (Desi Suyamto)	
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10.45 - 11.30	Watershed functions in landscape mosaics	Meine van Noordwijk
	<ul style="list-style-type: none">- Local ecological knowledge of critical watershed functions: methods for exploring local logic (Elok Mulyoutami)- Participatory landscape appraisal (PALA) in the context of critical watershed functions (Rudi Widodo)- Rapid Hydrological function Appraisal (RHA) and the next steps for RUPES Lake Singkarak (Kevin Jeanes)	
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	<ul style="list-style-type: none">- Rapid agrobiodiversity appraisal in the context of environmental service rewards RABA (Susilo Ady Kuncoro)- Birds in a coffee agroforestry landscape (Trudy O'Connor)- Management styles for rubber agroforests: tradeoff between profitability and biodiversity? (Gede Wibawa)	
	=> Discussion	
12.15 - 12.30	General discussion and reflection on the approach used	Meine van Noordwijk

- Friday morning January 27 (8.30 - 12.00) Bulangan room CIFOR building

Poverty, benefit flows, conflicts and improved governance of agroforestry landscapes

8.45 - 9.00	Introduction and overview	Chip Fay
9.00 - 9.45	Poverty mapping, farming systems and forest margins in Indonesia	Suseno Budidarsono
	<ul style="list-style-type: none">- Poverty mapping approaches (Sonya Dewi)- Spatial analysis of farming systems and forest margins in Indonesia (Danan Hadi)- Rapid tenure claim appraisal tool (Gamma Galudra)	
	=> Discussion	
9.45 - 10.00	Coffee break	
10.00 - 10.45	Multiscale negotiation support for community based forest management	Chip Fay
	<ul style="list-style-type: none">- Evolution of the negotiation support system in Lampung (Gamal Pasya)- Impact analysis of HKM implementation (Suyanto)- Gender aspects of HKM in Sumberjaya (Novi Khususiyah)	
	=> Discussion	
10.45 - 11.30	Economic analysis of agroforestry	Suyanto
	<ul style="list-style-type: none">- Applications of the Policy Analysis Matrix tool for appraisal of agroforestry systems (Suseno Budidarsono)- Who controls and benefits from tambaks in Aceh (Indra)- Rapid market opportunity appraisal (Joel Tukan)	
	=> Discussion	
11.30 - 12.00	Rewards for environmental services	Sonya Dewi
	<ul style="list-style-type: none">- How much sedimentation control can be bought in Sumber Jaya: a designed experiment (Beria Leimona)- Typology of environmental services and reward mechanisms (Meine van Noordwijk)	
11.50 - 12.00	General discussion and reflection on the approach used	Chip Fay

Simulation and appraisal tools connecting trees, plots, farmers and landscapes

2005/2006 External Program and Management Review (EPMR) of the World Agroforestry Centre (ICRAF)

External Program and Management Review (EPMR) site visit to Indonesia: Dr. Ken Brooks

- Monday 23 – Wednesday 25 January: Sumber Jaya (Lampung) to visit ASB/RUPES site
- Thursday January 26: Simulation and appraisal tools connecting trees, plots, farmers and landscapes
- Friday January 27: Poverty, benefit flows, conflicts and improved governance of agroforestry landscapes

It has been more than 7 years since the previous EPMR visit and the ICRAF program in Indonesia has evolved further: more sites, more young scientists and less ‘international’ ones, more policy and development linkage; we hope to maintain focus, cohesiveness, salience and quality....

Introduction to ICRAF South East Asia – Meine van Noordwijk
“Our work is linking trees to farms, agroforestry farms to their landscape context and consequences, and landscapes with farmers to the governance systems and external stakeholders that shape them”

Science priorities for CGIAR

“All our work is directly linked to the CGIAR science priorities, and thus linked to the Millenium Development Goals. We support multifunctional landscapes that provide food & clean water to urban poor, income and local services for rural poor and conserve resources for future harvests.”

“All our activities are aimed at research support for development – starting from the identification (“framing”) of issues, through activities with partners, and the outputs we produce, we have the uptake and outcomes in mind, and gear towards ‘impact’ on poverty and environment.”

The four global themes of the World Agroforestry Centre defining the sides of a cube and trying to expand the cube

Meanwhile, the reality of our target beneficiaries and partners is **inside** this cube, integrating it all

“To provide some internal structure to all these activities, ICRAF has globally recognized four thematic areas – which connect like the sides of a cube + efforts to expand the box (cube). In fact, however, the real agroforesters of the world are inside the cube, integrating all aspects. Our themes are not ‘divisions’.”

“South East Asia + China is home to a higher number of poor people than all of Africa combined – but fortunately the overall growth offers real hope for poverty reduction. Population density (colour on the map) varies in our region from <10 to >1000 persons km⁻², and this significantly influences agroforestry issues.”

“While the traditional image of South East Asia landscapes has forest on the hills and people/ agriculture in the lowlands, in fact we deal with a gradient in tree density within agroforestry; the institutions for Forestry & Agriculture involve an artificial and unnecessary split”

“Our work therefore tries to reach across four systems: trees, farms, landscapes and governance. At each level we explore the components, focus on the human dimension and consider the cross-scale linkages; this makes for 4 * 3 regional focal areas”

The site visit to Sumber Jaya (Lampung, Sumatra) looked at the way research on trees, plots, farms and landscapes is integrated with development support based on conflict management, rewards for environmental services and diversifying coffee farms. **Integration** is the key word.

Simulation and appraisal tools connecting trees, plots, farmers and landscapes

Introduction and overview (Meine van Noordwijk)

Tree establishment and growth in agroforests (Laxman Joshi)

- The SEXI-FS Spatially explicit individual-tree-based agroforest simulator (Degi Harja)
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- Mycorrhiza requirements of Dipterocarp trees for agroforests (Hesti Tata)

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Watershed functions in landscape mosaics (Meine)

- Local ecological knowledge of critical watershed functions: methods (Elok Mulyoutami)
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- Management styles for rubber agroforests: tradeoff between profitability and biodiversity? (Gede Wibawa)

“In today’s seminar we will provide some highlights of the work that has a primarily ecological/ agronomic orientation, while tomorrow the focus is on socio-economic issues. As you will see, however, it is difficult and not very useful to keep the two apart...”

Tree establishment and growth in agroforests (*Laxman Joshi*)

- The SEXI-FS Spatially explicit individual-tree-based agroforest simulator applied to rubber agroforests (*Degi Harja*)
- Forest tree regeneration in rubber agroforests in Jambi: influences of landscape context? (*Saida Rasnovi*)
- Mycorrhiza requirements of Dipterocarp trees for agroforests: shifting paradigms (*Hesti Tata*)

Tree establishment and growth in agroforests

The SEXI-FS Spatially Explicit Individual-based Forest Simulator Applied to Rubber Agroforests

Degi Harja¹, Gregoire Vincent²

¹World Agroforestry Centre (ICRAF), Bogor;

²IRD, Montpellier

“Of these three pictures of rubber agroforestry, one is ‘virtual reality’. Farmers who plant trees may want to know how their trees can grow given the amount of space and light available, but don’t have the time for real-world experiments; the SEXI-FS model is designed to help them.”

SEXI-FS

A Spatially Explicit Individual-based Forest Simulator

“The model keeps track of the canopy shape and tree height for any number of trees or tree spacing, whether monoculture or mixed tree stand; even-aged or a mixture of ages; it also allows to test management actions such as the removal of individual trees.”

Parameterizations

- DBH Increments
- DBH - Height
- DBH - Crown Width
- Sensitivity to Light
- Other Species Specific Characteristics

“The main characteristics that are needed at tree species level are the allometric relations of canopy shape, the potential growth rate and the response to shading; these parameters can be derived from monitoring tree growth over a few years across a range of neighbourhood situations”.

DBH-Height Parameterization

“These are examples of how the relationship between stem diameter and tree height differs between dense stands and isolated trees; in a tree such as *Shorea javanica* the difference is relatively small as the branches don’t reach far; in a tree such as *Acacia mangium* there is a ‘big effect.’”

Rubber Plantation Calibration

Distance	Population/Ha
6 × 6	278
5 × 5	400
8 × 3	417
7 × 3	476
6 × 3	555
4 × 4	625
5 × 3	666
4 × 3	833
3 × 3	1111

The Girth Size of 6 Years Old Rubber

“When checking predicted against measured girth of rubber for 6-year old stands with tree populations of 200-1200 trees per ha we obtain a good match.”

With and Without *Imperata*

“With some further model assumptions we can look at the effect of *Imperata* grass on rubber growth, and vice versa the effect of shading out the grass through the developing tree canopies.”

Acacia interplanting

“An example of the use of the model is the exploration of different planting patterns of a mixture of rubber and *Acacia mangium*; instead of the regular pattern as we see to the left, a ‘double row’ pattern of rubber has more opportunities for intercropping in the early stages.”

Rubber-*Acacia* mixture

“Depending on the year of planting of *Acacia* trees into the rubber stand, a substantial negative effect is predicted on the height growth of the rubber trees; for the double row planting system (on the right), there is less reason to delay the planting of *Acacia*”

Rubber Agroforest

DBH distribution in agroforest after 20 years of simulation

“After these exercises with simple planting patterns that help us verify model predictions, we can have a go at the mixed ‘jungle rubber’ systems, with their internal rejuvenation by seedling establishment. The predicted diameter frequency distributions seem to be realistic.”

Current Work and Expansion Possibility

- Scenario Management
- Fruit Production
- Economic Module
- Add the geometry of **Palm trees, Banana and Bamboo.**
- Growing the trees on the slope area for **Erosion Control.**

“Current work on the model is targeting a range of management interventions, the addition of an economic module that links in fruit production, and the addition of rules sets for banana and palm growth forms. A very recent idea is to add predictions of anchoring and soil network roots for landslide control on slopes.”

“The model has now been presented in a number of training courses that provided feedback on features that can make the model more directly useful. All of the model and documentation is available on the web site. The model is developed on an ‘open source’ Java platform.

Thank You

“In the first years of ICRAF’s work in Indonesia, the Alternatives to Slash and Burn (ASB) research (Phase I&II) identified rubber agroforests as a *win-win* for profitability and environmental services, compared to food crop systems. Is woody plant regeneration really comparable to natural forests?”

RATIONALE

- **Biodiversity loss is at alarming rate**
- **Deforestation**
(case for Indonesia, the rate is about 2 million ha per year (FWI/GFW,2002))
- **Traditional rubber agroforest has long been recognized as a reservoir area for many wild species**
- **Most floristic survey base on a limited number of unit sampling in a unique site**

OBJECTIVES

- **TO INVESTIGATE RAF POTENTIAL AT THE LANDSCAPE LEVEL AS A REFUGE AREA FOR FOREST WOODY SPECIES**
- **TO EXAMINE FACTORS AFFECT ON FLORISTIC DIVERSITY**

“The background for my PhD research is that biodiversity loss in Indonesia is alarming, both by loss of overall habitat (‘deforestation’) and by loss of quality of remaining forests. Rubber agroforests have become a major reservoir for the original diversity of lowland forests. However, data refer only to ‘plot level’ analysis

“The objective of my research therefore is to assess the potential of rubber agroforests as refuge for regeneration of forest woody species, looking at both plot and landscape scale diversity. The data set was collected to characterize RAF richness as well as differences with natural forest.”

SITE LOCATION

Plot Location	Total Plot RAF	Total Plot Forest
Muara Kuamang, Pelepat	16	
Pulau Batu, Jujuhan	2	
Rantau Pandan, Rantau Pandan	42	20
Sepunggur, Muara Bungo	3	1
Rambah, Tanah Tumbuh	8	3
Semambu, Sumay	6	6
Pasir Mayang, Tebo Ulu		1
Total	77	31

FLORISTIC SURVEY

VARIABLE-AREA TRANSECT METHOD

Remarks:

d_1, d_2, d_3 : Distance of further tree of five closer trees to transect line

TL : Transect long (60 m)

i, ii, iii : Cell number (12)

TRANSECT METHOD WITH CIRCULAR ELEMENTARY SUBPLOT

Remarks:

d : subplot diameter (6 m)

TL : transect long (60 m)

1,2,3 : number of subplot

OTHER DATA

- CANOPY STRUCTURE
- SOIL CHARACTERISTICS
- AGE OF 'KEBUN'
- PREVIOUS VEGETATION OF 'KEBUN'
- MANAGEMENT OF 'KEBUN'
- DISPERSAL MODES

“Research focussed on Muara Bungo district in Jambi (Sumatra). It involved rubber agroforest (RAF) and forest plots of multiple locations – all together 108 plots were characterized. However, natural forest not available for comparison at all locations.”

“The floristic survey used the variable-area method developed by Douglas Sheill (CIFOR), and included all saplings of woody plants, with a minimum height of 1 m and a maximum stem diameter of 3 cm.”

“Further data included the canopy structure, soil characteristics, age of the rubber agroforest and its history (derived from forest or from earlier agriculturally used land), current tapping and management regime. A database of dispersal modes of trees was based on fruit characteristics.

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“Analysis of the data set has not yet been completed, so the following results are indicative only. The total number of woody plant species found in the rubber agroforests matches that of forest, but the total sampled area is larger. The confidence intervals of ‘rarefaction’ results (corrected for sample size) overlapt.”

“Except for rubber, the ‘invasive exotic’ *Hevea brasiliensis*, all woody plants belong to the indigenous flora. There is little difference in the lists of the 10 most common plant families, but only 1 species occurred in the top 10 of both habitats.”

“Further analysis aimed at comparing frequency of occurrence (at plot level) and the abundance of the trees once they are present in a plot. 77 and 85% of the tree species is ‘rare and scarce’ for forest and RAF, respectively; only 20 and 11%, respectively, is ‘frequent and abundant’. No major difference, thus.”

“A comparison of ‘Hubble-graphs’ for both systems reveals that the rubber agroforest is only slightly below the natural forest in its diversity profile; there is no indication at all of the ‘truncation’ that is typical of ‘habitat islands’. Both habitats have access to the full regional species pool.”

Dispersal Modes

Fraction of species per dispersal modes in forest and RAF

	Num.	Anemochory distant	Zoochory distant	Zoochory short	Autochory local	NA
Species in RAF ONLY	284	0.0634	0.7113	0.0352	0.0458	0.1444
Shared Species	405	0.0543	0.7309	0.0419	0.0765	0.0963
Species in Forest ONLY	241	0.0498	0.6432	0.0415	0.1494	0.1162
Total	930					

“Some difference in dispersal mode of the tree species was found: as expected the RAF has more wind-dispersed, small-seeded (early succession stages) trees and less large-seeded non-dispersed (‘autochory’) trees (typical of late succession)”

“Analysis of the floristic composition of the plots suggested that the rubber agroforests above 60 years of age are different from the others, with the 40-60 year old plots showing the largest between-plot differences.”

“Contrary to expectations, the floristic similarity with forests decreased with age of the rubber agroforests, rather than increasing. A possible explanation is that the younger plots were closer to remaining natural forests than the older ones and thus received more influx of forest tree seeds.”

“Using yet another way of analyzing the data set, the total species richness of RAF and forests appears to be remarkably similar, but the overlap between the two habitats is in fact small. Further analysis of landscape context and history is under way.”

“We tentatively conclude that rubber agroforests and natural forests have approximately similar levels of diversity of regenerating saplings, but that their species composition differs. Landscape context is probably important. A mosaic of RAF and forests will maximize landscape scale tree diversity.”

ECTOMYCORRHIZA REQUIREMENTS OF DIPTEROCARP TREES FOR AGROFOREST: SHIFTING PARADIGM

M.H.L. Tata and M. van Noordwijk

INTRODUCTION

- Natural forest in Sumatra is dominated by Dipterocarpaceae, which produce valuable timber and NTFP.
- Dipterocarps has close association with ectomycorrhiza (EM) fungi → nutrient and water absorption
- Deforestation → forest area decrease
- Farmer managed rubber agroforst (RAF) has become a major reservoir of forest biodiversity and forest services
- Enrichment planting with Dipterocarps → an option for landscape restoration
- Efforts to re-introduce forest trees may be limited by survival of these fungal partners in the soil
- Survival of forest EM fungi in different land use types probably depends on the type of vegetation and on the possibilities for these fungi to find suitable hosts.

Existing Paradigm of EM

A. Mechanism

- **Dominant EM Fungi** : Basidiomycetes, such as *Russula*, *Amanita*, *Scleroderma*, *Boletus*, *Laccaria* (Smits, 1995)
- **Sensitivity to land cover change**: very sensitive to open soil

B. Consequence

- * **Forest regeneration**: dipterocarp species are not easily establish in open vegetation
- * **Silviculture**: EM inoculation is essential

Hypothesis

Inoculum of ectomycorrhizal fungi will survive in the soils for limited time after a change to a different land use type; the need for artificial mycorrhization in the nursery of dipterocarps can thus be predicted from the plot history

“One of the tree families that is relatively scarce in the rubber agroforests is the *Dipterocarpaceae*, the main timber producers of the lowland forests. With increasing scarcity, it becomes interesting for farmers to enrich their agroforests with such trees. Is that difficult?”

“My PhD research is supported by a number of institutions. The starting point is the requirement of Dipterocarpaceae for an ectomycorrhiza (EM) partner. If that is no longer present in the soil, after disturbance, it will have to be introduced in the nursery stage, with costs & effort to find a good match.”

“The current ‘paradigm’ (researched in Kalimantan) is that it is indeed difficult to get *Dipterocarpaceae* started in reforestation or enrichment planting efforts, because the main EM fungi are themselves sensitive to forest disturbance (exposure of the soil to sunshine). Inoculation is thus essential.”

LAND USE CHANGE IN JAMBI

How's survival of mycorrhiza for reforestation with Dipterocarp trees?

“The past decades of land use change in Jambi province have provided an ‘experiment’ that allows us to test the decline of inoculum potential of soils for Dipterocarps, along a habitat gradient from forest to crop fields and *Imperata* grasslands. The Belowground Biodiversity project set up a series of sites.”

Site Descriptions

Slope (0- 6 %)- Muara Kuamang
6-15% - Kuamang Kuning
15->45%-Rantau Pandan

Altitude : 100 m – 500 m

Rainfall 3000 mm/yr
Temperature:27-30 °C

Soil Type:
 ▲ Rantau Pandan (R): kandiudults, good drainage, depth solum,
 ▲ Muara Kuamang (M): dystrodepts, poor drainage, severely flooded
 ▲ Kuamang Kuning (K): hapludults, depth solum

“Survey data were collected from the lowland peneplain in Muara Kuamang and Kuamang Kuning, and the lower piedmont zone in Rantau Pandan – both in Jambi. Soils on the sites (Ultisols and Inceptisols) are typical for the respective zones.”

Study mycorrhizal inoculum potential of various LUT in nursery using *Shorea* as bait

“Soil from a range of land use histories was brought to Bogor for an inoculum test with two *Dipterocarp* tree species. The growth of tree seedlings was recorded and their roots were analyzed for mycorrhiza (nearly all roots), followed by identification of fungal species using molecular taxonomy.”

Mean of total height of *S. lamellata* and *S. selanica* seedlings at the age of 10 months. (V= rubber monoculture, W=oilpalm, X=cassava, Y=agriculture, Z=Imperata grassland, K=Kuamang Kuning, M=Muara Kuamang, R=Rantau Pandan, C=Control)

S. lamellata, 10 months

Table 1. Soil chemical properties at different LUT in Jambi

LUT	pH		Bahan organik				HCl 25%		Bray 1 P ₂ O ₅	Nilai Tukar Kation (NH ₄ -Acetat 1N, pH7)							KCl 1N		Total Fe	Koreksi Kadar Air
	H ₂ O	KCl	Walkley/Kjeldahl			P ₂ O ₅	K ₂ O	cmol+/kg							KB*	Al ³⁺				
			C	N	C/N			Ca		Mg	K	Na	Jumlah	%		cmol+/kg	%			
----- % -----			-- mg/100 g --			-- ppm --		----- cmol+/kg -----							%	cmol+/kg	%			
MU	4.35	3.87	1.55	0.11	14.34	13.47	3.58	17.51	0.50	0.17	0.06	0.03	0.75	1.50	0.35	1.37	1.07			
MT	3.76	3.74	3.25	0.26	12.58	42.84	11.91	25.46	0.73	0.45	0.12	0.01	1.30	4.95	0.68	4.30	1.27			
RU	3.88	3.71	2.53	0.17	15.05	15.47	6.43	7.51	0.61	0.21	0.10	0.01	0.93	4.50	0.66	2.21	1.25			
RT	3.70	3.69	3.21	0.22	14.96	19.61	7.78	11.49	0.76	0.24	0.11	0.00	1.11	4.52	0.67	2.43	1.21			
RV	4.15	4.01	1.90	0.13	14.54	13.44	4.77	8.87	1.29	0.35	0.06	0.00	1.69	1.87	0.32	1.76	1.11			
KW	4.35	4.02	1.84	0.13	14.30	22.42	6.36	26.89	1.27	0.34	0.10	0.02	1.73	1.70	0.25	2.53	1.10			
KV	4.45	4.00	2.21	0.15	15.06	17.90	4.46	14.63	1.46	0.47	0.06	0.02	2.02	1.69	0.35	2.72	1.18			
KX	4.36	4.06	1.59	0.11	14.77	17.56	5.57	17.22	1.37	0.43	0.08	0.00	1.87	1.36	0.29	2.26	1.11			
KZ	4.40	3.99	1.87	0.13	14.38	19.04	6.59	15.83	1.57	0.48	0.10	0.03	2.18	1.58	0.35	2.10	1.11			
KY	4.13	4.03	3.39	0.22	15.17	17.21	4.97	29.15	1.91	0.59	0.07	0.07	2.64	1.51	0.30	0.52	1.07			

(Note: T=forest, U=RAF, V=rubber monoculture, W= oilpalm, X=cassava, Y=agriculture, Z=imperata, M=Ma. Kuamang, R=R. Pandan, K=K. Kuning)

“To our surprise, the tree seedlings planted in soil from *Imperata* grasslands in the Kuamang Kuning area were growing very well. In fact land use history proved to be unimportant for this site; overall growth was slightly less on the Rantau Pandan soils, again without clear advantage for the forest soils.”

“Soil chemical analysis provides some clues to a possible explanation. Soils from Kuamang Kuning had rather high available phosphorus levels, while those for Rantau Pandan are poorer. All soils are very acid, with pH (KCl) around 4.0 and exchangeable aluminium at 10-40% of ECEC.”

EM Fungi Identification

Sporocarp surveys :

Suspected EM fungus:

- *Scleroderma*, *Boletus*, *Russula*, *Clavaria*, *Handkea*, *Thelephora*

Molecular Analysis:

- REF and mycorrhizosphere fungus colonize *Shorea* seedlings planted in the soil from 7 LUT.

- REF and mycorrhizosphere present at all LUT

- Identification based on 28S DNA: *Thelephoraceae*, *Cortinarius callisteus* and *Laccaria* sp., several *Ascomycetes* group of *Fusarium*, *Pestalotiopsis*, *Nectria*, *Aspergillus*, *Trichoderma*, *Phoma*, *Phomopsis*

“Identification of the mushrooms (‘sporocarps’) collected in the plots brought some surprises. In fact the higher fungi (*Basidiomycetes*) were infrequent, but DNA analysis showed an abundance of *Ascomycetes*. This analysis is still ongoing, so results are preliminary.”

Evidence of EM in Jambi Site

A. Mechanism

- Dominant EM Fungi : Basidiomycetes (*Russula*, *Scleroderma*, *Boletus*) and Ascomycetes (*Cratellus*, and *Tuberaceae*)
- Sensitivity to land cover change: Longterm Imperata grassland site still has high MIP

B. Consequence

* Silviculture: Initial growth of non-inoculated EM Dipterocarps seedlings in RAF seems to be OK

“Compared with the initial paradigm and expectations, however, we notice a number of contrasts. It appears that groups of fungi that survive under land use change are effective EM partners for the *Dipterocarps* so the need for inoculation is probably less than usually assumed.”

“New” Paradigm

A. Mechanism

- Dominant EMF: Other groups of Basidiomycetes (*Thelephoraceae*) and Ascomycetes (*Tuberaceae*)
- Sensitivity to land cover change: Either inoculum survival or effect of dispersal agent maintain high MIP

B. Consequence

Inoculation of EM in nursery stage is not necessary

Formulate Hypothesis:

Is “new” paradigm suit for Jambi site?

Is existing paradigm suit for all Borneo site?

“In fact we have to review the existing *paradigm* of sensitive ectomycorrhizal fungi as limitation on Dipterocarp growth. If inoculation is not necessary, enrichment planting may be easier than assumed. It is possible that Sumatran soils and fungi differ from those in Kalimantan/Borneo.”

Future Research

A. Mechanism

- * Dominant EMF : Exploration and taxonomy of EMF
- * Sensitivity to land use change: Experiment of soil sterilization (drought and heat) and its impact to MIP

B. Consequence

- Good news for farmer → no need EM inoculation (cost & management)
- Bad news for conservationist → may need revise argument

“Next steps in this research will aim to provide more detailed evidence. A field trial with inoculated/non-inoculated Dipterocarps in rubber agroforests of different age is under way. A new experiment will test stepwise soil sterilization. So maybe our forests can be restored after all...”

Agroforestation of grasslands (*Jim Roshetko*)

- Tree-site matching analysis as part of the Smallholder Agro-Forestry on Degraded Soils (SAFODS) project in Indonesia and the Philippines (*Betha Lusiana*)
- WaNuLCAS validity tests on SAFODS data and exploration of scenarios for converting *Imperata* landscapes to tree-based systems (*Ni'matul Khasanah*)
- FALLOW explorations of baselines and leakage for Clean Development Mechanism proposals (*Desi Suyamto*)

Agroforestation of grasslands

Tree-site-matching analysis

What trees are best to plant where

*Experience from Smallholder Agroforestry for
Degraded Soils (SAFODS) Project*

Betha Lusiana

Ecological Modelling Unit

World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES

ICRAF SOUTHEAST ASIA REGIONAL OFFICE

“The choice of tree species depending on the site, the type of agroforestry system and the market conditions remains one of the main questions that farmers have to get right if they want to benefit from their long term investment in ‘retirement’ trees. In the SAFODS project we explored the issue.”

Land use change in the tropics

“The Alternatives to Slash and Burn’ program (ASB) started to look at the forest use – degradation – restoration cycle in Southeast Asia and found that the 10 – 20 M ha of *Imperata* grasslands in Indonesia represent a transient stage. If the conditions are right, farmers are usually interested in trees and able to get them started... “

Constraints in planting trees:

“What do we mean by ‘if the conditions are right’? *Imperata* grasslands are maintained by fire, fire is maintained by conflicts over the tenurial status of lands. However, the initial choice of trees for agroforestation (*Gmelina* in the Philippines, *Paraserianthes* in Lampung) was based on lack of knowledge...”

Project work packages and their main relationships

“The SAFODS project, sponsored by the EU was set up to cover the continuum from strategic to adaptive research and development support on these issues, via 5 work packages. This presentation focuses on the tree-site matching issue, as basis for the choice of systems and the risks farmers take.”

Study Site

“The SAFODS project operates in the Philippines in two sites, Claveria on Mindanao and Leyte in the Visayas, and in one site in Indonesia. All are ‘degraded landscapes’, at least from a forester’s perspective; all have emerging smallholder timber systems, as soils don’t support permanent food crop systems.”

A Simple Indicator of Tree Site Quality

Perspective	Objective
Tree	What are suitable sites for this tree (given its provenance)
Site	What are the best tree species (provenances) for this site
Farmer	How can I judge whether a given tree & site combination will be productive?

“Usually tree-site matching starts by looking at what conditions are suitable for a given tree species’ growth. However, for any given site, this choice involves comparisons with the alternative options. For the farmer, lack (and costs) of information is the key constraint.”

Step 1. Calculate tree performance relative to ‘reference’

Tree Performance = Retardation Factor
= ln(Age_actual/Age_reference)

“The empirical data are derived from the size of trees of various age planted by farmers in various positions in the landscape. From these sizes we reconstruct a reference growth curve for each species, and can then derive a ‘retardation factor’ for each individual tree – relating reported age to the reference curve.”

Step 2. Identify ‘growth retarding’ or risk factors

Tree Performance = f(Land Position, Soil Type, Soil Texture, Soil Chemistry)

Indicator	Parameters
Land Position	Slope Position, Shading Indicator, Aspect, Elevation, Slope
Soil Type	Soil Morphology
Soil Texture	Sand, Silt
Soil Chemistry	C-Org, P, K, H-dd, Al-dd, pH, soil moisture, organic matter, N, P, K

“The second step then is to compare these retardation factors with a number of information sources of increasing complexity and costs: position, in the landscape, looking at the soil, feeling the soil for texture and full lab results on soil chemical and physical characteristics.”

Results on the approach

“We found differences between tree species and sites in the way various data sources help to account for variation in retardation factors. For *Acacia mangium* landscape position is informative and soil chemistry reduces uncertainty. For other tree species even complete data left huge uncertainty.”

“For a different group of native tree species in Leyte, the data of Fernando again show a wide range in patterns. For some tree species soil analysis is not necessary, as landscape position already provides guidance, for others it is a waste of resources as it provides little predictive power.”

Step3. Map relative suitability based on combined model for each tree species

“Integration of all these perspectives with the available spatial information for the sites is still in progress. In the past, standard GIS procedures have attempted to produce ‘suitability’ maps based on very little information relevant to the particular species’ growth. A more critical approach to confidence intervals is thus needed.”

Conclusion

- The four biophysical indicators (land position, soil type, soil texture and soil chemistry) can describe 4 - 74% variation of tree performance
- The high variation of tree performance that cannot be explained by the biophysical indicators implicates that farmers take considerable risk in planting trees on the basis of current 'scientific' knowledge: the 'unexplained' variation in performance is 26-96%

“Overall the analysis indicates that trees clearly differ in the type of ‘site properties’ to which they respond to. The complement of ‘site’ is probably ‘management’, and the low determination of tree growth by site properties may empower news for some farmers. Yet there is much variation that is still not explained by the model, so there will still be a risk of poor tree choice.

Acknowledgment

Dept. Soil Science
Brawijaya University

UPLB, Philippines

University of
Cordoba, Spain

“The data presented here were collected by three university teams and the current analysis is based on intensive interactions at project level.”

Scenarios for Recommendation of Tree-Crop Combination and Shade-based *Imperata* Control during Tree Establishment using WaNuLCAS model

Ni'matul Khasanah

Ecological Modelling Unit

“Also as part of the SAFODS project, research is done on the tree-soil-crop-weed interactions in the early stages of agroforestation on degraded soils. Field data are used to check the validity of the WaNuLCAS model, before a wider range of site-specific management options is explored.”

Smallholder agroforestry options for degraded soils: Tree establishment in cropped fields (SAFODS)

Part of the objectives of the project are :

1. Explore the consequences of a broad array of management options for transitions years of tree - crop combination which profitable for farmer
2. Explore the tree species for shade-based Imperata control

To meet those objectives: model approach used – WaNuLCAS :

- Model validity test (tree growth, crop yield, soil water)
- Scenario of tree - crop combination
- Scenario of shade – based imperata control

”Of specific interest is the shade-based control of *Imperata* in these systems. Early on, food crops can justify the weeding effort needed. However, between the last cropping year and full canopy closure, *Imperata* can start to re-grow and cause trouble to the trees, including fire risk.”

Main components in WaNuLCAS

The general lay out of zones and layer in the WaNuLCAS model

“The WaNuLCAS model was set up to deal with any tree, any crop and any soil and predict above- and belowground interactions based on light, water and nutrients. It uses a daily time step and considers 4 spatial zones and 4 depth layers in the soil. Parameter libraries are being built.”

Model validity test

Tree Diameter and Tree Biomass

Model can simulate the growth of the four trees species very well and relatively good fit with actual measurement

- *H. brasiliensis* + Cass
- *S. mahogany* + Cass
- *A. mangium* + Cass
- *P. talcatoria* + Cass

— 1 : 1

“Before we use the model for extrapolation of field data to other conditions we need to know the match between simulated and measured results. For the Lampung data set of SAFODS an acceptable match is obtained on tree stem diameter and tree biomass. *Paraserianthes* results are the least reliable.”

“The simulated impacts of trees of various species, ages and sizes on accompanying cassava yield (with little tuning of the model to the data), is acceptable, although some of the over-prediction solicits further exploration of possible causes not captured by the model.”

“A validity test for soil water content on the basis of cal-
culations for ‘average’ soil texture conditions shows overall correspondence in range and dynamics, but for a number of soil depths & plots the actual texture may have differed enough from the average to cause differences in soil water.

“Accepting for the time being that our model captures the essence of tree-soil-crop-weed interactions we can explore variations in choice of crop, tree and spacing. Cassava and sugarcane are the two crops that are most profitable in Lampung.”

Shade-based *Imperata* Control Time available for planting crop

- No weeding scenario → growth of the trees inhibited → not enough to shade the *imperata*
- Partial weeding scenario → growth of the tree better → enough to shade the *imperata*
- Fast growing trees are best for controlling *Imperata*

Conclusion

- WaNuLCAS model is acceptable for management tool in degraded soil.
- The yield of cassava and sugarcane is significantly influenced by tree species grown in the systems.
- Time available for planting crop in intercrop systems with slow growing trees (*S. macrophylla* and *H. Brasiliensis*) longer than fast growing trees (*P. falcata* and *A. mangium*).
- The wider the tree spacing, the longer time available for planting crop.
- Crops species does not significantly affect tree growth.
- Wood volume in monoculture systems are higher than intercrop systems.
- Fast growing trees are best for control *Imperata*

Thank You

Acknowledgment

Dept. Soil Science
Brawijaya University

“Fast growing trees will, according to the model, cover this 50-to-85% shading transition within 2 years, while slow growing trees may need 10 years to do the same and thus run substantial risk of fire. Weed control in the tree line leads to faster tree growth and thus lower risk of fire damage.”

“At this stage a number of conclusions emerge – although the full report is still in progress. Differences between trees, crops, soils and management regimes are substantial, and farmers will need to fine tune the generic recommendations to their site and conditions.”

“The model is probably far enough developed that it can be used to integrate key aspects of overall system design. We will share these results with extension agents for further testing with farmers in the real world...”

FALLOW Exploration of Baselines and Leakage for Clean Development Mechanism Proposals

Desi Ariyadhi Suyamto, Meine van Noordwijk, Betha Lusiana

World Agroforestry Centre, Southeast Asia Regional Office

EPMR Visit
26-27 January 2006, Bogor, Indonesia

“Agroforestation of degraded soils is not only interesting for farmers, it can also help store carbon and reduce atmospheric loading. Removing barriers to such agroforestation may count as a ‘Clean Development Mechanism’ (CDM); under CDM rules, the C-gains can be used to offset emissions elsewhere. “

FALLOW Model

To provide foresight of drivers’ changes, reveal the implications of baseline trajectories, and illuminate options for ‘future’ action

“The eligibility of project interventions to count as CDM depend on two fairly complex concepts: baseline and leakage. Both of these concepts assume that we can predict the dynamics of local land use change in response to ‘drivers’ of change, and with all environmental consequences.”

Conceptual Framework of the Model

“Real predictability at that system level is wishful thinking. We can, however, combine current understanding of the dynamics of knowledge, labour, land and financial capital into a model that tries to account for the main land use decisions in rural landscape mosaics. The FALLOW model is an attempt to do this.”

Sites of FALLOW Application for CDM Exploration

No.	Site	Challenges	Other contributors	Project	Status
✓1	Sebuku, Nunukan, East Kalimantan	Avoiding deforestation in ex-logging area	Kusuma Wijaya, Subekti Rahayu, CARE Indonesia	FORMACS	Reported
✓2	Muara Sungkai, North Lampung	Promoting smallholder timber-based systems in oil palm/rubber/sugarcane growing area	Ni'matul Khasanah, Rudy Widodo, Andree Ekadinata, Subarudi (CSEPRF) and Danan Hadi Prasetyo	ASEM 2002/066, CFC/IRSG/11	Reported
✓3	Sidrap, South Sulawesi	Transforming grasslands into tree-based systems in cashew-growing area	Andree Ekadinata, Dudy Nugroho, Sonya Dewi, James M. Roshetko, CIFOR	ADB/CDM	Preliminary results
✓4	Way Tenong, West Lampung	Transforming grasslands into tree-based systems in coffee-growing area	Andree Ekadinata, Dudy Nugroho, Rudy Widodo, CIFOR	ADB/CDM	Preliminary results
5	Kalahan, the Philippines	Resilience of non-timber forest-based enterprise to conserve the Kalahan forests	KEF, ICRAF Philippines	RUPES	In progress

“So far 5 site-specific applications of the FALLOW model have been made/initiated to explore land use change scenarios with their consequences for landscape level carbon stocks and farmer income. Several of these include estimates of *leakage* or effects on C stocks beyond project boundaries.”

Sebuku, East Kalimantan

“We will provide a quick tour of these model applications. The first was aimed at an area with substantial remaining forests in East Kalimantan, where a CIDA/ CARE supported project tries to enhance agroforestry development for protecting remaining C stocks.”

Model Simulation vs Satellite Imageries of Sebuku

“Initializing a landscape with the 1990 land cover plus the generic parameters of profitability of the various land use options, leads to a predicted land cover for 2003 that corresponds in land cover fractions, but differs in spatial details.”

Prospecting the Baseline of Sebuku

“Accepting the model’s simulations as indicative of a plausible reality, the *baseline* for this landscape is a gradual decline of carbon stocks as well as declines in *per capita* income.”

Prospecting CDM in Sebuku through Some Scenarios

Increase on c-stocks can possibly be achieved by reducing timber market to at least 75% and doubling the profitability of agroforestry systems, with consequences on income reduction

“Various policy interventions were tried in model scenarios to reduce the profitability of logging and enhance the profitability of agroforestry as alternative land use. In isolation these measures are insufficient to have the desired effect. In combination they are predicted to help.”

“The second case study refers to the SAFODS landscape of Muara Sungkai in northern Lampung. Here the starting point is a mosaic of overstretched food crop production systems, remnant riparian forests, a sugar cane plantation and the emergence of rubber, oil palm and timber systems.”

Model Simulation vs Satellite Imageries of Muara Sungkai

“Again we started with a validity test of the model by ‘predicting’ the (known) changes over the past 15 years on the basis of initial conditions and time-independent parameters. An acceptable match was obtained.”

Prospecting the Baseline of Muara Sungkai

“Extrapolating to the next 30 years (at constant product prices, so far) we expect a further reduction of forests as well as grasslands and sugar cane land, linked to a gradual increase in rubber and oil palm as smallholder tree crops. The baseline for C stocks is flat, income will slowly increase after an investment period.”

Prospecting CDM in Muara Sungkai through Some Scenarios

“In comparison with a ‘project’ approach to convert the existing sugar cane plantation to a timber plantation, most generic programs to remove barriers to spontaneous smallholder agroforestation are superior in their effect on farmer income and they can double landscape C stocks.”

Sidrap, South Sulawesi

“Sidrap in South Sulawesi has been selected at national scale for support as a pilot CDM site. It has grassland areas that are outside of the forest domain – and thus avoid some of the complexity of land tenure on contested state forest lands.”

Model Simulation vs Satellite Imageries of Sidrap

“Again we started with an attempt to reconstruct the land use changes of the past decade – again the match of land cover fractions is acceptable, but details of the spatial pattern differ. As is commonly found, cloud cover on satellite images causes uncertainty in the overall results.”

Prospecting the Baseline of Sidrap

“The baseline for C stocks in Sidrap is a gradual decrease in landscape level C stocks, while farmer income available for non-food expenses is expected to increase. Off farm labour on the rapidly expanding chicken farms is competitive with other uses of labour.”

Prospecting CDM in Sidrap through Some Scenarios

No.	Scenarios	Time average carbon leakage (M.t/yr ⁻¹)	Time average increase of non food expense per capita (million Rp/capita ⁻¹ .yr ⁻¹)	Time average increase of labor allocation (thousand persons.days/yr ⁻¹)					
				Off farm	Project	Agriculture	AF	Non timber monoculture	Timber monoculture
1	Promoting project through extension & subsidy	-5.63	-0.57	-87	140	-10	-7	-35	-1
2	Giving legal tenurial rights to farmers to access the lands freely	11.64	0.40	-65	0	7	4	54	0
3	Giving legal tenurial rights to farmers to access the lands freely, and promoting tree-based systems through extension, subsidy & market improvement	-46.42	3.15	-337	0	-97	328	85	22
4	Giving legal tenurial rights to farmers to access the lands for tree-based systems activities, and promoting tree-based systems through extension, subsidy & market improvement	-78.59	3.49	-342	0	-110	325	107	21

“Various combinations of interventions that provide tenurial access to the grasslands, spread technical knowledge of managing tree-based systems and enhance market access can again enhance both income and C stocks (with negative ‘leakage’), but only if they outdo the off farm options.”

Way Tenong, West Lampung

“As the last example we will consider the case of Way Tenong in the Sumber Jaya area in Lampung. The site was initially proposed for the CDM short list, but the proposal became delayed by institutional complications, as it technically refers to a *hutan lindung* (protection forest) area of low actual tree cover.”

Model Simulation vs Satellite Imageries of Way Tenong

“As before, we can achieve an acceptable prediction of the past decade of land cover change.”

Prospecting the Baseline of Way Tenong

“As a baseline we predict that slow removal of the tenurial access barrier plus continuation of fire, plus an increase in open-field agriculture (vegetables) will approximately balance the increase in carbon stocks in the coffee gardens with their increasing tree cover. The C baseline is thus negative.”

Prospecting CDM in Way Tenong through Some Scenarios

No.	Scenarios	Time average carbon leakage (Mt.yr ⁻¹)	Time average increase of non food expenditure per capita (million Rp. capita ⁻¹ .yr ⁻¹)	Time average increase of labor allocation (thousand persons.days.yr ⁻¹)					
				Off farm	Project	Agriculture	Coffee multistrata	Shaded coffee	Sun coffee
1	Promoting project through extension & subsidy	-0.90	-4.51	8	40	40	52	-97	-43
2	Giving legal tenurial rights to farmers to access the lands freely	43.43	5.79	-13	0	-50	-95	11	148
3	Giving legal tenurial rights to farmers to access the lands freely, and promoting tree-based systems through extension, subsidy & market improvement	41.34	23.27	-23	0	-89	-66	18	160
4	Giving legal tenurial rights to farmers to access the lands for coffee multistrata, and promoting coffee multistrata systems through extension, subsidy & market improvement	-22.70	13.03	-7	0	-33	128	-65	-23

“Among the various possible interventions the provision of tenurial rights on the grasslands in combination with rapid sharing of knowledge on AF plus improved market access including for farm grown timber) is the only one that will provide a win-win for income and C stocks.”

Conclusions

No.	Site	Conclusion
1	Sebuku, Nunukan, East Kalimantan	When a landscape is still dominated by forests, livelihoods of local people are very dependent on forest resource, thus depletion on carbon stocks could not be avoided. When timber market is reduced, people will move to agriculture and agroforestry, which means other types of deforestation with worst consequences on carbon sequestration. When timber market reduction was done simultaneously with agroforestry improvement, carbon stocks could be maintained while income was not reduced too much. Thus, reducing land-use-change carbon emission while increasing local benefit on this area should be done by the mean of promoting CB NRM (by adopting e.g. reduced impact logging) while improving agroforestry simultaneously.
2	Muara Sungkai, North Lampung	Promoting timber-based systems while improving timber market and enhancing social control on fire seems to be the best CDM solution in this area, instead of approaching it by large-scale project (i.e. timber plantation).
3	Sidrap, South Sulawesi	Giving tenurial rights to access grasslands for tree-based activities while promoting tree-based systems is possibly the best CDM solution in this area, instead of approaching it by project.
4	Way Tenong, West Lampung	Giving tenurial rights to access grasslands for coffee multistrata activities while promoting coffee multistrata systems (HKM) is possibly the best CDM solution in this area, instead of approaching it by project.

“In conclusion, the 4 case studies differ in setting and trajectory for C stocks. While potentially increasing both income and C stocks, agroforestry may have to be both technically improved and facilitated by markets for tree products before the potential can be realized.”

“The FALLOW model proved to be sufficiently flexible to deal with these various situations. This is no hard science with high levels of predictability. As a tool to explore plausible future scenarios and their interactions, however, the model can hopefully stimulate debate at a more quantitative level.”

Watershed functions in landscape mosaics (*Meine van Noordwijk*)

- Local ecological knowledge of critical watershed functions: methods for exploring local logic (*Elok Mulyoutami*)
- Participatory landscape appraisal (PALA) in the context of critical watershed functions (*Rudi Widodo*)
- Water detectives: watershed monitoring in northern Thailand (*video – David Thomas and Pornwilai Saipothong*)

Watershed functions in landscape mosaics

Local Ecological Knowledge of Watershed Functions: a Method for Exploring Local Logic

E Mulyoutami with L Joshi

Local Ecological Knowledge

- Local people's understanding (and interpretation) about elements and processes and inter-relationship between these elements in agro-ecosystems
- Generated through personal experience and from other sources
- Explanatory and logical (common sense)

“Flows of water are often too much, too little, too dirty or too sudden. Water is essential for crop production, domestic use, hygiene, animal and fish production, for transport and for production of electricity. It is thus easy to understand that everybody tries to interpret water flows”

“Differences in perception and ‘logic’ can easily arise and contribute to conflicts. Water flows are often linked to forests and other land use – and much of the debate on forest conversion is centered on water. Exploring local ecological logic is thus important to appreciate land use impacts.”

LEK about erosion

major components:

- Rain – duration and intensity
- Standing trees, bamboos and shrubs - root system and morphology
- Ground cover - leaf litter or live ground vegetation
- Soil – physical properties and nutrient content
- Slope

→ water turbidity, quantity downstream

“For example, our analysis of the local ecological knowledge (LEK) in Sumber Jaya by different farmer groups has indicated that erosion is understood as the result of a combination of conditions – not just due to ‘deforestation’.”

Main components in farmers understanding of soil erosion

“The local logic is elaborate and precise in its attribution of roles to vegetation to different parts of the overall pathway of events that leads to loss (transport) of soil. The detailed understanding indicates various possible points for intervention – more refined than just ‘reforestation’.”

Methodology

Knowledge-Based Systems (formal approach)

- systematic acquisition and recording based on individual and group discussions
- explainable and “logical” knowledge
- stored as simple (unitary) statements in computer
- source (person or document) recorded for each statement
- easily accessible, portable and updateable
- can be processed using artificial intelligence tools

“The previous example was derived by a systematic, formal exploration of the local knowledge, using a method known as the KBS approach, first developed at the University of Wales, Bangor. It takes the complex relations apart in its basic units and relationships, before reconstructing the whole network.”

“Four steps are identified in the analysis of any local knowledge system. The last step ‘generalisation’ tests how broadly the various elements of a knowledge base are shared – either geographically or within the community where the knowledge base was derived.”

Formal representation

- Record is made to what people said
- Forces an unambiguous representation: emphasis on *meaning not linguistic style*
- Break knowledge down into smallest meaningful units of statement
- Make meaning of local terms and concepts explicit

“Technically, the approach starts by carefully listening to what local people have to say, which terms they use and what these terms mean in an operational sense. The emphasis is on what is said and implied, not on the grammar as such. KBS thus complements linguistics.”

Knowledge articulation in Sumberjaya

- Knowledge among group of people based on
 - location (upstream, midstream, downstream),
 - 3 ethnic groups (Javanese, Sundanese, Semendos)
 - field type - coffee garden, paddy field, vegetable garden
- Knowledgeable informants interviewed from each group
- Semi-structured check-list
- Record interviews
- Extraction of knowledge statements (representation) – enter in computer using AKT
- Revisit farmers for further clarification/information

“In the exploration of local ecological knowledge of watershed functions in Sumber Jaya we were interested to find out whether or not the ethnic background, migrational history and current landscape position influences knowledge and ‘logic’. We followed a number of steps in the research.”

LEK on Critical Watershed Study: Sumberjaya

- Watershed: deforestation, flooding, soil erosion, and water problems
- Vegetation on riparian area for watershed conservation
- Conservation practice on each farmers plot – relates to coffee system

“In the summary database of this knowledge, we looked especially at three groups of relations: those that relate deforestation to water flows and erosion, those that focus on the riparian vegetation and those that describe soil conservation techniques feasible within coffee gardens.”

Run-Off and Soil Loss in WaNuLCAS model and its controlling factors

“Overall we found a close match between the explanatory model that farmers use and the ecological modellers’ perceptions reflected in the WaNuLCAS model – with a few noticeable exceptions and changes in emphasis. Both of these knowledge systems are far richer than the public dialogue that only concerns forest cover.”

Conclusions

- Local knowledge fairly detailed, explainable and logical
- Key components of local knowledge about watershed functions similar to scientific knowledge (e.g. Wanulcas)
- Local knowledge more refined for their site and experience
- Some difference in knowledge – e.g. upstream and downstream farmers with different knowledge about conservation practice on the plot
- Different ethnic groups practices are different – slightly different knowledge
- Knowledge exist, but not always practiced (resource constraints – labour, capital, land tenure)
- Soil conservation practices not adopted because insufficient benefit to individuals

“In conclusion: we have a good tool box for the analysis and documentation of local knowledge that can help support the local perspective in various conflicts and public debates. Knowledge is dynamic and blends in new elements, observations and ‘hear-say’. Extension can focus on gaps identified.”

“The Participatory landscape assessment as practised in Way Lirikan recently was derived from methods used in Vietnam by ICRAF colleagues; it builds on and re-enforces a long tradition in participatory rural appraisal – with a focus on landscape level issues of soil and water movement.”

Water = f (Forest)

“As in other parts of the Way Besai catchment (Sumber Jaya) the history of forest conversion to coffee, eviction of farmers by forestry agents, their return after the ‘*reformasi*’ in 1998 and the current choices in coffee agroforestry have a direct link with the dialogue on ‘watershed functions’.

Some results of the plot level erosion measurements

- Bodong: **0.3-37** ton/ha/year for forest, monoculture coffee, shade coffee, bare land
- Tepus & Laksana: **0.1-5** ton/ha/year for similar land use and slopes!
- *Selection of the site of the plots is more important than land use to explain differences in erosion!*

“Soil physical measurements of erosion at plot scale have revealed a remarkable difference in the sensitivity to erosion of the soils of Bodong site versus those of Tepus/ Laksana. It is clear that factors other than land cover play a substantial role.”

Monitoring Way Besay 2005

Flood Event

Sediment flow= 3000 NTU
($\odot$ 3 kg /m³) & Q = 100
m³/s

Sedimentation $\odot$ 0.1
mm/event /hr sink into
Reservoir area

WCK
WBS
RESERVOIR
WLP
WAY LIRIKAN No 1

Source Of Sediment

Purposes

1. Where does the sediment come from?
2. What kind of local efforts can be implemented to solve the sediment problem?
3. What are the constraints faced by farmers to implement local efforts and what activities can be implemented to resolve these constraints?

“After ICRAF and partners started monitoring the sediment content in the various streams (and brooks...) that contribute to the Way Besai we noticed that the Way Lirikan has the highest peak sediment concentrations in its water. This was a good reason for us to focus on this sub-catchment.”

“A sediment concentration of 1000 mg/l is high. We found that peaks flows coming out of the Bukit Rigis forest in this subcatchment can already contain over 1500 mg/l of sediment. Those from coffee on land-slide soil or from paddy rice valleys can be over 2500 mg/l.”

“This raises some important questions: where does all this sediment come from, how can it be brought under control and what would it take for farmers to actually do this?”

Methods

- Overview Survey- get common picture of existing problems
- Interview – Farmer Perception
- Transect Walk – Landscape Assessment
- Farmer Group Discussion - Resolution of Problem

“The PALA methodology follows a number of steps, to arrive at a shared understanding of the landscape and its formative elements. PALA tends to go a step beyond the KBS approach that may focus on the knowledge as such. PALA invites action as a end result.”

“The Way Lirikian subcatchment was mapped at 1:10,000 scale together with the farmers who identified relevant features, variations in soil as well as various ownership regimes. In part of the area the subsoil is locally called ‘soap mud’ and is very susceptible to erosion and collapse once exposed.”

Problem	cause	Negative Impact	Effort	Constraint
Erosion (coffee, footpath, & settlement)	-rainfall intensity -Slope gradient - Clean weeding -Less tree protector	- low production - high cost production - Degraded land - Turbidity of river	- Compost and manure - Minimum weeding - Shade coffee - Grass lasing - Terrace, torak, drainage, NVS	- Farmers motivation - Knowledge - Time allocation
Landslide	-rainfall intensity -Slope gradient -Mud Soap -Clay -Less tree protector -Water Accumulation -riverbank erosion	- Failed of Harvest - reduce area - Loss of economic resources - Turbidity of river	- Protection - Riparian zone - Planting Trees - Drainage Channel - terracing	- Unstable soil On Previous landslide area - Difficulties of Mud Soap management
Flooding	-Rainfall -treeless forest	- rise field - piled up sand and garbage - Broken DAM	- Dodger channel - Water management - building the DAM	- Unpredictable - Low motivation
Riverbank Erosion	-stream power -softness riverbed material -slope gradient	- Shallow river - Steep river	- Bamboo - Grass - Medium	- Less collective Responsibility

“After the landscape walks and transects, group discussions identified a number of problems, their perceived causes and negative impacts, as well as the efforts that can lead to their control once key constraints are resolved.”

“Similar to the KBS approach a diagram of the logical connections between the different aspects of the landscape plays a key role in the discussion of possible points of intervention.”

“In practice a lot of measures that could well reduce erosion and sediment loads of streams are not put into practice, because of a lack of collective action and direct economic benefits for the practitioners. Resolving conflict and giving farmer groups a role in watershed management can be the key to better results.”

Water detectives:

watershed monitoring in northern Thailand
(video preview – David Thomas and Pornwilai Saipothong)

-- a preview of a television program on the ‘Water Detectives’ in northern Thailand showed imagery of the local water quality monitoring as a step to empower local communities in their relationships with neighbours, both upstream and downstream.

Biodiversity of landscape mosaics (*Jean-Laurent Pfund*)

- Rapid agrobiodiversity appraisal in the context of environmental service rewards RABA (*Susilo Ady Kuncoro*)
- Birds in a coffee agroforestry landscape (*Trudy O'Connor*)
- Management styles for rubber agroforests: tradeoff between profitability and biodiversity? (*Gede Wibawa*)

Biodiversity of landscape mosaics

RAPID AGROBIODIVERSITY APPRAISAL (RABA) *in the context of Environmental Services Rewards:*

Susilo Ady Kuncoro, Meine van Noordwijk, Endri Martini, Pornwilai Saipothong, Veronika Areskov, Andree Ekadinata Putra and Trudy O'Connor

“Agroforestry can, undoubtedly, play a role in landscape level conservation of biodiversity: it provides habitat to many plants and animals, many of which have some direct utility to the farmers as source of food, fodder, fuel, building material or cash. Is this biodiversity of global significance?”

Background

“There are basically two approaches to achieve the dual functions of production and conservation: spatially segregate protected areas from exploitation, or functionally integrate conservation in production landscapes. The two can be combined – but in the ‘integrate’ option the tradeoff has to be closely guarded.”

Agrobiodiversity Conservation

... agriculture tends to operate in a
'TRADE-OFF' zone

Agriculture **IS NOT** the best
BUT 'MIGHT' be essential for
conservation

“The rubber agroforests of Jambi have more than a century of history in combining functions but are currently under threat by intensive monoculture plantations of rubber or oil palm. Is it time for ‘rewards for environmental services’ to step in and pay for the global conservation functions? Time is running out.”

Rewards for Environmental Services

Problems :

- INFORMATION; NOT FAIRLY NEGOTIATED
- Transaction cost is HIGH

RABA

... aims to help flow of INFORMATION

... is NOT an assessment technique but an 'ADD-IN' tool,
in which different techniques are combined

“As nice as the idea of ‘rewards for environmental services’ may sound, there are serious challenges to get such systems established – the ‘buyers’ and ‘sellers’ don’t have equal access to information and transaction costs are high. RABA was designed to appraise options in an early stage.”

Rapid Agrobiodiversity Appraisal

“In bridging between potential ‘buyers’ and ‘sellers’ of biodiversity conservation services, we need to look at natural, human and social capital. The value of the service, the degree of threat and the opportunities that local community regulation provide determine the case. Trust will have to be built.”

Rapid Agrobiodiversity Appraisal

“In essence a SWOT (strength, weakness, opportunity, threat) analysis is needed from both the buyers’ and sellers’ perspective, helped by brokers who can identify negotiation options. RABA is set up to do this within a 6 month time period for a budget of less than 10 000 USD, to keep transaction costs down.”

RABA in Bungo

“To test the RABA concept, analysis was made of the rubber agroforest landscape of Muara Bungo (Jambi) and the crop-forest mosaic in northern Thailand. The level of prior data collection differed. Protocols were modified in the process. Both cases came to a positive conclusion.”

RABA in Bungo

Sumatra is considered 'hotspot' <i>Good vegetation structure</i> Financially Sound <i>Bufferzone</i>	People see the benefit from ES <i>Increasing Productivity without losing the ES benefit</i>
Value	Opportunity
Trust	Threat
Level of Trust is low <i>Local people are willing to negotiate if there's a benefit for them</i>	Conversion to monocultural system <i>Government Policy highly supports Intensive Agriculture</i>

“In summarizing both cases a value* opportunity*threat*trust framework was made. In the case of Bungo the threat of private decisions to convert rubber agroforests is high, while the opportunity of community scale regulation is small. The potential value of riparian rubber AF as ‘corridor’ justifies the trial of reward schemes.”

RABA in Bungo - Conclusion

... for agrobiodiversity conservation initiative

- a haven for plant diversity,
- buffer zone/corridor area for adjacent forest and national parks

potentials
but ...

Finding intermediaries, interested parties (buyers)?

“The overall conclusion is a ‘yes, but’ rather than an unqualified ‘yes’, as it will be a challenge to find interested ‘buyers’, given the opportunity of buying conservation functions elsewhere. The lack of attractive ‘conservation flagships’ such as orangutan is a challenge...”

Birds in the Coffee Agroforestry landscape of West Lampung, Sumatra

Trudy O'Connor

“Bird-friendly coffee has become a way for farmers in Central America to benefit from the ‘environmental services’ that they provide to (migratory) birds and thus to the coffee-drinking people who care about these birds. Could the same concept work in Sumatra?”

Study context

“shade coffee plantations can contain as much biodiversity as forest habitats”
(Perfecto, 1996)

“My PhD research project was set up to answer a series of questions about the presence of birds, the quality of the habitat, the threats posed by hunting and the opportunities for bird conservation in West Lampung. Natural forest has rapidly lost ground there, mainly replaced by coffee gardens.”

“The study area was the coffee agroforestry – forest mosaic of Sumber Jaya, but comparisons were also made in Krui on the west coast of Lampung, where the damar agroforests represent a further evolution of ‘shade coffee’ systems.”

“The Sumber Jaya landscape mosaic offers opportunity to compare different land cover types within the same landscape. The remaining forest of Bukit Rigis is a major point of reference, while the patchiness of the landscape creates a major challenge.”

Study questions

- What is the contribution of the coffee gardens to local bird habitats?
- What is the difference in bird assemblages between different garden types?
- What is the most promising approach to bird conservation in the area?

“The study questions focussed on the habitat value for various ‘functional groups’ of birds, on the concept of species assemblages and on the opportunities of conservation. Data were collected through a standardized survey method, replicated between seasons.”

Species composition

- Great difference between forest habitats and coffee gardens
- Change between coffee garden types, but does not rapidly approach forest assemblages
- No bird species listed by IUCN were found in coffee gardens

MDS of bird species composition in each habitat type

“As expected, the more open landscapes of rice fields and *Imperata* grasslands differed in bird composition from the coffee gardens, the more so if these were of a ‘multistrata’ type. The damar gardens provided the closest match to forest, but were still substantially different.”

Study findings: People Comments on trees and birds

- Main reason for growing trees was to shelter coffee, followed by the benefits of extra produce
- 70% said that bird populations had clearly declined (n=45)
- Most people said that if the forests were gone, birds would move to habitats elsewhere
- 88% said that gardens had a role to play in bird conservation (n=40)

“All farmers interviewed liked to see birds in their gardens, and most said that bird populations had in fact declined. Most were also convinced that their birds had moved elsewhere – assuming that they still had a place to go to. However, most also acknowledged that gardens can protect.

Achieving bird conservation in Sumberjaya?

- For local bird conservation forest remnants must be maintained
- Different potential in different zones across landscape
- Best results are likely by group action
- Potential problems:
 - lack of understanding of environmental processes
 - lack of direct incentive for biodiversity conservation

“The data were collected in the current landscape mosaic and some evidence was obtained (not shown here) that the remaining forest played a role in the presence of birds. Some form of collective action will be needed to improve habitat value. The direct threat of trapping for the captive bird trade is certainly a factor to be reckoned with.”

Acknowledgements

- Thanks to my supervisors, including Dr Meine van Noordwijk, my field assistants Fauzan and Jufri, the helpful farmers and tricky birds of Lampung.
- Bird pictures from MacKinnon and Phillips (1993) A field guide to the birds of Borneo, Sumatra, Java and Bali, Oxford University Press

“The opportunity for developing a premium price for bird-friendly coffee from West Lampung is limited as yet – other aspects of quality of the product would have to substantially improve. The birds will have to depend on local champions for the time being.”

“Earlier presentations demonstrated the high biodiversity levels in the jungle rubber systems of Indonesia, and their relation to the management style selected by the farmers. Is the tradeoff between profitability and biodiversity unavoidable? Or can a middle ground be found?”

INTRODUCTION

- **Management practice of smallholder rubber in Indonesia is unique in the world**
- **Why unique?**
 - Indonesia has the largest rubber areas in the world (3.5 M ha)
 - Smallholders cover 84% of the total rubber area
 - Smallholder system is based on slash and burn practice.
 - Intercropping with annual food crops: first 2-3 years.
 - *Unselected seedlings is the most popular planting materials used*
 - *Very low inputs and extensive farm management*
 - **No fertilization**
 - **Low level of weeding**
 - **Limited pests and diseases control**

“While Indonesia has the largest rubber area of the world, it does not have the highest rubber production, as Thailand and Malaysia manage more intensively. The vast majority of rubber is produced by smallholders, usually managing < 5 ha per family. ‘Unselected’ seedlings are normally used.”

Consequences of the low farm management

- Mixture between rubber and other forest re-growth species: **complex jungle rubber**
- Very slow and heterogeneous rubber growth,
- Low productivity, half to one third of that of estate plantations (650 kg/ha/y).

However . . . BENEFITS :

- Protect soil and water resources
- Conserve partly of the forest bio-diversity
- Important sources of income for farmers
- Require low capital, labor and cash inputs to establish
- Produce diverse ranges of foods, fruits and timbers

ESTATE PLANTATION

- Monoculture with clonal planting materials
- Intensive and high cost of establishment
 - ✓ periodic fertilization application
 - ✓ regular weeding
 - ✓ good control of pests and diseases
- High productivity (> 1250 kg/ha/y)
- Low level of biodiversity

Farmers' Choices: based on their Family resources

Trade-off between Profitability & Biodiversity (Integration or Segregation)

“The low management intensity allows for the ‘jungle’ element in the agroforests, but leads to low productivity per unit area. However, the low input cost – low output system can still provide attractive ‘returns to labour’ if land is freely available.”

“By contrast, the estate plantations have a long history of selecting planting material through clonal propagation that increases per-tree productivity by a factor 3 or more and doubles production per ha. Smallholders generally know about this option, but adoption rates are low...”

“In the early phase of ASB the concept of a tradeoff between biodiversity and (area-based) profitability was discussed and hypotheses were framed of the opportunity to increase rubber tree productivity while maintaining most of the biodiversity value in new types of rubber agroforestry.

Farmer Management Options

(ASB, STD3, DFID, SRAP/SRAS CFC...)

- **Jungle rubber agroforest**
- **Improved rubber agroforests**
 - **RAS 1: rubber clones under jungle rubber conditions**
 - **RAS 2: intensive rubber agroforest with food crops, fruit trees, timber trees**
 - **RAS 3: rubber agroforest to control Imperata by covers crop and fast growing trees**
- **Monoculture**

PERFORMANCE OF CLONES UNDER RAS ENVIRONMENT (RAS 1.2)

- **PB 260 and RRIC 100 are the most performing clones under RAS (Jambi and West Kalimantan)**

- **Growth BPM1 and RRIM 600 are slower due to White Root Diseases**
- **Seedling growth is the slowest among clones**

Species observed at RAS 2.2 in West Kalimantan

Number of valuable tree species: 32 (fruit & timber trees)

**Durian, Petai, Rambutan (fruit) & Keladan (timber)
the most popular trees planted by farmers**

“Through a combination of projects and studies we now have >8 years of experience in how farmers respond to these new options, how selected clonal trees grow under reduced input conditions and how the tradeoff evolves. This presentation provides just a few highlights.”

“As expected tree growth and girth increment of the clones exceeded that of the unselected seedlings, reaching the tappable size of 40 cm in a 4 year period in Jambi and 5 years in West Kalimantan. Some disease problems were encountered and clones differed in growth.”

“Especially in West Kalimantan farmers maintained a large diversity of local fruit and timber trees in their gardens with clonal rubber. In Jambi, many farmers reduced tree diversity as soon as they had clonal rubber.”

Cost of establishment of RAS year: 1-5

	MATERIALS (Rp)	LABOR (WD)
• RAS 1	3,564,750	224
• RAS 2	5,019,765	437
• RAS 3 LCC	3,974,550	218
• RAS 3 FGT	3,809,375	264

Monoculture Intensive: Rp 10,000,000-12,000,000

Conclusion & follow up

- Various options of RAS: Combination productivity and biodiversity
- **Biodiversity: Due to limited resources at the beginning (jungle rubber)**
- Diversification: market access and technology for various products (fruits, timber, rattan, resin)
- **Provide farmers with basket of options on RAS, adapted to their circumstances**
- **Technology transfer (farmer groups, local governments)**

Terima Kasih

Thank You

Terima Kasih

Terima Kasih

“From an economic perspective the reduced-input systems with selected clonal rubber are certainly interesting, as initial investment costs can be substantially reduced compared to the current practice in estates.”

“In conclusion, our systems analysis has provided a more fundamental understanding of the options and historical choices by farmers. A range of management intensities will suit farmers in different conditions. A tradeoff with biodiversity is real, but also due to low market value of common non-rubber components of the gardens.

“The on-farm experiments are maintained as early tapping results don’t guarantee life-cycle success. Farmers tapping techniques need to adjust to the opportunities of clonal trees. Local budwood gardens with quality planting material are essential but need initial support.”

Poverty, benefit flows, conflicts and improved governance of agroforestry landscapes

Introduction and overview (Chip Fay)

Poverty mapping, farming systems & forest margins (Suseno)

- Poverty mapping approaches (Sonya Dewi)
- Spatial analysis of farming systems and forest margins in Indonesia (Danan Hadi)
- Orangutan conservation without tenure conflict? (Gerhard Manurung)

Multiscale negotiation support for community based forest management (Chip Fay)

- Evolution of the negotiation support system in Lampung (Gamal Pasya)
- Impact analysis of HKM implementation (Suyanto)
- Gender aspects of HKM in Sumberjaya (Novi Khususiyah)

Economic analysis of agroforestry (Suyanto)

- Applications of the Policy Analysis Matrix tool to agroforestry (Suseno Budidarsono)
- Who controls and benefits from tambaks in Aceh (Indra/Suseno)
- Rapid market opportunity appraisal (Joel Tukam/Jim Roshetko)

Rewards for environmental services (Sonya Dewi)

- How much sedimentation control can be bought in Sumber Jaya (Beria Leimona)
- Typology of environmental services and reward mechanisms (Meine van Noordwijk)

“The primary mandate of the CGIAR is to help reduce rural poverty through profitable and sustainable land use practices. Agroforestry can be attractive, as yesterday’s seminar showed. Today we focus on poverty, benefit flows, conflicts and improved governance of landscapes with trees...”

Poverty, benefit flows, conflicts and improved governance of agroforestry landscapes

Poverty mapping, farming systems and forest margins in Indonesia (*Suseno Budidarsono*)

- Poverty mapping approaches (*Sonya Dewi*)
- Spatial analysis of farming systems and forest margins in Indonesia (*Danan Hadi*)
- Orangutan conservation without tenure conflicts? (*Gerhard Manurung*)

Poverty mapping, farming systems and forest margins

Poverty Mapping Approaches

Sonya Dewi

EPMR site visit, Bogor, 27 January 2006

“Although poverty is a simple word, it has many forms. Most CGIAR centres have invested in the quantification and mapping of poverty in relation to their specific mandate. The current presentation looks at poverty from a forest/agroforestry perspective, at the CIFOR/ ICRAF interface.”

Why is poverty mapped?

- varies from place to place, not in randomly distributed way: spatial heterogeneity and spatial dependence matter
- is multidimensional, with different determinant factors, some geographical, some not
- needs to be measured in relevant ways both in terms of indicators and level of disaggregation, for targeting and intervention

“Poverty needs to be understood in its spatial context, as lack of access to healthy food, health services, education or income opportunities and lack of recognition and say in the policy arena can be based on multiple constraints. We need to understand those, before we can remove them.”

“These pictures from East Kalimantan illustrate that ‘physical access’ and thus spatial pattern is a major determinant of the various poverty dimensions. The rich resources of the forest don’t easily get people out of poverty unless problems of physical & political access are resolved.

Poverty measures

- Economic: monetary indicators, particularly expenditure and income, and non-monetary proxies, e.g., productive assets or durables
- Social: non-monetary indicators, such as quality and access to education, health, other basic services, nutrition and social capital
- Demographic: gender and age structure
- Vulnerability: indicators to reflect exposure to shocks that can affect poverty status, e.g., environmental hazard, political change.

“There have been many attempts to measure the various dimensions of poverty. Economic ones (the famous 1 \$ per person per day) are indicative, but don’t capture the longer term access to ‘public services’ and vulnerability to shocks and hazards.”

Poverty estimation/measure methods

- Small area estimation: combine household survey and census data (econometric models)
- Aggregate of census data into indices (livelihood-system analysis)
- Quantitative-qualitative combination (participatory appraisals and livelihood-system analysis)

Source: Davis, 2003

“At a more aggregate level (countries or districts) the ‘human development index’ now integrates health, wealth and education. For higher resolution studies a combination of household level data and livelihood system analysis is appropriate.”

Existing poverty mappings vary in:

- extent and resolution
- objectives
- poverty measures
- approaches in measuring poverty
- analysis of spatial determinants
- uses/impacts

Density of poor livestock keepers by farming system

Extent	Developing world
Resolution	Country
Objective	Linking poverty and livestock
Poverty measure/ approach	Economics (WB rural poverty rate, < 1USD, TAC)
Analysis	Visual, descriptive

Source: ILRI, Mapping Poverty and Livestock 2003

Cambodia: Food security and vulnerability

Extent	Cambodia
Resolution	commune
Objective	Geographical targeting for food aid
Poverty measure approach	Vulnerability/participatory
Analysis	Qualitative-quantitative, GIS overlay

Source: WFP, from Henninger & Snel, 2003

“Existing poverty maps differ in extent, resolution, objectives and poverty measures. Some are used primarily to communicate a certain perspective and influence decisions on resource allocation – as ‘poverty sells’ in a development context.”

“As an example of a global poverty map that is focussed on a particular livelihood option, this map of ‘poor livestock keepers’ reveals some interesting patterns – but ignores the people and cultures without livestock who may be poor as well. Such a map helps to discuss ILRI priorities.”

“At a more detailed level, the analysis of Cambodia of the targets for food aid by the World Food Program recognized several clusters with similarity in types and causes of poverty, as a basis for their strategic plans.”

— 58 —

“This map of Vietnam refers to the percentage of people at commune level below the national poverty line and clearly shows that poverty is associated with ‘uplands’ with the deltas of the Mekong and Red River virtually free of poverty. These also happen to be the main cities.”

“Spatial analysis of poverty patterns over time in Brazil allow a comparison of the main forest areas of the Amazon and main agricultural areas of the northeast that are a source area of migrants. Human well-being in the forests of the western Amazon appears to be generally low.”

Poverty – Forest

- Indonesian example
- Where are the poor?
- How are landscape-level carbon stocks and poverty related in Indonesia?
- What are the spatial determinants?
- Where and how forest and deforestation play roles?

“What about the relationship between poverty and forest in Indonesia, which used to be the land of ‘rich forests and poor people’. Is district level forest cover related to district level welfare indicators?”

“Forest cover (here we show ‘closed forests’) is low in Java (where 3 out of 5 main urban centres are located), patchy in Sumatra and only high in Kalimantan and Papua.”

How are landscape-level carbon stocks and poverty related in Indonesia? (district level)

“Statistically there is no significant relationship in Indonesia at district level between forest cover and the fraction of the population below the national poverty line.”

Bivariate Local Indicator for Spatial Autocorrelation

“However, if we look more closely at the spatial pattern, we can see a clear grouping of districts with ‘high forest + high poverty’ and ‘high forest + low poverty’ in Kalimantan, with ‘low forest + high poverty’ in SW Sumatra and central + E Java. The rest is ‘intermediate’.”

“If we zoom in on one of these ‘high forest + low poverty’ areas in East Kalimantan we see a clear pattern with high values of the human development index (HDI) in some of the upriver communities and low values in the midstream swamps. High HDI is associated with land suitability.”

“Economic opportunities do not easily match with existing forest cover – so part of the forest may be spared by lack of other land use options... Other parts of the forest, however, are vulnerable as land conversion can be profitable.”

“In our study the presence of provincial and district roads was a key determinant of the index of economic opportunities, followed by the presence of transmigrants and recent deforestation rate.”

HDI vs economic opportunities, natural resources, population, access to market

Spatial error model^a of WELL-BEING

Variable	Coefficient	S.D.	z-value
<i>EDI</i>	0.19	0.05	3.70**
<i>AGRO SUITABILITY</i>	0.27	0.03	7.86**
<i>LAND USE INTENSITY</i>	0.15	0.06	-2.39*
<i>FOREST 92</i>	0.53	0.08	6.79**
<i>POPULATION</i>	8.87E-05	1.64E-05	5.39**
<i>TIME TO DISTRICT</i>	-0.03	0.02	-1.13
<i>TIME TO SUB-DISTRICT</i>	0.01	0.03	0.38
<i>LAMBDA</i>	-0.44	0.13	-3.30**

^awith maximum likelihood estimation, number of observation=73, R²=0.98, LIK=63.65, AIC=-113.31
* and ** are significance level of 0.05 and 0.01

“The human development index (HDI) was positively linked to 1992 forest cover, agro-suitability and population density, and negatively associated with current land use intensity.”

- How poverty mappings can be useful?**

 - policy development and monitoring tool for geographic targeting and intervention
 - research tool for priority setting, poverty determinant study, hypothesis formulation, data integration, multiple scale analysis
 - communication tool between stakeholders: increase transparency
 - in ICRAF language of themes

“Analyses such as the above can help in developing policies that target the poor and help to maintain forest cover. The relationships prove to be richer and more complex than the ‘poverty-driven deforestation’ hypothesis suggest. In applying the approach to agroforestry the problem: is a lack of ‘agroforestry’ maps.”

Agro-ecosystems, population densities and land cover in Indonesia: upland-lowland relationships

Danan Prasetyo Hadi and Meine van Noordwijk

“Rewarding the Upland Poor for the Environmental Services they provide (‘RUPES’) assumes that poverty and ‘upland’ conditions are linked. The analysis presented here of agro-ecosystems, population densities and land cover is targeting upland-lowland relationships in Indonesia.”

Background

- The world's highest population densities region
- Contains closed forest area and many land cover types intermediate between closed forest and open-field agriculture or urban domains
- The world's highest rate of land-ocean transfer sediment (Milliman et al. 1999)
- Increasing interest in landscape level interactions between land users in uplands and lowlands
- Basic data on the total area and the number of people involved in the various combinations of land use types is needed

Major farming systems in East Asia and Pacific
(source: Dixon et al., 2001)

Objectives

- Distinguish upland-lowland linkages among agro-ecosystems

Key combinations related to watershed functions

- lowland rice (1) downstream of upland mosaics (4)
- lowland rice (1) downstream of forest (8)

Key combinations related to biodiversity functions

- tree crops (2) next to forest (8)
- tree crops (2) next to upland mosaics (4)
- upland mosaics (4) next to forest (8)

- Estimate the area, population density and total number of people involved in the various landscape combinations of agro-ecosystems at district and island level
- Estimate the fraction of actual forest cover in the various agro-ecosystems

“South + East +Southeast Asia has the world’s highest population densities. Nevertheless, it still contains closed forest areas of various types and high biodiversity value. It has the highest transfer of sediment to the oceans and thus major challenges to ‘environmental services’.”

“In a global comparison of farming systems, southeast Asia is dominated by types 1, 2, 4 and 8, with a noticeable area of 5 in the montane mainland part. We focus here on forest (8), upland mixed systems (4), tree crops (2) and lowland rice (+ urban) (1).”

“By superimposing an upland-lowland distinction onto this map of agroecosystems we can get a sense of how much of the lowland rice system is downstream of ‘forest’ rather than ‘upland mixed’, and how much of the ‘tree crops’ is in close association with ‘forest’ (relevant for biodiversity values).”

Datasets and Methods

Datasets:

- FAO classification of agro-ecological zones ('agro-ecosystems' or 'farming systems'), 2001
- CIESIN district level human population data, 1995
- IGBP land cover classification, 1996
- GTOPO30 digital elevation model

Methods:

- Spatial analysis using overlay technique

Flowchart

Results (cont.)

Agro-ecosystems of Indonesia split by subcategory according to upland-lowland links

“Technically, the analysis was based on the combination and overlays of a number of spatial datasets, all rectified to the same coordinate system”

“Combination of the farming system map and a digital elevation model led to the distinction of upland-lowland relations, which were then combined with population data and compared to existing ‘standard’ land cover maps.”

“Although the FAO farming systems classification is rather coarse, its combination with elevation data resulted in clear patterns of upland-lowland relations, with clear differences between the major islands.”

Results (cont.)

Human population density in Indonesia in 1995, ranging from < 10 persons km⁻² in parts of Kalimantan, Sulawesi and Papua, to more than 750 persons km⁻² in Java/Bali/Lombok.

Average population densities in the various landscape-level combinations of agro-ecosystems

Fractions of Indonesia's 195 M people (in 1995 – 2005 estimates are 230M) living in the various agro-ecosystems

“Human population density is high on Java + Bali (+ Lombok), intermediate in Sumatra and S Sulawesi and generally low in most other parts.”

“Combining the population density data with the upland-lowland agroecosystem maps, we see that the highest densities occur in ‘rice below upland crop mosaic’, while the density in ‘rice below forest’ is less than that in the ‘upland crop mosaic’ per se.”

“Overall $\frac{3}{4}$ of the Indonesian population is related to the ‘upland crop mosaics’, either because they live in a rice (urban) system downstream of upland crop mosaic upland areas, or because they live in such a mosaic themselves. ‘Rice below forest’ harbours only 3% of the Indonesian people.”

“Area-wise the ‘tree crops’ in association with upland crop mosaics or forest account for a quarter of the land, as does the upland crop mosaics; the ‘forest agroecosystem’ covers 37% of the land.”

“In combination with the IGBP land cover classification, we see that all the 4 major ‘farming systems’ still contain at least 1/3 of ‘evergreen broadleaf forest’ – which at ‘pixel’ level may in fact be a dense homegarden/ village under coconut cover... The forest agroecosystem is ¾ forest.”

“The simple conclusion is that nearly all of Indonesia is thus part of an agroforestry landscape mosaic, with variable intensity of land use. In terms of number of people affected, the dynamics of the ‘upland crop mosaics’ above ‘lowland rice + urban’ systems’ should be our main focus.”

Background

- Both species of Orangutan are on the IUCN Red List of Threatened Species
- The Sumatran Orangutan is Critically Endangered; in the last 25 years the population decreased 80%
- Batang Toru watershed is the main habitat of the Sumatran Orangutan outside of protected areas (170 to 400 individuals)
- Poor livelihood conditions of communities surround the area (comprise of 234,000 Ha)

Objectives

- Catalyzing improved protection of Orangutan habitat,
- Developing sustainable economic alternatives for local communities in Batang Toru

“Sumatra still harbours a tiny population of a special type of ‘forest people’, not represented in the ‘human development index’. Their main problem is lack of secure land rights...

Can conservation be achieved without trampling the rights of local farmers?”

“In 2005 Conservation International and ICRAF started a joint project to explore the options for conserving the main population of Sumatran Orangutan living outside of protected areas: the 200-400 individuals living in the Batang Toru area in close association with their *Homo sapiens* relatives.”

“The CI + ICRAF project, funded by USAID, is trying to catalyze protection of the remaining habitat and respect for the protected species status of Orangutan, by developing sustainable economic alternatives for the local communities surrounding the remaining forest.”

Methods for Approach

- Supporting community-level successes
- Building alliances to foster support and bring resources to managing Orangutan conservation efforts in West Batang Toru
- Building local capacity to plan, implement, and manage livelihood and Orangutan conservation efforts and their components
- Improving the ability of relevant authorities and agencies to establish and enforce policies needed to support Orangutan conservation
- Integrating monitoring into planning

“The approach we chose requires full appreciation of local efforts, ambitions and opportunities. We try to provide data and relevant experience, and thus offer options for the (local) government systems to secure development + conservation.”

The Study Site: West Batang Toru

“Our initial reconnaissance of the West Batang Toru area shows that the conditions vary surrounding the remaining forest. The area is rich in agroforestry and tree crop traditions, but also used for logging, mining and hydro+ geothermal electricity generation.”

Batang Toru Matrix

Sector	Threats	Opportunities	Landuse System	Priority Species	Socioeconomic Factors	Extension-Marketing Issue
Batang Toru - Aek Nabara	1) hunting, 2) mine, 3) logging, 4) private plantations, 5) road construction	1) enrichment planting, 2) no hunting for Orangutan so far, 3) environmental education	1) rubber-salak AF, 2) old jungle rubber, 3) paddy dry-land, 4) homegarden, 5) bare-land, 6) logged forest (small patches and traditional smallholder management), 7) rubber & oil palm plantations	1st (rubber, salak, paddy), 2nd (annual crops, patchouli, durian, pete, timber trees)	low density population, medium road, health & education, majority Mandailing ethnic & minority Nias ethnic	1) no knowledge and skills for tree propagation, farming management, & post-harvest handling, 2) limited availability of cash and labour, 3) limited information concerning demand trends-prices, product specification & related marketing options, 4) disadvantageous "IJON" credit
Aek Nabara – Sibulan bulan Restoring canopy level corridor to East Sarulla habitat?	1) road improvement, 2) National Park issue, 3) shifting cultivation, 4) landslides	1) strong claims & protecting for traditional land management, 2) enrichment planting, 3) good collective actions, 4) ecotourism	1) aren AF, 2) rubber AF, 3) kuhlmanis AF, 4) paddy field, 5) annual crops field, 6) coffee-cacao AF, 7) shrubs (small patches & traditional smallholder management)	1st (rubber, aren, paddy), 2nd (coffee robusta, cacao, annual crops, durian, pete)	low density population & centre around settlement, medium road, education & health infrastructures, majority Mandailing ethnic with Moslem religion	

“Our first effort to get an overview of the situation led to this table that identifies a number of ‘sectors’ of the forest margin with different ‘threats’ from an orangutan perspective, land use systems and opportunities to enhance development + conservation”

Preliminary Finding...

Landuse Systems in Batang Toru

“Agroforestry systems of the area rely on rubber, cacao, sugar palm (aren) and/or coffee as main income source, with oil palm plantations and rice fields complementing the mosaic. The forests are a source of timber, with rattan nearly depleted and ‘eaglewood’ still profitable.”

Preliminary Finding...

Accessibility to Study Site

“Some of the recent agricultural expansion into the forest occurs in remote places, with difficult access for the farmers, ethnically linked to Nias. In other parts Orangutan occurs close to the villages, without obvious conflicts with the agroforestry land use systems.”

ICRAF Activities

- Develop local support for conservation-based income alternatives
 - Help community members to identify the socio-economic threats and opportunities of local livelihood systems, macro-economic development, and markets
 - Mapping land use and land cover

“After this initial reconnaissance, we will focus on testing the options for providing local support to tree-based income opportunities. So far rubber, cacao, *gaharu* (eaglewood) and *nilam* (patchouli oil) have been identified as entry points for enhanced agroforestry. The system and tenure analysis continues.”

Multiscale negotiation support for community based forest management (*Chip Fay*)

- Evolution of the negotiation support system in Lampung (*Gamal Pasya*)
- Impact analysis of HKM implementation (*Suyanto*)
- Gender aspects of HKM in Sumberjaya (*Novi Khususiyah*)

Multi-scale negotiation support for community based forest management

EVOLUTION OF THE NEGOTIATION SUPPORT SYSTEM IN LAMPUNG: *Five years refinement of the method to succeed science and knowledge transformation.*

By:

Gamal Pasya and Chip Fay

Presented in EMPR Meeting, Bogor 27 January 2006

Background

- Rapid conversion of tropical forests leads to loss of biodiversity, massive carbon release into the atmosphere, smoke & haze problems and impacts on watershed functions. (Meine et al, 2000)
- Part of this forest conversion is poverty-driven, but it interacts with logging, tree crop plantation development, government sponsored resettlement programs and increased accessibility and road construction (Meine et al, 2000)
- Inconsistency of current policies on (forest) land use come up with many conflicts and resulting deforestation time by time. So far, such environmental services those expected from state forest zone cannot be generated. (Fay and Pasya, 2000)
- In most of the cases, deforestation and degradation of forest generate pecuniary, political, and real externalities (Price, 1982)

“Many strands of our work at ICRAF come together in what we have called our ‘Negotiation Support System’ (NSS), as we realized that Decision Support System (DSS) refer to a single decision making authority and most of INRM issues require negotiations,our NSS systems evolve.”

“Forest degradation and conversion is associated with many drivers and many problems. Economic development depends on the establishment of productive land use systems that respect their neighbours’ interests. Over time, however, the government has lacked consistency in its policies.”

ICRAF and partners are bringing new and relevant knowledge, in the form of biophysical, socio-economic and policy research results, to multi-stakeholder negotiations over natural resource management priorities and strategies. ICRAF terms this approach as **Negotiation Support Systems (NSS/SPN)**.

NSS is a systematic approach that responds to the needs of stakeholders to gain a deeper **understanding of the natural resource management problems** they are facing. **Land and trees tenure** in the watershed and protected area buffer zones are emerging as priority areas of work for the NSS approach.

In the first approach of NSS in Mid Year of 2000, there are **four sequential stages** of NSS implementation to allow it work:

“ICRAF aims to support the negotiation processes in landscape mosaics by a focus on tools for analyzing land use options as well as processes for multistakeholder evaluation of these options and ways to negotiate a way forward.”

“NSS was developed to provide a systematic approach to the problems of natural resource management. In Indonesia land and tree tenure is one of the most contentious issues that needs to be addressed in the context of maintaining watershed functions and conservation”

“As initially conceived in 2000, there are 4 components of the NSS that need to influence each other: identifying the stakes various actors have in the landscape, the way the landscape meets expectations, the process of negotiation and the implementation of change.”

NEGOTIATION SUPPORT SYSTEM (NSS); *Bringing science and knowledge to the table*

“The numbering 1, 2, 3, 4 is in fact arbitrary as it is a feedback loop that we want to enhance in all its aspects.”

Four Stages of NSS Implementation:

1. Identifying actors/stakeholders and understanding goals and indicators used for predicting current and future landscape conditions.
2. Develops tools to linkage land use plan with performance indicators of watershed functions, economic benefits, social functions, etc. which acceptable to stakeholders.
3. Supports the process of negotiation in the context of point 1 and 2.
4. Provides refined technical and institutional innovative options to help stakeholders achieving common goals/resolutions.

Obstacles in the beginning of implementation

- The fact that farmer trust to government lost due to repressive policies of government in the past.
- There were ongoing process of changes and dispersing of authorities of NRM among government levels in the context of decentralization thus resulting the need to re-map relevance stakeholders (both actual and potential).
- The urge to have the right table for negotiation.

“As a stepwise approach by an outside ‘negotiator’ it makes sense to start with the stakeholder identification and multiple perspectives on what the problem actually is.”

“In the application of NSS in Sumber Jaya, the main issue clearly was the breakdown in relations between farmers and government due to the evictions of the past. However, the process of decentralization created new opportunities to improve.”

Therefore the approach of NSS was refined in end year of 2000, and then termed as a “Multi Level – NSS”

“We realized that the interconnections between the different layers of government were key to the success – and we started a multi level NSS, taking steps from local to district to provincial scale.”

“So item 3 became re-labeled to be a multi-level negotiation process”

“The linkage between *site* (village or *kecamatan*), *district* (*kabupaten*) and *province* was provided through a hierarchical network, all within the framework of existing laws and regulations.”

WHY MULTI LEVEL – NSS (*Expectations*)

- ⇒ **Integrating NSS approach to the frameworks of decentralization process and regional autonomy, particularly related to the distribution of NRM authorities in government levels.**
- ⇒ **Localized negotiation efforts to capture local contexts**
- ⇒ **Shortening chain of negotiation and to deliver the benefits of conflict resolution directly and rapidly to stakeholders.**
- ⇒ **Reduce negotiation costs**

The Next Challenges:

- Are NRM conflict roots clearly define? Are those problems, conflicts, or perceive?
- Are the stakeholders the right persons representing their communities/parties/ disputants? How is the mandate? And how is their conflict management style?
- Are the research results to support the negotiation (socio-economically, politically and, ecologically) feasible enough to be options and bases for achieving agreement?
- How to measure the opportunities of success of achieved agreement?
- How to measure the sustainability of achieved agreement? How to convince that all stakeholders will commit on their achieved agreement (with less unfaithfulness).

Therefore the approach of MULTI LEVEL - NSS was refined 2004-2005:

- Enriching the model with Social Analysis System
 - A bundle of analysis tools that commonly used in sociology, anthropology, clinical psychology, socio-agriculture, and participatory planning
 - These participatory tools can be modified easily refer to the different level of knowledge of users
 - Not to settle the conflict but it is aimed to disclosure the conflict more clearly.
- Then the approach not only composes of inter-discipline but also inter system analysis (hard and soft systems analysis)
- Has been tested with different scales, in different sites (Bukit Rigis Protection Forest - West Lampung District, Mount Betung Conservation Forest - Bandar Lampung District, Laiwanggi Wanggameti National Park – East Sumba District, Rinjani National Park – NTB Province) and, with different results.

“The multi-level NSS was set up to address the multiple layers at which decisions can in fact be made. However, it is fair to say that ‘decentralization’ in Indonesia involved a steep learning curve for all and a fair amount of confusion on authority for implementing change.”

“Next, we could take a more serious look at how the NRM problems were defined at the different levels and how open the various actors were to innovative solutions that met their (implicit) criteria and indicators. The focus on ‘forest’ needed *deconstruction* to get at the real meaning.”

“We found that the bundle of tools of the ‘Social Analysis System’ was useful in this regard, as we needed to blend ‘hard’ and ‘soft’ science across the scales.”

“In many cases we found that latent conflicts had long historical roots and that articulation of the various stakeholder positions could *intensify* conflicts, initially. A certain level of balance in assertiveness is needed before the parties can be brought to a negotiation table.”

“The interface between the landscape mosaic and these multiple stakeholder dialogues is the next challenge – so far the negotiations have focussed on ‘inputs’ (‘planting trees’), not on ‘outputs’ (monitoring of landscape functions).”

“The Negotiation Support System process in Sumber Jaya was key to the agreements signed between the district head (Bupati) and farmer groups about managing the forest margin under the umbrella of *HKm*, a form of community-based natural resource management. What *impacts* can we expect?”

Sources for this presentation

- On going project “Property Rights, Environmental Services and Poverty in Indonesia (Basis-ICRAF-IFPRI-MSU)
- S. Suyanto , Rizki Pandu Permana, Noviana Khususiyah and Laxman Joshi. 2005. Land tenure, agroforestry adoption and reducing of fire hazard in a forest zone: a case study from Lampung, Sumatra, Indonesia. Agroforestry System. 65-1-11
- S. Suyanto, Noviana K, Beria L. 2006. Poverty and Environmental Services in Way Besay Waterhed. (draft article for ecological and society journal)

“This presentation is based on a number of reports and data sets, especially ongoing research under the BASIS-CRSP project with Michigan State University, IFPRI and Lampung University.”

Research Context

- In 2000, the government initiated a community forestry program (HKm), which
 - Provided for secure tenure through long term lease contracts with farmer groups in protected forest land
 - Requirements of farmer groups:
 - Develop a management plan for protected forest
 - Plant multi-story agroforestry trees with coffee on deforested protected forest land
 - Protect the soil with soil and water conservation measures
 - Protect remaining forest area

“We started from the HKm agreements that provide tenure security in exchange for a commitment to restore and maintain soil cover by adding trees to coffee monoculture systems.”

“The different colours in this map give the different combinations of past evictions and current HKm agreements (under negotiation or agreed) for the ‘*hutan lindung*’ (protection forest) part of the Way Besai catchment (Sumber Jaya and Way Tenong subdistricts). Green is part of the national park.”

HKm Situation

no	Name of HKM Group	Starting year of coffee garden	Eviction	Year of formation of HKm	Area (Ha)	Total number group member	ha/ member	HKM Groups Status
1	Bina Wana	1967	1993	1999	362	478	0.76	approved
2	KAMPH MWLS	1970s	1993	2000	173	142	1.22	approved
3	KPPSDA Setia Wana Bakti	1970s	1993	2000	150	120	1.25	approved
4	Rimba Jaya	1977	NR	2000	600	290	2.07	approved
5	KAMPH Rigris Jaya	1963	1993	2000	74	70	1.06	approved
6	Tri Buana	1970s	1991	2000	678	314	2.16	approved
7	Wana Jaya	1982	1993	2003	599	419	1.43	formally apply
8	Ribang Alam	1970	1994	2004	2,906	1390	2.09	formally apply

Sources : Survey Basis-ICRAF

“The various HKm applications differ in area (75 – 2000 ha) and number of farmers (70 – 1400) involved, with an average of 0.75 – 2 ha per member/ household.”

no	Name of HKM Group	Starting year of coffee garden	Eviction	Year of formation of HKm	Area (Ha)	Total number group member	ha/ member	HKM Groups Status
9	GKT Alam Lestari Sejahtera	1970s	1993	2001	677	602	1.12	process in groups
10	Ulu Pete	1970s	1993	2004	150	85	1.76	process in groups
11	Wana Mandiri	1973	NR	2001	1,031	146	7.06	process in groups
12	Mardi Rukun	1973	NR	2003	1,050	141	7.46	process in groups
13	Wana Karya / wana lestari	1973	NR	2001	400	172	2.33	process in groups
14	Hijau Kembali	1963	1993	2002	125	30	4.17	process in groups
15	Mekar Jaya	1976	1993	2000	150	123	1.22	process in groups
16	Rukun Lestari	1979	NR	2000	1,097	387	2.83	process in groups
17	Wana Makmur	1975	1994	2004	1,435	643	2.23	process in groups
18	Wana Mulya	1970	1994	2004	266	143	1.86	process in groups
19	Air Pakuan	1975	NR	2000	428	240	1.78	process in groups
20	Mulya Abadi	1975	1993	2000	1,000	356	2.81	process in groups
21	Gunung Raya	1973	1994	2001	478	195	2.46	process in groups
22	Asahan Lestari	1970	1994	2001	212	171	1.24	process in groups
23	Sido Makmur	1963	1993	2001	200	183	1.09	process in groups
24	Karya Tani	1963	1993	2004	77	51	1.51	process in groups
25	Lampaung Mandiri	1970	1994	2004	150	70	2.14	process in groups
26	Abung Lestari Jaya	1968	1993	2004	100	75	1.33	process in groups
27	Mekar Arum/ Cipta Sari	1968	1993	2004	200	76	2.63	process in groups
28	Mabar Jaya A	1978	NR	2002	600	75	8	process in groups
29	Wana Marga Rahayu	1973	NR	2004	200	150	1.33	process in groups

Sources : Survey Basis-ICRAF

“There is a substantial number of groups currently processing the application – with some targeting 7 – 8 ha per household, but most in the 1 – 2 ha range. A community-scale survey compared the perceptions of farmers in the 6 situations where HKm permits had been granted with 23 cases where HKm is ‘under discussion’”

Impacts: perceived security of tenure relative to private owned land

Group	N	Before reformation -1997 (%)	After reformation -1998 (%)	2005		
				In the process of HKm (%)	5-year HKm (%)	25-year HKm (%)
Hkm permit	6	18	34	41	68	88
Hkm in progress	23	11	43	54	77	91

“When asked to rate their security of tenure relative to privately owned land, most farmers perceived this to be only about 15% before the 1997 ‘reformasi’ period. Government change lifted it to about 40% and a 5-year temporary HKm till about 70%; a 25 year HKm would make it 90%.”

Impacts on land price

Group	Number of group (N)	Good land coffee price				
		Before reformation 1997	After reformation - 1998	2005		
				In the process of Hkm	5-year Hkm	25-year Hkm
		(Rp)	(Rp)	(%)	(%)	(%)
HKm permit	6	1,400,000	8,625,000	5,125,000	8,000,000	10,666,667
HKm in process	23	1,773,913	9,152,174	6,434,783	8,804,348	12,021,739

Group	Number of group (N)	Good land coffee price (in equivalent of coffee kg)				
		Before reformation 1997	After reformation - 1998	2005		
				In the process of Hkm	5-year Hkm	25-year Hkm
HKm permit	6	427	756	854	1,333	1,778
HKm in process	23	541	802	1,072	1,467	2,004
Coffee price (Rp/kg)		3,276	11,410	6,000	6,000	6,000

“This sense of security is also reflected in the price (‘compensation’) for land transactions. In the lower table the price is given in ‘coffee equivalents’ as the ‘KrisMon’ coffee prices of 1998 were very high. The HKm process thus leads to a considerable gain in asset value.”

Impacts on Income

Group	N	Expected Increase In income	Expected no change in income
Hkm permit	6	100	0
Hkm in progress	23	96	4

Sources : Survey Basis-ICRAF

“All farmers also expect a positive impact of the HKm permits on income.”

Impacts on bribe

Group	N	Have you had to pay bribes to maintain access to land	
		Yes	No
Hkm permit	6	83	17
Hkm in progress	23	74	26

Group	N	No longer demanded (%)	No longer paid after reformation time (%)	Stopped as soon as HKm group formed (%)	Stop because of actions of Village leader
Hkm permit	5	40	40	20	0
Hkm in progress	17	18	29	47	6

“Part of this increase in income derives from a lower exposure to ‘illegal levies’. Nearly 80% said they had to pay to maintain access to their coffee gardens in the past. The ‘reformasi’ reduced the need to pay bribes, while formation of a HKm group stopped the need for ‘bribes’.”

“Evidence so far also points at an increase in willingness to control fires and a reduced likelihood of fires that escape control (although there has not been as severe a dry season as 1994 or 1997 had after the *reformasi* period). The repeated burn scar of Trimulyo is now under control.”

Perceived Responsibility to protect the remaining forest

Group	Number of group (N)	Jointly protect forest and do not clear forest & shrub land	Jointly protect forest and the member give information about illegal logging
Hkm permit	6	67	33
Hkm in progress	23	69	26

“The farmer groups indicated that they indeed take joint responsibility for protecting the remaining forest and refrain from clearing forest and shrub land. Nearly 1/3 go a step further and also report illegal logging by outsiders to the relevant authorities (often with disappointing results...).”

Perceived Responsibilities regarding tree density and composition of the group

Group	Number of group (N)	Planting of timber and fruits with true number and composition	Planting of timber and fruits but wrong number and composition	Planting of timber and fruits and not aware number & composition
Hkm permit	6	83	17	0
Hkm in progress	23	43	9	48

“The groups that have obtained the temporary (5-year) HKm permit know that they are expected to plant timber and fruit trees in their garden, although some get the details wrong. For the groups with HKm under discussions, the details of the commitments are often not yet clear.”

Conclusion:

- Increase tenure security
- Increase land price
- Increase Income
- Reduce fire
- Reduce bribe
- Increase trees planting
- Improve land management
- Improve watershed function (soil and water conservation)
- Protect remaining forest and reduce illegal logging

“Overall these results give the impression that HKm is a resounding success, with multiple gains both for the farmers and for the government & environmental perspective. With these results one would expect a rapid spread of the use of the HKm instrument....”

“The previous presentation provided evidence of a win-win for farmer income and environmental values due to the use of the HKm instrument. Beyond overall gains, however, we need to know the effect on distribution (poverty) and gender. Follow-up surveys are now available.”

METHODOLOGY

- ☐ Household survey
- ☐ Income survey

“The following data are derived from a detailed household survey in two villages where farmers have access to limited lands outside of the ‘protective forest’ domain, and have substantial areas of coffee garden within this domain. Our survey compared income and assets between these categories.”

Sources of Income in Way Besay Watershed Lampung in 2004

Result

Source of Income	Income per Households				Income per capita	
	Leuwi Monyet		Rigis Jaya		Leuwi Monyet	Rigis Jaya
	Rupiah	%	Rupiah	%	Rupiah	Rupiah
A. Farm Income	4,702,037	70	4,890,517	64	1,184,393	1,192,809
Coffee garden at State land	2,732,748	41	1,510,197	20	688,350	368,341
Coffee garden at Private land	908,467	14	2,373,093	31	228,833	578,803
Coffee garden at tenancy	0	0	268,513	3	0	65,491
Rice field	437,055	6	124,844	2	110,090	30,450
Others Farm income	623,767	9	613,870	8	157,120	149,724
B. Non Farm	645,933	10	531,533	7	162,704	129,642
C. Wage	1,099,250	16	1,242,167	16	276,889	302,968
Agriculture	874,250	13	835,000	11	220,214	203,659
Non Agriculture	225,000	3	407,167	5	56,675	99,309
d. Others	270,834	4	1,060,333	14	68,221	258,617
Transfer	130,667	2	326,333	4	32,914	79,593
Share cropping	140,167	2	734,000	10	35,307	179,024
e. Total Income per year	6,718,054	100	7,724,550	100	1,692,205	1,884,037
F. Income per day	18,507		21,280		4,636 (0.51 USD)	5,162 (0.68 USD)

“The average per capita income in 2004 in both study villages was 0.5 – 0.7 \$/day, well below the poverty line. More than 80% of income is derived from agriculture, with coffee gardens as the main source in both villages.”

Household Income from coffee garden per year In Way Besay Watershed Lampung in 2004

Result

	Leuwi Monyet	Rigis Jaya
Inside Protection Forest		
Total income coffee garden	2,657,183	1,557,047
% coffee	86	86
% annual crop	3	10
% tree crop	10	5
Outside Protection Forest		
Total income coffee garden	908,467	2,594,757
% coffee	83	82
% annual crop	0.1	5
% tree crop	17	13
Total Income	3,565,650	4,151,803
Family Labor used	108	146
% Female	28	30
Average Area per household (ha)	2.03	1.97
Return to Labor	33,015	28,437

“Coffee was 80- 85% of agricultural income, both in the forest and on private lands; other trees provided 15% of income on private lands, annual crops were more prominent in the (younger) farms on forest lands. The return to labour of about 30,000 Rp/ day compares well with urban jobs.”

Income inequity in Way Besay Lampung in 2004

Source of income	Leuwi Monyet			Rigis Jaya		
	Income's Shares	coefficient concentration	Pseudo gini ratio	Income's Shares	coefficient concentration	Pseudo gini ratio
A. Farm Income						
Coffee garden at State land	0.41	0.99	0.37	0.20	0.50	0.19
Coffee garden at Private land	0.14	1.78	0.67	0.31	1.53	0.58
Coffee garden at tenancy	0	0	0	0.03	1.97	0.74
Rice field at State land	0.06	0.88	0.33	0.02	0.26	0.10
Others Farm income	0.11	1.02	0.38	0.18	0.45	0.17
B. Non Farm	0.10	2.22	0.84	0.07	1.05	0.40
C. Wage						
Agriculture	0.13	-0.33	-0.13	0.11	-0.79	-0.30
Non Agriculture	0.03	-0.06	-0.22	0.05	1.43	0.54
d. Others						
Transfer	0.02	0.21	0.08	0.04	0.55	0.21
e. Total Income			0.38			0.30

- The results of the overall pseudo gini ratio of income both for Leuwi Monyet (0.38) and RJ (0.30) are relatively small, this indicated that income at 2 site was more equity distributed
- coefficient ct of coffee garden at state land is <1, indicated that equity
- coefficient ct of coffee garden at private land and non farm is >1, indicated that inequity

“Two indicators were used to quantify inequity in income: the coefficient of concentration and the Pseudo-Gini ratio. For both villages and both indicators we see that the coffee gardens on forest lands reduced inequity (compared to total income in the village), while private lands enhanced inequity.”

Land inequity in Way Besay Watershed Lampung in 2004

Land Status	Leuwi Monyet			Rigis Jaya		
	Income's Shares	coefficient concentration	Pseudo gini ratio	Income's Shares	coefficient concentration	Pseudo gini ratio
State land	0.86	0.94	0.36	0.54	0.58	0.19
Private land	0.13	1.44	0.56	0.38	1.41	0.46
Tenancy	0.01	0.17	0.07	0.08	1.87	0.61
TOTAL			0.39			0.32

- The pseudo Gini ratio of land holding for LM was 0.39, while it was 0.32 at RJ those Gini Ratio are relatively small, indicated that land relatively distributed equity
- the coefficient concentration of state land is less than unity both for LM and RJ, this indicated that used of state land narrowing inequity

“The same result was obtained for size of the land holdings as an ‘asset’ indicator. A similar result was earlier obtained (and published) for Trimulyo. The claims on forest land thus are made especially by relatively poor farmers, and HKm may reduce poverty, both relatively and absolutely.”

Average land holding per household by land use, village and location

Villages	n	Coffee garden		Rice Field		Bush fallow		Total	
		Ha	%	Ha	%	Ha	%	Ha	%
Lewimonyet	30	2.02	100	0.25	100	0.47	100	2.75	100
Inside Protection Forest		1.72	85	0.25	100	0.42	89	2.39	87
Outside Protection Forest		0.31	15	0	0	0.05	11	0.36	13
Rigis Jaya	30	1.97	100	0.1	100	0.2	100	2.27	100
Inside Protection Forest		1.02	51	0.03	25	0.2	100	1.24	55
Outside Protection Forest		0.96	49	0.08	75	0	0	1.03	45

- Average land holdings at LM farmers (2.75ha) were larger than those of RJ farmer (2.27ha)
- LM farmers are more dependent on land inside protection forest area (87%) the while RJ farmers had 55% of their land holdings located inside protection forest area

“Some differences were observed between the two villages, with larger dependence on ‘forest lands’ in Leuwi-Monyet than in Rigis Jaya, but there was about 2 hectares of coffee farm per household in both cases.”

Gender aspects in Sumberjaya

Education Level

Villages	n	Year of schooling (%)				Average number of years Schooling	t test
		Illiterate	Not finished elementary school	Finished elementary school	Above elementary school		
Leuwi Monyet							t stat=0.10
Male	30	3	30	40	27	6.1	(P>10=0.58)
Female	30	3	21	59	17	5.9	
Rigis Jaya							t stat=0.55
Male	30	17	37	30	17	4.9	(P>10=0.92)
Female	30	13	27	37	23	5.5	

“Positive effects on poverty reduction – but what about gender aspects? All HKm groups that received permits only had male members.

In terms of education we found little difference between male and female members of the household interviewed.”

Female Activity at coffee garden

Activities	Family Labor	Hire Labor
	% Female	% Female
Weeding	30	5
Pruning	15	0
Fertilizing	9	0
Harvesting	39	20
Hauling	16	0
Drying	53	0

“The gender profile differed between the various tasks that are involved in coffee farming, harvesting and handling, with 9 – 53% of the tasks carried out by female household members where family labour was used. Hired labour was mostly male, with 20% female only in ‘harvesting’.”

Male Bias in Income

Male Bias in Income

$$= (M-F)/(M+F)$$

MBI = 0 → equity

MBI = 1 → inequity

Male Bias Income

Leuwi Monyet
0.44

Rigis Jaya
0.40

“A simple indicator of ‘male bias’ in income was calculated, which will indicate a value of 0 for full equity and values up to 1 for ‘male bias’ (and negative values for female bias). The resulting ‘male bias in income’ is moderate and in line with the reported labour (‘70-30’) allocation in coffee farming.”

Conclusions

- ❑ Income per capita per day is below poverty line
- ❑ Income and land holding from state forest land is high
- ❑ Income and land holding from state forest land tends to narrow inequity
- ❑ All members of HKM groups are male, but female contributed to income and land management
- ❑ Education level between male and female is not significantly different

“In conclusion, we have seen that the coffee farmers of Sumber Jaya operated below the international poverty line in 2004, that access to forest lands enhanced equity within the village and that female income is roughly proportionate to female participation in coffee farming activities.”

Economic analysis of agroforestry (*Suyanto*)

- Applications of the Policy Analysis Matrix tool for appraisal of agroforestry systems (*Suseno Budidarsono*)
- Who controls and benefits from tambaks in Aceh (*Indra/Suseno*)
- Rapid market opportunity appraisal (*Joel Tukan/Jim Roshetko*)

Economic analysis of agroforestry

“For more than 10 years ICRAF has now used the Policy Analysis Matrix or PAM as a basis for assessing the profitability of agroforestry systems relative to other options, both at farmgate (private) and *economic* prices.”

Smallholders’ objectives

- Production incentives
- Food security
- Adoptability
- Discounted returns to labor at private prices
- Food entitlement pathway
- Policy distortion, market imperfections and other institutional barriers

“In the development of the ASB matrix for assessment of tradeoffs between profitability and environmental services, we started from a number of smallholders’ objectives.”

Policy makers' objectives

- **Growth**
- **Equity**
- **Stability**
- **Discounted returns to land at social prices** (potential profitability)
- **Employment generation**
- **Adoptability by smallholders**
- [Local environmental impacts]

Three categories of policies that affect agriculture and natural resources

- Agricultural and natural resource price policy : commodity-specific policy affecting one commodity at a time
- Macro-economic policies: nation-wide; affecting all commodities simultaneously
- Public investment policies: capital expenditures from public budget affecting various agricultural agencies, groups, producers, traders, and consumers

Three price policy instruments

- ♦ **Taxes and subsidies: transfer between public budget and producers and consumers.**
- ♦ **International trade restrictions: taxes and quota limiting import and export**
- ♦ **Direct controls: regulation of marketing margin.**

“These may be compared to the policy makers’ objectives at more macro scale. A number of differences in objectives are apparent, although high returns to labour are desirable from both perspectives.”

“Government policies are usually a complex mixture of rules, incentives, taxes and disincentives; some of these policies affect specific commodities (and thus the relative attractiveness of different farm options), others all commodities simultaneously (but may favour or disfavour non-farm options).”

“Three major types of price instruments are normally used – their effects may be contradictory , compensatory or synergistic.”

PAM Policy Analysis Matrix

The PAM is a matrix of information about agricultural and natural resources policies and factor market imperfections that is created by comparing multi year land use system budget calculated at financial and economic prices

Standard reference: Monke EA and Pearson SR. (1998)

Profitability identity

	Revenues	Costs		Profits
		Tradable Inputs	Domestic Factors	
Private Prices	A	B	C	D
Social Prices	E	F	G	H
Effect of Divergence and Efficient policy	I	J	K	L

It composes of two set of identities – one set defining *profitability*, and other defining the difference between private price and social values, measuring the *effect of divergence*, as the difference between observed parameters and parameters that would exist if the divergence were removed (Monke and Pearson, 1995, pp.: 16 –19).

Profitability identity

	Revenues	Costs		Profits
		Tradable Inputs	Domestic Factors	
Private Prices	A	B	C	D
Social Prices	E	F	G	H
Effect of Divergence and Efficient policy	I	J	K	L

Private profitability calculations show the competitiveness of the agricultural system at given current technologies, output values, input cost, and policy transfer. Private profits are valued in actual market price.

Social profitability valuations measure comparative advantage or efficiency in agricultural system. Efficient outcomes are achieved when economy's resources are used in activities that create the highest level output and income. Social profits are valued in prices that reflect social opportunity cost; hence social valuation of outputs and inputs that are traded internationally, are given by worlds prices.

“The PAM method was designed by Monke and Pearson to look at the net effect of all these policy measures on the profitability of farming options. It takes a ‘land use system’ as the unit of analysis, and starts by defining a relevant time frame for appraisal, relative to the life cycle of the production system.”

“By calculating revenues, costs for tradable inputs, costs for domestic factors (labour...) and profits at two types of prices, it allows for a number of ratios and contrasts to be calculated. Private prices reflect current reality for the farmers, social prices the reality of the overall economy.”

“The various contrasts (‘divergences’) refer to subsets of the overall policy impact on profitability.”

Effect of divergences: Output and Input Transfer

	Revenues	Costs		Profits
		Tradable Inputs	Domestic Factors	
Private Prices	A	B	C	D
Social Prices	E	F	G	H
Effect of Divergence and Efficient policy	I	J	K	L

Output transfer ($I = A - E$) and **Input Transfer** ($J = B - F$) arise from two kinds of policies that cause divergence between observed and world product price : commodity - specific policies (wide range of taxes, subsidies and trade policies) and exchange rate policies

Effect of divergences: Factor Transfer

	Revenues	Costs		Profits
		Tradable Inputs	Domestic Factors	
Private Prices	A	B	C	D
Social Prices	E	F	G	H
Effect of Divergence and Efficient policy	I	J	K	L

Factor transfers, ($K = C - G$), defined as the difference between the costs of all factor of production (labor and capital) valued in actual market prices, and social costs of these factors.

The effects of divergence in the factors market are the result of both underlying **market failures** and **distorting policies**. It indicates inefficiency-causing distorting policies affecting factor market, and market failures in factor market.

Effect of divergences: Net Transfer

	Revenues	Costs		Profits
		Tradable Inputs	Domestic Factors	
Private Prices	A	B	C	D
Social Prices	E	F	G	H
Effect of Divergence and Efficient policy	I	J	K	L

Net Transfers, $L = I - J - K$, shows the extent of inefficiency in an agricultural system. It is also the difference between private profit and social profit, hence $L = D - H$.

“First of all, a comparison of the divergences in revenue and tradable inputs tells us whether the government is protecting the producers or (domestic) consumers. It is common for negative ‘revenue transfers’ (‘cheap food for the cities’) to be compensated by positive ‘input transfers’, e.g. fertilizer subsidies.”

“The divergence on domestic factors shows us how much the allocation of land and labour follows the current opportunities in the economy as a whole.”

“Finally, the divergence on net profits shows how the positive and negative effects of ‘policy’ work out on the profitability of farming

Ratio Indicators : Profitability

	Revenues	Costs		Profits
		Tradable Inputs	Domestic Factors	
Private Prices	A	B	C	D
Social Prices	E	F	G	H
Effect of Divergence and Efficient policy	I	J	K	L

Private cost ratio (PCR): $C/(A-B)$

How much the system can *financially* afford to pay domestic factor (including normal return to capital) and still positive

Domestic Cost Ratio (DCR): $G/(E-F)$

How much the system can *economically* afford to pay domestic factor (including normal return to capital) and still positive. It indicates how efficient the systems use domestic resource.
DRC > 1 indicate inefficient used of domestic resource

Ratio Indicators : Policy Transfers

	Revenues	Costs		Profits
		Tradable Inputs	Domestic Factors	
Private Prices	A	B	C	D
Social Prices	E	F	G	H
Effect of Divergence and Efficient policy	I	J	K	L

Nominal Protection Coefficient (NPC) :

an estimate of the extent to which a commodity price has been affected by government interventions, and is defined as the ratio of that's commodity's domestic price to its international reference price.

on tradable outputs (NPCO) : A/E indicates output transfer

on tradable input (NPCI) : B/F indicates input transfer

Coffee farming in Sumber Jaya

- The system has been improving from simple coffee farming system (under traditional shifting cultivation technique) to more intensive systems; mostly managed by smallholder of various ethnic groups (the pioneer Semendonese, Sundanese, Javanese, very few Lampung natives, Batak and Balinese).
- Forest conversion for coffee farming (on the state forestland) had created serious problems
 - Conflict of interest regarding land status and land uses created problems to control the use of state forestland
 - The existence of administratively recognized villages within protection forest

“A number of ratios are also of interest:

the private cost ratio and domestic cost ratio indicate the efficiency of using domestic resources.”

“The nominal protection coefficient allows comparison at commodity level.

Application of this to the partial budgets for the ‘crop’ and ‘tree’ component of agroforestry systems in the SAFODS project showed crops to be protected and trees to be taxed.”

“Application of the PAM method to the various coffee production systems in Sumber Jaya focussed on a comparison of ‘shaded’ and ‘sun’ coffee, as practised on private or ‘forest’ lands.”

Coffee farming in Sumber Jaya

- Forest conversion for coffee farming (on the state forestland) had created serious problems
 - Conflict of interest regarding land status and land uses created problems to control the use of state forestland
 - The existence of administratively recognized villages within protection forest
 - An assessment carried out by *Tim Kopi* (Ministry of Forestry) estimated that in July 1998 there are about 115,000 ha (out of 410 thousands ha) of state forestland in Lampung province have been cultivated for coffee farming (Gintings, 1999).

“As part of a government policy task force ‘Tim Kopi’, an assessment was made of various proposed taxation regimes for coffee farms on forest lands.”

Coffee farming in Sumber Jaya

Typology

“The analysis started with development of a typology of coffee farming systems.”

Profitability

Returns to land

The present worth of benefit (revenues) less the present worth of the cost of tradable inputs and domestic factors of productions (NPV) - valued at private prices (private profitability), is an indicator for **production incentive**, and at social prices* is an indicator of **potential profitability**

Note

*) Social price is the economic prices that removes the impact of policy distortion : taxes, subsidy and other local levies and market imperfections,.

“Two key indicators of profitability were used: the returns to land, where all labour is accounted for at the current wage rate...”

Profitability

Returns to labor

- The wage rate that sets the NPV equal to zero
- Returns to labor that exceed the average daily wage rate, indicate that individuals with their own land will prefer this activity to off-farm activities.
- Returns to labor valued at private prices can thus be viewed as the primary of indicator of profitability for **smallholder's production incentives.**

“... and the returns to labour where the wage rate is adjusted until the net present value is zero.”

Profitability *data requirements*

- a detail-farm budget calculation
- proper prices for calculating the costs and returns
- the macroeconomic assumption used in this assessment.

“To calculate these ratios, we first of all need a good account of the input requirements and product flows per year over the life time of a production system.”

Profitability *data requirements*

Pricing the Costs and Returns

The assessment uses ten years annual average prices*) of all tradable farm inputs and farm commodities that are cast in the respective constant prices (constant price 1997) :

- **local market** prices as the basis of calculation of farm budget valued at private-financial prices.
- **export or import parity prices** at farm gate as the basis for the comparable farm budget valued at social prices

Note :

In this regard, the period under study is 1991 to 2000.

“In fact, prices for products and inputs vary between and within years – we use a long term average value as a simple indicator of what farmers may expect for the coming years. In fact, however, more flexible management decisions in response to prices can increase profitability.”

Profitability

macroeconomic parameters used

Year 2000

- Exchange rate (Rp / US \$) 8,374
Wage rate in Sumatra (Rp/person-days) 8,000
- *Real* interest rate (net of inflation)
 - Private* **20%** per annum
 - Social* **15%** per annum

Returns to labor and the Labor requirement

Coffee Systems	Return to Labor at private price	Year to Positive Cash Flow	Discounted Establish- ment Cost	Labor Requirement	
				Establish- ment (person-day)	Labor for Operation (ps-d/ha/year)
SUN COFFEE					
High Input Monoculture	7,137	5	10,473,363	1,116	212
High Input Monoculture w/ Grafting	6,463	5	10,473,363	1,116	204
SHADE COFFEE					
Shade Base	8,239	4	6,602,622	871	107
Shade Base with under storey	11,101	4	6,607,355	871	107
Fruit Base	8,794	4	6,599,056	870	107
Fruit Base with under storey	11,348	4	6,599,056	870	107
Timber Base	11,773	4	6,620,473	873	162
Timber Base with under storey	14,382	4	6,620,473	873	166

Sources : Budidarsono et al (2001) and Kuncoro and Budidarsono (draft)

“For our study we used prices of the year 2000 – and thus results are different from current conditions.”

“The study found that timber-based coffee systems with under storey would provide higher returns to labour than monoculture (‘sun coffee’), when assessed over the life time of the system and at moderate discount rates. Planting trees into coffee gardens makes sense for farmers, as long as they can expect to harvest them.””

Provincial Level Policy Setting

Provincial Decree No 7 / 2000

- Regulate retribution of commodities (32 items) harvested and collected from the state forestland, including coffee.
- Although not clearly stated, the decree seems to have two objectives: to generate forest rehabilitation fund and to discourage forest encroachment.
- The decree eventually affects the return of those who cultivate state forestland and the NTFP gatherer.

“These results were part of the considerations for provincial level policies on ‘retribution’ for coffee from state forest lands. As farmers don’t pay land tax for these farms, some form of retribution was deemed to be fair.”

Provincial Level Policy Setting

The impact

- Under coffee prices of Rp 3,167/kg at farm gate, except the multistrata coffee systems, all coffee systems cultivated in the state forestland would not be profitable.
- Although multistrata coffee still profitable to cultivate, its return to land will decrease by 41% and return to labor will decrease by 17.5%.
- The assessment gives a hint that under current coffee price, the objective of the Provincial Decree to discourage coffee cultivation within state forestland seems hard to achieve. If coffee price at farm gate never fall under Rp 3,500 per kg, coffee cultivation within state forestland remain attractive and rather an opportunity to farmer to have a semi-secure tenure for coffee cultivation in the state forestland

“The proposed ‘retribution’ was high enough to make coffee monoculture on state forest lands unattractive – while it still allowed positive margins for the multistrata coffee, be it at lower ‘returns to labour’. Variable coffee process, however, influence these results.”

WHO CONTROLS AND BENEFITS FROM *TAMBAK* (BRACKISH WATER AQUACULTURE) IN ACEH

Study on Socio-Economic Aspects of
Tambak Production in Aceh before and after
the December 2004 Tsunami

Integrated Natural Resource Management and Livelihood
Paradigms in Recovery from the Tsunami in Aceh,
A Ford Foundation funded project

Indra MP and Suseno Budidarsono

“The December 2004 Tsunami brought Aceh and its coastal zone to the forefront of public interest in discussions on environment and development. Conversion of mangrove forest to shrimp/fish ponds almost certainly increased the death toll from the tsunami...”

“Murals in Meulaboh along Aceh’s west coast try to capture the wall of water that took all people by surprise.”

“The devastation was unprecedented in recorded human history.”

“After the emergency relief phase, when clean water, food and shelter were available and the wounded had received care, the discussion started on sustainable livelihood options along the coast – but also on the ‘causes’ of the human damage and the role of the fish/shrimp ponds.”

“ICRAF and other CGIAR centres operating in the Tsunami-affected countries responded in a number of ways. A joint web-site was started to facilitate information flow. In Indonesia the Ford Foundation supports a study on ‘integrated natural resource management’ for Aceh.”

Background of the study

- There is widespread pressure and interest from government and international donors to assist in the restoration of these aquaculture-based livelihoods, particularly along Aceh's northeastern coast, after December 2004 tsunami
- Little is really known about the social, economic, and legal issues related to brackish water aquaculture in Aceh

“The study reported here is part of that project. Its aim is to understand who controls and benefits from the *tambaks* (fish/’shrimp ponds), especially along the N and E coast of Aceh. Little quantitative data existed before the Tsunami.”

Objectives

- To assess and get a clear understanding of the social, economic, and legal issues related to brackish water aquaculture in Aceh
- Provide information to international donors and government to design a more appropriate intervention for assisting households formerly dependent on brackish water aquaculture ponds for their livelihoods

“The objective of the study was to clarify the social, economic and legal issues that relate to the development of *tambaks* in the mangrove zone, as a contribution to the debate on rehabilitation strategies.”

Methods

- Rapid assessment
 - field observation
 - secondary data
 - in-depth interviews
 - focus group discussions
- Farm budget

“The study used *rapid assessment* methods to try and construct farm budgets for the operation of *tambaks*, focussing on ‘returns to land’ and ‘returns to labour’.”

“Our study involved all tsunami-affected parts of the north and east coast of Aceh – with a gradient in impact by the Tsunami from Banda Aceh eastwards. A number of villages was selected for detailed survey.”

“According to available statistics, the total area of tambaks was more than 30,000 ha, with an average annual productivity of shrimp or fish of 0.5 t/ha. The total number of households involved was nearly 15 thousand, with an average of more than 2 ha/household.”

“Mangrove conversion for tambak production occurred throughout the 1980’s, but in fact during the 1990’s the area of active tambaks declined. The main reason for this was a virus disease that affected the ‘tiger shrimp’ production, the most profitable enterprise.”

The Production values in 2003

- MAFF/World Bank figures suggest the fishery sector of Aceh provides produce with a value of US\$176.67 million.
- The value of brackish water aquaculture products is 32% of the total value
- The total value in 2003 has been estimated in Dinas Perikanan statistics as around US\$56.3 million (based on farm-gate figures – estimate total value of production that will increase as product moves along the market chain)
- an estimated US\$ 9.7 million is fish [milkfish estimated as US\$7.2 million], and the major value of US\$ 46.5 millions is crustaceans.
- Tiger shrimp makes up the biggest proportion, providing US\$41.8 million to total value.

“Despite this stagnation or decline in the tambak sector, it still formed 32% of the total fisheries value of Aceh province, prior to the Tsunami.”

TAMBAK AQUACULTURE : MAIN ACTORS

The diagram illustrates the relationships between four main actors in tambak aquaculture: Owner/Farmer, Toke, Farm Operator, and Laborer. The Owner/Farmer is at the top, connected to the Toke and Farm Operator. The Toke is connected to the Farm Operator and Laborer. The Farm Operator is connected to the Laborer. The Laborer is at the bottom. Various flows are indicated by arrows: Working capital (Owner/Farmer to Toke), Marketing (Toke to Owner/Farmer), Working days (Owner/Farmer to Farm Operator), Wage or yield % (Farm Operator to Owner/Farmer), Rent or Yield % (Farm Operator to Owner/Farmer), Working days (Farm Operator to Laborer), Marketing (Laborer to Farm Operator), and Tambak (Laborer to Farm Operator). A timestamp '08.12.2005 11:49' is visible in the bottom right corner.

“The question of who owns and benefits from the tambaks proved to be fairly complex, as a network of local investors (‘toke’ or middlemen), farm operator, owner/farmer or labourers was involved.”

TAMBAK AQUACULTURE : MAIN ACTORS

In the selected villages

Toke	27
Tambak owner	834
Number of households	2,712
Number of people	12,285
Tambak area (ha)	1,433,15 ha

There are considerably more people involved directly or indirectly dependant on aquaculture as part of their livelihood strategies

- hatchery operators and employees,
- feed suppliers and salespeople
- people involved in trading, marketing and services

08.12.2005 11:49

“In the selected villages we found that 1,433 ha of tambak was owned by 834 people (nearly 2 ha each), involved 2,712 households (0.5 ha/household) and 12,285 persons. In fact the sector provided further employment in hatcheries, feed suppliers and along the market chain.”

“In our study we observed a gradient where all tambak areas were destroyed by the Tsunami close to Banda Aceh while damage was about 50% in Aceh Utara and Loksheimawhe where our survey ended.”

“Overall we found that tambak owners represented only 6% of the people who directly relied on the tambaks as their source of income or employment.”

Land Tenure issue

Although most tambak were privately owned, but it is estimated that only few numbers hold land title deed (estimated 9.4%)

“Most of the tambaks were considered to be on ‘private lands’ by their owners, but only 9% was actually certified with a formal land title.”

“In 3/4 of the tambaks the household that owned the tambak also was the main operator, usually relying on credit from the middlemen for the necessary investment.”

“Among the 10 villages studied, only one had a clearly different pattern of ownership: in one of the villages in Bireuen district most of the operators were renting the tambak from a ‘land lord’.”

Simple farm budget (per hectare)

Investment	25,190*)			
Working capital	10,546	9,046	10,546	30,137
Returns	17,250	21,250	21,650	60,150
	6,704	12,204	11,104	30,013
Employment				633
Return to labor				47,392**)

*) two years

**)current wage rate : Rp. 30,000 – Rp. 50,000

“Preliminary data on the farm budgets suggest that the tambaks provide employment for 633 person days per ha per year, at a return to labour that is certainly attractive: 47,000 Rp per day of work. This compares well with urban employment opportunities.”

“In conclusion, the

Conclusion

- Tambak provide rural employment and generate income for rural economy
- Tambak owners does not always controlling tambak production
- Tambak rehabilitation would accelerate the economy of tsunami affected area

conversion of mangrove to tambaks along Aceh's N and E coast was primarily driven by economic opportunity, with a combination of local land 'ownership' and capital obtained from local middlemen/investors. Rehabilitation of the labour-intensive tambaks will provide income and employment."

"We found a lot of activity to restore the tambaks – but also considerable confusion over how and where the coastal protection functions of mangroves were to be restored. Interagency coordination needs to be improved and a clear policy on the 'no-go' part of the coast is needed, otherwise current efforts will lead to disappointment."

Market Chain Improvement:

Linking Farmers to Markets in Nanggung, West Java, Indonesia

Joel C. Tukan
James M. Roshetko
Suseno Budidarsono
Gerhard S. Manurung

World Agroforestry Centre (ICRAF) &
Winrock International – Bogor, Indonesia

International Symposium on Improving the Performance of
Supply Chains in the Transitional Economies
International Society for Horticultural Science (ISHS)

Lotus Pang Suan Kaew Hotel
Chiang Mai, Thailand July 19-23, 2005

"The previous results on the profitability of land uses that include agroforestry have been based on the average farmgate price that farmers receive. However, this price can change with changes in the market chain – and it is often assumed that farmers can improve their 'marketing' skills."

“The following test of this hypothesis was based on a case study of the farmers in Nanggung district, close to Bogor – operating in the Halimun ecosystem Surrounded by the last substantive area of forest on Java.”

INTRODUCTION

Agroforestry Innovations and Livelihood Enhancement Program

develop a replicable and efficient extension approach to improve farmers' tree gardens, both quality and quantity of products, and strengthens farmer's ability to respond to market opportunities.

CORE ACTIVITIES:

- Training workshops for farmer leaders
- Extension Follow-up with farmer groups
- Market and Economics studies

WHAT ARE THE PROGRAM ADDRESSES?

Livelihood enhancement
(poverty reduction) &
Conservation (improving farm
productivity, market linkages)

“The case study is based on an 18 months period of involvement with agroforestry innovations and livelihood enhancement in the area, supported by USAID and carried out by RMI (a local NGO), Winrock International and ICRAF staff.”

MATERIALS AND METHODS

“The project tested a new approach to extension, based on the stimulation of farmer group formation, farmer-lead research and joint analysis of opportunities for improvement of the management of the mixed gardens.”

RESULTS

Farmer Profile

1. Farmers landholdings are small; cultivates 0.3 ha of irrigated rice and 0.5 ha of upland tree garden
2. Average annual income is Rp 9.2 million, ranging from Rp 325,000 to Rp 37.7 million
 - 37.4% of the respondent households live below the poverty line
 - 73.3% of the respondents (household heads) consider themselves farmers
 - Only 3.8% of households rely on agriculture as their sole source of income
 - Off-farm income: Trade (operating small shops), service sector and industry

“Most villagers still see themselves primarily as farmers, despite the proximity of urban centres and employment opportunities in the mining and service sector.”

Priority Species identified by triangulating data from the first workshop, market studies and tree garden inventories.

Table 1. Species with high potential to enhance smallholders’ incomes in Naggung.

Species	Farmer Preference	Market Study (Unmet Demand)	% of Trees in Inventoried Gardens
Banana (<i>Musa paradisiaca</i> L.)	1	High	45.3%
Durian (<i>Durio zibethinus</i> Murr)	1	High	1.3%
Petal (<i>Parkia speciosa</i> Hassk)	1	High	1.8%
Jackfruit (<i>Artocarpus heterophyllus</i> Lam)	1	High	2.8%
Mangosteen (<i>Garcinia mangostana</i> L.)	2	High	0.6%
Rambutan (<i>Nephelium lappaceum</i> L.)	2	High	2.6%
Jengkak (<i>Ardisia cuneata</i> Benth)	1	Local market	2.6%
Sengon (<i>Paraserianthes falcataria</i> L.)	1	High	8.7%
African wood (<i>Mitrospora eminii</i> L.)	1	High	16.7%
Bamboo (<i>Bambusa</i> spp.)	1	High	24.1%*
Chili peppers (<i>Capsicum annuum</i> L.)	1	High	Not present
Tomatoes (<i>Lycopersicon esculentum</i> Mill.)	1	High	Not present
Sweet corn (<i>Zea mays</i> L.)	3	High	Not present
Peanuts (<i>Arachis hypogaea</i> L.)	3	High	Present
Green beans (<i>Vigna radiata</i> L.)	1	High	Present
Chickpeas (<i>Cicer arietinum</i> L.)	1	High	Present

“The mixed gardens contain a wide range of tree and other woody species – along with areas used for growing annual crops. Banana and bamboo emerged from the surveys as the number 1 and 2 opportunities to increase income from unsatisfied market demand.”

Tree Garden Types, Species Component, Management and Productivity

“A typology of the gardens showed a substantial variation in management intensity and focus on timber trees as ‘retirement plan’ or fruit trees for immediate income. Some of the gardens were considered ‘fallow’ – available for more intensive use in the future.”

“Four market channels were recognized, with a number of links in the chain between producer and consumer. Most of the bananas were sold to local collectors, who took care of the grading (sorting) and further marketing.”

Fig 1. Percentage of Banana Marketing Channel used by Farmer

“Expressed per unit product, the profit margins increased along the market chain. Sorting of the farmer produce allowed the middlemen to target different markets with different qualities of products.”

Fig 2. Profit margin received by market actors

Table 2. Comparison of prices, costs and margins associates with different banana marketing channels.

No	Descriptions	Channel 1		Channel 2		Channel 3		Channel 4	
		Price/bunch (Rp)	Percentage (%)	Price/Bunch (Rp)	Percentage (%)	Price/bunch (Rp)	Percentage (%)	Price/bunch (Rp)	Percentage (%)
1	Farmers								
	Selling Price	10,000	100.00	6,500	23.21	6,500	14.77	6,500	10.83
2	Collectors								
	Buying Price			6,500	23.21	6,500	14.77	6,500	10.83
	Selling Price			15,000	53.57	20,000	45.45	20,000	33.33
	Marketing Margin			8,500	30.36	13,500	30.68	13,500	22.50
	Marketing Cost			1,450	5.18	1,450	3.30	650	1.08
	Profit Margin			7,050	25.18	12,050	27.39	12,850	21.42
3	Local Traders								
	Buying Price			15,000	53.57			20,000	33.33
	Selling Price			28,000	100.00			40,000	66.67
	Marketing Margin			13,000	46.43			20,000	33.33
	Marketing Cost			1,465	5.23			5,665	9.44
	Profit Margin			11,535	41.20			14,335	23.89

i) Farmers sell bananas to collectors at a price of Rp 5,000-Rp 7,000/bunch. Prices indicates in the Table are averages. (Collectors assume one bunch can produce 8 hands of banana).

ii) Percentage indicates percentage of consumer buying prices.

“A further analysis of the margins between consumer and producer showed that farmers only received 10-20% of the price consumers paid, except for ‘channel 1’, where farmers sell directly.”

Continue (Table 2)

No	Descriptions	Channel 1		Channel 2		Channel 3		Channel 4	
		Price/ bunch (Rp)	Peren tage (%)	Price/ Bunch (Rp)	Peren tage (%)	Price/ bunch (Rp)	Peren tage (%)	Price/ bunch (Rp)	Peren tage (%)
4	Regional Traders								
	Buying Price							40,000	66.67
	Selling Price							48,000	80.00
	Marketing Margin							8,000	13.33
	Marketing Cost							40	0.07
	Profit Margin							7,960	13.27
5	Regional Retailers								
	Buying Price					20,000	45.45	48,000	80.00
	Selling Price					44,000	100.00	60,000	100.00
	Marketing Margin					24,000	54.55	12,000	20.00
	Marketing Cost					2,200	5.00	40	0.07
	Profit Margin					21,800	49.55	11,960	19.93
6	Consumer								
	Buying Price	10,000	100.00	28,000	100.00	44,000	100.00	60,000	100.00

i) Farmers sell bananas to collectors at a price of Rp 5,000-Rp 7,000/bunch. Prices indicates in the Table are averages. (C)ollectors assume one bunch can produce 8 hands of banana).
 ii) Percentage indicates percentage of consumer buying prices.

“Where up to 5 steps were involved between farmer and consumer, every step operated at a profit margin of 10-25%, after accounting for costs.”

DISCUSSION

WHAT IS THE HIGH POTENTIAL OF TREE GARDENS PRODUCTS IN NANGGUNG

- 45.3 % of the trees in gardens are bananas
- 75.9 % of tree gardens contain bananas
- Banana grows well in Nanggung area
- No significant diseases (fusarium, BDB, BBTV)
- Only 1.5 hours from Bogor and 2.5-3.0 hours from Jakarta
- Banana demand greater than supply (local to international)
- Farmers are interested in intensifying their farming system

“This analysis, logically, stimulated interest by the farmers in a more direct role in marketing. They clearly have comparative advantage on providing for demand on the local and Jakarta markets.”

Current tree gardens management

No Management:

1. Farmers do not focused on marketable varieties
2. Lacking access to quality germplasm - plant whatever is available
3. Agricultural inputs (fertilizers and pesticides) is infrequent
4. Fundamental banana cultivation is not practiced
5. Little to no weed control is conducted under and near bananas
6. Systematic or uniform spacing is not followed
7. Common to see 6-7 stems per plant
8. The removal of senescent leaves and male flowers is not conducted
9. Harvesting is not based on fruit maturity but rather on the arrival or anticipated arrival of local collectors, which is often unannounced.
10. Bunches are often stored on the floors of homes or farm sheds for 1-3 days before collectors' arrival
11. Bananas are sold in bulk by bunch regardless of quality
12. Collectors do not pay a price differential based on variety.

“However – farmers maintain many varieties of banana and they are not equally appreciated in the market chain.

Management intensity (and cost...) is low, while a lot of quality is lost between harvest and sale to collectors.”

“After this initial analysis, farmers became really excited...

We helped by a series of consultations and visits.”

“Farmers learned that by targeting Grade A and Grade B bananas their farmgate price could be three times as high as they currently get...”

“The impacts that a change in marketing could have are thus substantial – and considerably larger than a change in physical productivity could expect to achieve.

However, the better price clearly set a process in motion to produce higher quality products.”

CONCLUSIONS

Experience indicates that farmers are best served by:

1. Focusing on a limited number of species that are appropriate for local biophysical conditions and have a high market value/demand;
2. Utilizing high quality germplasm (provenance, varieties, etc) to increase productivity and profitability;
3. Managing tree gardens to yield tree products that meet market specifications;
4. Developing permanent market linkages.

“Here we found a dilemma: a focus on less species and only those products for which there is current market demand seems logical – but what about risk? Is following the conventional pathway of ‘specialization’ really in their long-term interest?”

Farmer Implementation

No	Activity	% of farmers
1	Using appropriate spacing	100
2	Utilize recommended varieties (quality germplasm)	100
3	Using Fertilizer	89
4	Circle Weeding	78
5	Number of stem retained	78
6	Good harvesting	78
7	Pest and Disease management	33
8	Leaf Pruning	22
9	Drainage	11

“All farmers found that simple recommendations on plant spacing and ‘quality germplasm’ were easy to follow; most also followed recommendations for reducing the number of shoots retained and better harvesting methods. Pest and disease management was less popular.”

Recent impacts identified

- 20-25% increase in stem productivity
- 85% of production meetings specification
- damage decrease from 10% to 3% using plastic crates
- 35% in transportation volume (plastic crates)

“With simple measures and in a short term farmers experienced an increase in stem productivity and saw 85% of their production meet the specifications for Grade A or B. A shift to plastic crates reduces damage on the way to the market...”

Terima Kasih

Thank You

“Our case study is in line with the hypothesis that a more direct involvement of farmers in the market chain can pay off for farmers of mixed gardens within reach of large urban markets. This may be a ‘*special case*’ (?), but it was an opportunity that had remained underutilized.”

Rewards for environmental services (*Sonya Dewi*)

- How much sedimentation control can be bought in Sumber Jaya: a designed experiment (*Beria Leimona*)
- Typology of environmental services and reward mechanisms (*Meine van Noordwijk*)

Rewards for environmental services

The last 2 presentation on RUPES will connect it all...

A presentation on the External Program and Management Review (EPMR)
Bogor, 27 January 2005

A Designed Experiment in Rewarding Environmental Benign Land Use Practices

An action research supported by
the Economy and Environmental Program for Southeast Asia
(EEPSEA)

Beria Leimona
L.Beria@cgiar.org
RUPES Program – ICRAF SEA

“Rewarding the Upland Poor for the Environmental Services they provide – RUPES has become a well-known concept. Are expectations too high? Can transaction costs be kept low enough? Will the rural poor actually benefit? What mechanisms are most promising for each situation?”

RUPES

*aims to enhance the livelihoods and
reduce the poverty of upland poor in
Asia while supporting environmental
conservation at the global and local
levels*

Supported by IFAD
Coordinated by the World Agroforestry Centre (ICRAF)
Implemented with local, national and international partners

“The RUPES action research is supported by IFAD and has many national and international partners, engaged at site or national policy level.”

RUPES Agenda

What services to whom and where?

Watershed functions, Biodiversity, Landscape beauty, Carbon storage ~ as influenced by land use practices

How do all stakeholders know?

Bridging local, scientific and policy ecological know-ledge, negotiation support systems, local monitoring

Which reward mechanisms and how they work?

Land tenure, Trust funds, Infrastructure, Social capital support, Eco-label markets, Ecotourism – Equity, Efficiency, Effectiveness

Which policies can support?

Direct involvement of local governance, clear implementation of global conventions, integrated natural resource management, community-based forestry

“Four major types of questions are guiding all that we do.”

- **RUPES Action Research Sites**
- **Areas of Interest**

“Rupes currently has 3 action research sites in Indonesia, 2 in the Philippines, 1 in Nepal, about 15 ‘associated sites’ and active national for a in other Asian countries as well.”

Research Site: Sumberjaya District

“The following presentation highlights just one of these sites: Sumberjaya – a watershed that has been discussed in earlier presentations. Actual forest cover differs substantively from the targets... Coffee farms provide income, though households still classify as ‘poor’”

Potential RES scheme in Sumberjaya

- **RUPES (Rewarding Upland Poor for Environmental Services They Provide) Program in Sumberjaya since 2003**
- **To support and mobilize capacity of poor local upland communities and government agencies to develop workable reward schemes for environmental services provided by upland poor.**
- **Three potential schemes in RES:**
 - Direct monetary reward for delivering good quality domestic-use water → local scale
 - Land tenure security → sub-watershed scale
 - Direct monetary reward for rehabilitating riparian zone → landscape scale

“In Sumber Jaya we look at three nested scales for reward schemes for environmental services:

- the provision of potable water for domestic use,
- tenure agreements for the forest margin (HKm),
- direct monetary rewards for improved management of the riparian zone to reduce sediment loads of the river.”

Goal and Objective

The Goal:

To establish **fair and sustainable** environmental service rewards for the communities in Sumberjaya watershed

The Objectives:

- Design of a **direct incentive scheme** for increasing and maintaining good water quality of Way Besai River;
- Estimation of **range of values** that would be enough to motivate individuals in participating in a program that restricts their land management using an actual experimental auction.
- Analysis of **changes of conservation behaviors and perspectives** of the community groups involved in the program.

“A new study will focus on this last aspect, and target the development of fair and sustainable reward mechanisms that stimulate long-term behavioural change; payments will be expected to be made by the hydro-electricity company (PLTA) on the basis of their enhanced efficiency with less turbid waters.”

Research Design

Initial assessment:

- Inputs from Participatory Landscape Assessment (PALA)
- Series of Focus Group Discussion

Experimental and Actual Auction

Direct incentive scheme implementation

- Contract signing and making payment
- Monitoring activities and mid-term evaluation

Process documentation

“The research design starts with the PALA assessment (see page 36-40) and takes steps towards an ‘auction’ where the PLTA will try to maximize the amount of sediment reduction it can buy for a set amount of money. We will monitor the transactions and their costs.”

Policy Relevance

... *recommendations potentially useful to policy makers*

- An innovative way to determine level of incentive for conducting government programs.
- Inputs on alternative scenarios in developing a reward scheme for environmental services.
- Strong scientific basis for negotiation
- Inputs for efficient (and effective) budget allocation (in public funding scheme)

“We expect that this study will answer a number of questions in the policy domain, especially in between the paradigm of ‘principled valuation’ and ‘fully market based, negotiated deals’. We look for negotiations that are informed by the science of watershed functions...”

Thank You

More information about RUPES

RUPES Program

c/o World Agroforestry Centre
PO Box 161, Bogor, 16001, INDONESIA
Tel: +62 251 625415
FAX: +62 251 625416
Email: RUPES@cgiar.org

<http://www.worldagroforestrycentre.org/sea/Networks/RUPES>

“This study is just starting – further details are available on request... Updates will be provided through the RUPES website and newsletter. You can find us at www.icraf.org/sea/networks/rupes

Donkeys, Carrots, Sticks and Roads to a Market for Environmental Services: Rapid Agrobiodiversity Appraisal for the PES – ICDP Continuum

Meine van Noordwijk & co-authors
ICRAF-Southeast Asia

“In our efforts to synthesize what we learn from the efforts to make reward mechanisms work, we are reflecting on the combination on regulatory and incentive-based approaches. The simple “rules haven’t worked, now the market will fix it” is way too naïve...”

“We find that much of the dialogue on environmental services is still framed in a deforestation/ reforestation language. In fact, however, in landscapes in between ‘100% open field agriculture’ and ‘100% forest’ the issues are as much about spatial pattern as they are about the number of trees or area of forest. In ‘integrate’ tradeoffs need to be guarded”

“The simple *rules* versus *rewards* choice is often framed as carrot or stick, assuming that the farmer indeed has to go to the market and that the donkey doesn’t want to move... Can we learn from this analogy? How can rules & rewards be used in synergy?”

“The starting point for RUPES is that land use in the uplands can affect many ‘lateral flows’ and ‘services’, but that these impacts don’t translate to benefits or costs that the upland farmers see when they choose among the options they have. Recognition & rewards can help, but transactions can be costly.”

“In fact there have been and still are many attempts to make the goals of livelihood improvement/development and environmental conservation a reality. RUPES is inclusive and sees a ‘strict’ form of PES (payments/markets for ES) as only one of a range of options.”

“Basically the interaction between local agents, an agroecosystem and external stakeholders can be considered at the level of **outcomes** (for ES and livelihoods), **inputs/ actions** (what farmers do), **plans** or **objectives**. The interaction with external stakeholders can focus on any of these levels.”

“In developing ES reward mechanisms we have learnt that four dimensions need to be considered, right from the start. The first may seem to be very obvious: Value or the presence of ‘*real*’ and ‘*significant*’ environmental service effects of land use change.”

“In practice, however, perceptions of ES effects rather than real ES effects drive the discussion. To be sustainable, however, reward mechanisms must withstand scrutiny. An example is the case of Lake Singkarak where a hydroelectricity company pays and money would be used for ‘reforestation’...”

“The Paningahan community maintains the best forest cover of the whole catchment and expected to get a major part of the ES payments. Is ‘their’ forest indeed responsible for the water that drives the turbines? We started a ‘rapid hydrological appraisal’ or RHA.”

“Our water balance model suggests that land cover in the catchment will influence a number of terms in the balance, but have little effect on electricity production (‘HEPP water use’). The main issue probably is water quality of the lake – with complex cause-effect relations.”

RAMES = Rapid Appraisal of Marketable ES				
	RHA: Hydrologic al services	RABA: agrobio- diversity	RaCSA: carbon stocks	Eco- tourism
PRA: land use, stakeholders	Interviews + focus group discussions + surveys			
Land use change analysis	Satellite remote sensing + GIS			
LEK = local knowledge&values	Interviews	Interviews, ethnobotany	Soil + ve- getation typology	??
PEK = policy perceptions&values	Interviews, sec. data	Interviews, sec. data	Check Kyo- to eligibility	??
MEK = ecological models	GenRiver	Survey + scaling	Measure C- stocks	??
Plausible ΔLU scena- rios+indicators: tradeoffs	RAMES model			??

“Similar to the RHA we have developed methods and tool boxes for the appraisal of agrobiodiversity, carbon stock issues. Our target is to compare all stakeholder perceptions plus ecological models, but at affordable cost and in < 6 months... The methods can be used jointly for ‘bundled’ services”

Threat, Tradeoffs & Externatities

“When the ‘value’ is clear, we find that the willingness to engage by external stakeholders depends on the level of threat: at low level of threat the ES is perceived to still be a *public good* that can be appreciated free of charge by all. At high levels of threat, external stakeholders don’t want to be ‘black-mailed’...”

“In between these two levels of threat are the options to engage... However the same ‘case’ can be presented in multiple ways. For example, the rubber agroforests of Jambi may appear a ‘lost case’ because of oil palm threat, or ‘still safe’ in agroforest romanticism. Communication is the key...”

Opportunity

Prototype for formal recognition under community forestry law??

Mae Raek Land Use Plan

produced through localized negotiations

“Partly compensating for the level of threat, when seen as the private profitability of less ES friendly land use options, is the opportunity that derives from community scale regulation. Local ES concerns may coincide with external ones and reduce the levels of threat...”

“As example of these community-scale regulations we may consider the forest situation in Thailand – where much of the uplands of the Chao Phraya that flows by Bangkok is considered to be protected (“Class I”) watershed. Any farming in these area is illegal...”

“When we zoom in, however, we see that local scale regulation and land use planning provides effective protection to the more sensitive landscape positions, while farming is allowed elsewhere. Supporting this local ‘regulation’ rather than declaring it ‘illegal’ probably makes sense.”

“This paradigm shift has lead to a strong interest in local resource mapping, negotiation support systems and planning exercises. Local rules can indeed modify the tradeoffs and it may be more effective to deal with a ‘farmer group’ or ‘community’ than with individual farmers.”

Trust

“The fourth dimension relates to ‘trust’ or the likelihood that negotiations between local community members and outside agents can even get started, let alone lead to tangible results and implementable agreements. Trust between government and farmers is often at a low level.”

“In the relationship between ‘upland’ forest-farmers and government we can recognize a number of stages, from latent to open conflict, with the realization of ‘myth- perceptions’ that lead to unnecessary lose-lose, and the early exploration of ‘win-win’... RUPES ideas can help form a bridge.”

“In fact the four dimensions *value, threat, opportunity* and *trust* match the *outcomes, actions, plan* and *objectives* level of understanding the linked farmer-agroecosystem-ES-beneficiary system. We can now see how the various conservation + development approaches all solve part of the puzzle.”

“Our four dimensions also refer to four types of ‘capital’, and the keywords ‘Criteria & Indicators, LU restrictions, Spatial planning and Respect & autonomy. In fact we see that the carrot, the (locally operated) sticks, the dancing farmer & donkey and the cart all have a place...”

“In a nutshell, every proposal for a locally adapted ES reward mechanism will have to be able to make a convincing case on each of the four dimensions – otherwise we’re probably all wasting our time... We need ecological, agronomic, spatial, social, economic and institutional expertise to make sense of this type of landscape agroforestry.”

The agroforesters of Asia have a lot of opportunity to transform and improve their lives and landscapes...

We can help by removing constraints, artificial divisions and by challenging 'myth-perceptions'...

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2. Biodiversity conservation through agroforestry: managing tree species diversity within a network of community-based, nongovernmental, governmental and research organizations in western Kenya.
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11. Bird diversity and land use on the slopes of Mt. Kilimanjaro and the adjacent plains, Tanzania
12. Water, women and local social organization in the Western Kenya Highlands
13. Highlights of ongoing research of the World Agroforestry Centre in Indonesia
14. Prospects of adoption of tree-based systems in a rural landscape and its likely impacts on carbon stocks and farmers' welfare: the FALLOW Model Application in Muara Sungkai, Lampung, Sumatra, in a 'Clean Development Mechanism' context

Who we are

The World Agroforestry Centre is the international leader in the science and practice of integrating 'working trees' on small farms and in rural landscapes. We have invigorated the ancient practice of growing trees on farms, using innovative science for development to transform lives and landscapes.

Our vision

Our Vision is an 'Agroforestry Transformation' in the developing world resulting in a massive increase in the use of working trees on working landscapes by smallholder rural households that helps ensure security in food, nutrition, income, health, shelter and energy and a regenerated environment.

Our mission

Our mission is to advance the science and practice of agroforestry to help realize an 'Agroforestry Transformation' throughout the developing world.

A Future Harvest Centre supported by the CGIAR

United Nations Avenue, Gigiri - PO Box 30677 - 00100 Nairobi, Kenya
Tel: +254 20 7224000 or via USA +1 650 833 6645
Fax: +254 20 7224001 or via USA +1 650 833 6646
Southeast Asia Regional Programme - Sindang Barang, Bogor 16680
PO Box 161 Bogor 16001, Indonesia
Tel: +62 251 625 415 - Fax: +62 251 625 416
www.worldagroforestry.org