

*Deforestation in Indonesia:
A Household Level Analysis of the
Role of Forest Income Dependence
and Poverty*

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Organization of the Presentation

- **Introduction**
- **Research Objectives**
- **Data and Study Sites**
- **Model**
- **Results**
- **Conclusion**

Introduction

Forest dependent people:

- 20% (12 million) rural people living on state forest land are poor

Forest loss in Indonesia:

- **Rate:** 1 million ha/year (1980s) to 2 million ha/year (since 1996)
- **Forest cover lost:** 162 million ha (1950) to 88 million ha (2005)
- **Agent:**
 - logging
 - industrial timber and agricultural plantations
 - transmigration
 - small scale farmers - shifting cultivation

Research Objectives

Motivation:

- profound impact of the current alarming deforestation rate on large numbers of Indonesian rural poor who are dependent on forests

Aims:

- Investigate the factors associated with deforestation by small-scale farmers
- Investigate the factors associated with the Indonesian household's decision-making process with respect to forest clearing
 - Role of poverty?
 - Impact of forest income dependence?
 - Effect of agricultural practices?

Data

Household level data

- Survey of 214 households in five villages in East Kalimantan
- Survey design:
 - Data: socio-economic, income, land clearing practices (livelihoods, forest environments, institutional forms, market contexts)

Village level data

- Village survey
- Village Potential Statistics – Statistics Indonesia
- Land use/Forest maps – Ministry of Forestry

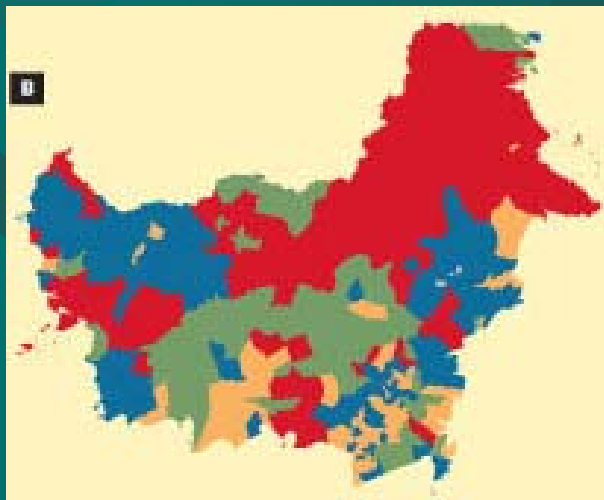
Study Sites

East Kalimantan



Study Sites

East Kalimantan



- High forest, low poverty
- High forest, high poverty
- Low forest, high poverty
- Low forest, low poverty
- No data

(World Bank, 2006)

Study Sites

- **Semi-commercial farms**

- 90% households have cash agricultural income
- 86% households have non-cash agricultural income

- **Forest income dependence**

- 85% households have forest income (share to total income: 30%)
- 68% households have non-cash forest income (share to total income:20%)

- **Forest clearing practices (for agricultural expansion)**

- Sedentary agriculture (103 households)
- Shifting cultivation (77 households)

Model

- **Labor allocation decision**

- Activities: agriculture (L_G), forestry (L_F), off-farm (L_W), land clearing (L_C)

- **SUR estimation**

- The relationship is captured by the correlation of the error terms

$$A_{ij} = b_1 + b_2 H_{ij} + b_3 V_j + b_4 W_{ij} + e_{ij}$$

$$FI_{ij} = p_1 + p_2 H_{ij} + p_3 V_j + p_4 W_{ij} + u_{ij}$$

$$WI_{ij} = h_1 + h_2 H_{ij} + h_3 V_j + v_{ij}$$

A : Area cleared

FI : Forest income

WI : Wage income

H : Vector of household variables

V : Vector of village variables

W : Vector of wealth measures

	Q1:Initial		
Dependent Variable: Cleared area (Ha)			
Poverty Indicators			
Agricultural land own 2000 (ha)	0.227	(3.70)	***
Agricultural land own 2000 squared	-0.008	(-2.64)	***
Wealth index 1999			
Household (HH) Level Variable			
HH Size (persons)	0.113	(1.65)	*
HH member ≥ 15 yrs old	0.223	(2.22)	**
HH head age (years)	-0.094	(-2.34)	**
HH head age squared	0.001	(2.26)	**
HH member average educ. ≥ tertiary school	-1.006	(-2.67)	***
Dependent variable: Forest Income			
Agricultural land own 2000 (ha)	-0.025	(-2.27)	**
HH member average educ. ≥ tertiary school	-0.160	(-2.35)	**
HH member avrg. educ. = secondary school	-0.081	(-2.16)	**
HH head ethnicity (dummy indigenous)	0.119	(2.09)	**
Number of Observations	214		
R ²	0.474		

z-values in brackets; *:significant at 10%; **:significant at 5%; ***:significant at 1%

	Q1:Initial			Q2:Poverty		
Dependent Variable: Cleared area (Ha)						
Poverty Indicators						
Agricultural land own 2000 (ha)	0.227	(3.70)	***	0.349	(4.53)	***
Agricultural land own 2000 squared	-0.008	(-2.64)	***	-0.013	(-3.65)	***
Wealth index 1999				0.681	(1.77)	*
Household (HH) Level Variable						
HH Size (persons)	0.113	(1.65)	*	0.050	(0.59)	
HH member ≥ 15 yrs old	0.223	(2.22)	**	0.208	(1.74)	*
HH head age (years)	-0.094	(-2.34)	**	-0.168	(-2.79)	***
HH head age squared	0.001	(2.26)	**	0.002	(2.67)	***
HH member average educ. ≥ tertiary school	-1.006	(-2.67)	***	-1.227	(-1.89)	*
Dependent variable: Forest Income						
Agricultural land own 2000 (ha)	-0.025	(-2.27)	**	-0.009	(-0.67)	
HH member average educ. ≥ tertiary school	-0.160	(-2.35)	**	-0.139	(-1.26)	
HH member avrg. educ. = secondary school	-0.081	(-2.16)	**	-0.049	(-1.11)	
HH head ethnicity (dummy indigenous)	0.119	(2.09)	**	0.064	(0.85)	
Number of Observations	214			131		
R ²	0.474			0.534		

z-values in brackets; *:significant at 10%; **:significant at 5%; ***:significant at 1%

	Sedentary Agriculture			Shifting Cultivation		
	coefficient	z-val		coefficient	z-val	
Dependent Variable: Cleared area (Ha)						
Poverty Indicators						
Agricultural land own 2000 (ha)	0.150	(2.48)	**	-0.158	(-0.61)	
Agricultural land own 2000 squared	-0.005	(-1.65)	*	0.103	(1.73)	*
Household (HH) Level Variable						
HH Size (persons)	0.009	(0.10)		0.019	(0.24)	
HH member ≥ 15 yrs old	0.225	(1.86)	*	0.494	(3.52)	***
HH head age (years)	-0.061	(-1.30)		0.136	(1.72)	*
HH head age squared	0.001	(1.18)		-0.002	(-1.86)	*
HH member average educ. ≥ tertiary school	-0.406	(-0.55)		-0.942	(-2.31)	**
HH member average educ. = secondary school	-0.118	(-0.43)		-0.737	(-3.08)	***
HH head duration of occupancy (years)	0.002	(0.20)		-0.015	(-1.66)	*
HH head ethnicity (dummy indigenous)	-0.346	(-0.95)		1.642	(2.43)	**
Use chainsaw (dummy)	-0.335	(-1.01)		1.130	(4.14)	***
Number of Observations	102			75		
R ²	0.339			0.662		

*:significant at 10%; ** :significant at 5%; *** :significant at 1%

Correlation of Residuals	Initial	Poverty	Sedentary Agriculture	Shifting Cultivation
ρ_{LF} (cleared area - forest income)	-0.071	-0.086	-0.109	-0.058
ρ_{LW} (cleared area - wage income)	-0.118	-0.006	0.050	-0.126
ρ_{FW} (forest income - wage income)	-0.348	-0.304	-0.201	-0.493
Breusch-Pagan test of independence (P-value)	0.000	0.004	0.132	0.000
Number of Observations	214	131	102	75

Conclusion

1. Poorer farmers are more dependent on forest based income
2. Poorer farmers are less likely to clear forests
3. No significant interdependencies between forest income and clearing
4. Higher off-farm employment opportunities are significantly correlated with lower forest pressure
5. Shifting cultivators drive the relationships:
 - Determinants of forest clearing
 - Interdependencies between activities

Thank you