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Trends and Future Scenarios of Forestry and Other Land Uses Employment in Indonesia: a Modeling Approach

Kerry Purnomo

Abstract

Environmental sustainability and poverty are some of the most important targets in the United Nations Millennium Development Goals. However, the relationship between employment and forestry development is unclear, especially when it comes to illegal logging. This study aims to generate projections for forestry and other land use in Indonesia and develop policy scenarios to decrease unemployment and improve environmental sustainability by examining natural forests, logging, forest plantations, iwood-based industries and trade. The study observes the components of natural forest, logging, forest plantation, wood-based industries and trade. The study uses systems dynamic to implement a model of interaction among forest structure industries, actors and their institutions. The study finds that the current practice of forest management will experience growth in employment before it collapses, starting with Riau followed by East Kalimantan and Papua. Massive forest planting will benefit deforested land, but may jeopardize employment and livelihood in community land. Land tenure reform can boost the employment to meet the overall government target on unemployment level of 5.11% in year 2009.

Keywords: *unemployment, deforestation, model, policy scenario, small-scale forestry* **JEL Classification**: £24, *Q15,C50,H40,O17*

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Herry Purnomo

I. BACKGROUND

Along with poverty alleviation and forest sustainability, forestry employment is the major concern among policy makers. The forest sustainability and job availability are critical indicators for the performance of the government every where in the world including Indonesia. However, the relationship between decent work and forestry development is unclear. ILO (2001) reported that the forest industries themselves have been subject to intense economic and environmental pressures over the last decade. This has been affecting all sub-sectors: forestry, wood industries, pulp and paper and furniture. The sector has reacted with a number of moves in order to secure its long-term future. These moves have far-reaching social and labor implications. Some have negative impacts; others open up new opportunities.

The government of Indonesia (GoI) aims at decreasing the level of unemployment from 9.9% in 2004 to 5.1% in 2009. This unemployment decreasing will reduce the poverty level from 16.6% in 2009 to 5.1% 2009. However, BPS reported the unemployment in Indonesia increased from 8.1% (2001) to 10.3% (2005) of labor force. During the last three year the rate of unemployment increases 850,000 annually, in which the percentage of unemployment rate of skilled labors (high school and university graduates) is bigger than unskilled labors.

The MoF predicted 150,000 people lost their jobs in forest industries in 2003, and it increased to 600,000 persons in 2004 due to shortage of logs. MPI (Masyarakat Perhntanan Indonesia) reported 60% of employees lost their jobs. The meubelair industries continue to loose their employment due to weak in design, low productivity, shortage of wood materials, competition against China, Vietnam and Philippines and high economic costs in harbors and high transaction costs concerning local government regulations.

The GoI's efforts to downsize Indonesia's wood processing industries have met with the resistance from the internal and external government. The internal central government and local governments, assume that the closure of those industries will reduce the employment availability, which contrast with the government program to reduce unemployment and poverty. Unemployment is the major issue in Indonesia. The forest industry groups concern with their investment and debts. The labor unions that generally are not well representative in the decision making processes concern with jobs availability for their members.

This paper represents the dynamic forestry employment in Indonesia vis-a-vis forest policy scenarios. This model might contribute to the development of storylines for alternative futures or scenario of Indonesian forestry in relation with the employment. This simulation model targets the audience of decision makers in the fields of politics, policy, business and civil society movements. They can learn the model and its possible future scenarios. Modeling for learning is a concept to bring the decision makers to explore their own mental model and provoke the mental change (Senge and Sterman 1994; Sterman, 2000).

II. METHODOLOGY

Berck and Hoffmann (2002) outlined the analytical methods that can be used to assess environmental and natural resource policies on employment. They examined four basic approaches namely: supply demand analysis of the affected sector in the single market and multi-market; general equilibrium simulation input-output (I-O) and social accounting matrix (SAM); non-linear computational general equilibrium model; and time series econometric estimation of the adjustment process. These methods have both advantages and disadvantages. I-O and SAM approaches require understanding of the structure of the whole system affected by the policy at a particular time. This is an ideal situation to see the effect of policy on the overall sectors. However, it has to be supported by extensive data, which is not easily available in an accepted degree of quality in developing countries such as Indonesia.

Understanding the structure of the system and its dynamic is the subject of system-based modeling approach. System dynamic modeling is based more on the understanding how the system works over time rather than intensive data (Grant 1997). In other words, systems dynamic combine the system structure of SAM and the time dimension of time series method.

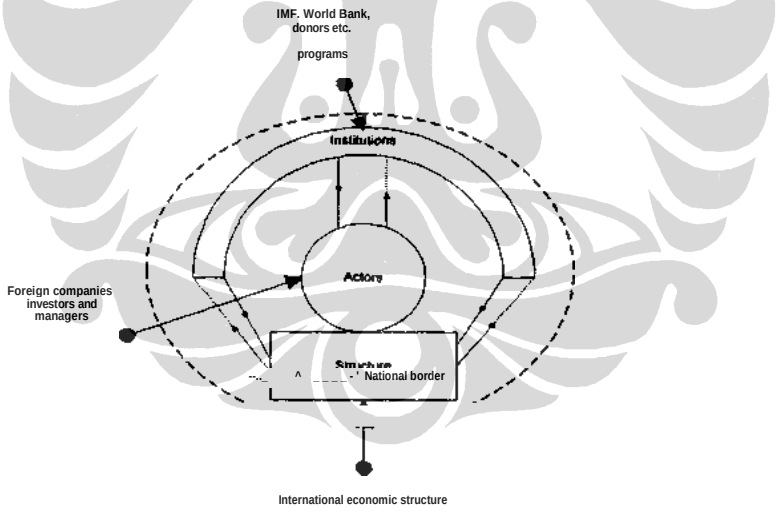
There are several methods that can be classified as systems based approach in general including fuzzy cognitive mapping, multi-agent systems and systems dynamic (Forrester 1999, Sterman 2000). The steps involved in the model are (a) identification of the issue and problem; (b) development of a dynamic hypothesis explaining the cause of the problem; (c) development of a simulation model of the system at the root of the problem; (d) Verification of the model; and (e) development of scenarios. The scenarios are then used for learning of possible futures (Fahey and Randall 1998) and for taking possible actions (Checkland 1989).

III. FORESTRY EMPLOYMENT, TRADE AND SCENARIOS

3.1 Theoretical Approach

Sato (2005) argued the usefulness of SIA (Structure-Institution-Actors) approach in analyzing economic change and its impacts (Figure 1). S is defined as a playing field i.e. a field in which actors play, I as formal and informal rules and their enforcement, A is an entity of action. If we used a metaphor sumo wrestling, then the two sumo players and referee are A, the sumo ring is S, and the rules of the sumo game are I. Domestic S, I and A are affected by those outside the national border. Institutional program reforms from IMF, World Bank and CGI can directly influenced the I. Domestic A can be effected by foreign companies and investors coming into the country. Domestic S is influenced by interrelationship with the international S through trade and investment. Institutional reforms may have changed the lineup of actors (I—»A); some new actors emerged, while other actors disappeared. The existing actors may react in accordance with purpose of I reform, but may show unexpected deviation, react against the reform's purpose (A—>I). The example of A here include labor union, central and local government, industrial groups, banks, firms.

Figure 1 ***SIA approach (Sato 2005)***



Gale (1998) revealed three forest industry components i.e. tenure system, industry composition and trade barriers. In most producing

countries, formal ownership of tropical forest is vested in the state. Under the system of concession, the government acts on behalf of the state lease the right to manage forest and cut timber to private or state owned concessionaires. The concessionaires receive licenses that set out the terms and conditions under which timber extraction may take place. The state, by means of Forest Management Licenses (FMLs), divests itself of direct responsibility forest responsibility and devolves these responsibilities to private individual and corporations (Gale 1998).

3.2. Forest Resources and Policy Context

The Government of Indonesia (Gol) divides 109 millions hectares forest area into five functions i.e. nature and water conservation, protected forests, limited production forests, forests with special functions and conversion forests. The government implements different management schemes and policies for each forest function area. In terms of forest function area there is no major change in the last five years. Moreover, the statistics reported there is addition one million hectare during those years. However, if we look at the forest cover of Indonesia in year 1992, 2000 and 2002 (Figure 2) then very clear the forest in Riau, East Kalimantan and Papua for instance were decreasing. The average degradation rate during the last twenty years has been occurring and increasing dramatically. The forest area amounts to 1.8 millions ha annually degraded during 1985-1997,2.6 millions ha in 1998-2000, and 3.5 millions ha after year 2000.

Figure 2

Indonesia Forest cover year 1994 (NFI[1]), 2000 (SPOT[2]) and 2002 (MODIS[3])

After crisis that hit Asia in 1997, Indonesia has been struggling to reconstruct its 'economy and to implement a wide range of institutional reforms including forestry. The World Bank has made the shocking forecast that Indonesia's lowland natural forests will disappear by 2010 unless effective measvires are taken to stop the deforestation. The causes of deforestation include over-logging, fires, transmigration and forest conversion to agricultural land (Sato 2005).

3.3 Forest Industry

The Indonesian forest industry structure consists of FML holders, logging companies, mills and trading companies. Some FML holders also act as a logging company. It means they conduct the logging by its own. The others contract logging companies to log their forests. They enjoy fee

1 MoF (1996)

2 Hans-Jurgen Stibig. 2003. TREES Project, Joint Research Centre.

' Taconi L, Kurniawan I. 2004. Indonesian Deforestation and Forest Degradation Monitoring project, Forests and Governance Programme, CIFOR.

coming from extracted timber. Indonesia's permanent and limited production forests have been allotted by the government to FML holders. PERUM PERHUTANI, a state own company, manages forest plantations, which is primarily teak plantation. Outside Java, private companies hold most FMLs for natural and plantation forests. INHUTANI, other state own companies, hold few FMLs outside Java exclusively and in joint venture with the private companies. At the beginning of the concession time in 1970s, the number of HPH (Hak Pengusahaan Hutan, FML in form of commercial logging company) is 500. To date, remain only 150 HPHs. The FML holders operate throughout Indonesian Archipelago in the various statuses of forest resources. Each forest of FML may have primary forest, logged-over area and disturbed forest.

3.4 Employment in Forestry

Ministry of Industry of Indonesia (2001) revealed the number of employment in timber and other forest based industries is as follows 1,532,637 (household based), 393,292 (small-scale), 81,323 (medium-scale) and 488,712 (big-scale). ILO (2001) reported the total employment in Indonesian forestry sector is less than 1 million. However, this figure according to ILO is the formal employment or visible sector. ILO predicts the visible sector in forestry employment is only 37%; the rest of 63% is invisible.

The 'Kabinet Indonesia Bersatu' (KIB) under President Soesilo Bambang Yudhoyono has set target to decrease unemployment to 5.1% in 2009. It means his cabinet has to create 15.58 million new jobs in the period of his presidency 2004-2009 (Table 1).

Table 1

National economic and employment projection[4]

Year	labor force (millio)	New labors (millio)	Economic growth (%)	Employ merit level (million)	New generated employment (million)	New created employ-ment for 1% economic growth	Unemployment level	
							(mill! -on)	(%)
2004	103.97	1.34	5.13	93.72	0.91	177,388	10.25	9.86
2005	105.95	1.98	5.5	95.73	2.01	365,455	10.22	9.65
2006	107.96	2.01	6.08	98.32	2.59	425,987	9.64	8.93
2007	110.01	2.05	6.70	101.24	2.92	435,821	8.77	7.97
2008	112.10	2.09	7.20	104.57	3.33	462,500	7.53	6.72
2009	114.23	2.13	7.64	108.39	3.82	500,000	5.84	5.11
Total generated employment (2004-2009)				15.58				

IV. MODEL DEVELOPMENT

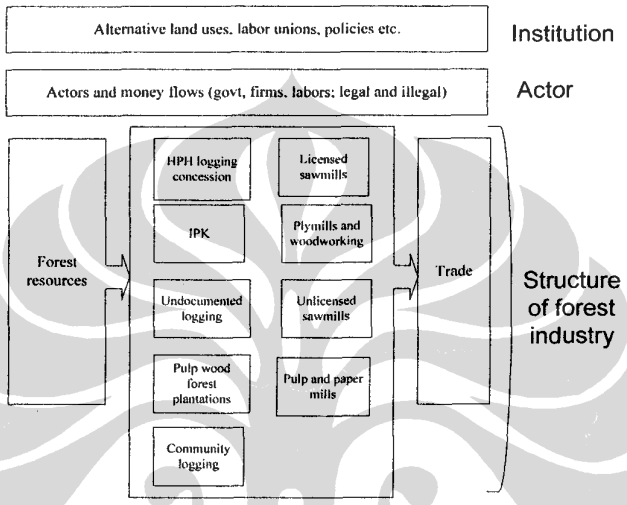
The forestry employment model is a model which aims at producing scenarios for forestry employment in the future. At the top level, SIA approach was implemented, which elaborated the structure, actor and institution involved in forestry employment. The model was guided by the questions of dynamic of employment level, policy impacts to employment and land tenure reform.

4.1. Conceptual Design

The static structure of the developed model is given in Figure 3. The first category is 'Structure', which comprises forest resources, forest industries and trade. The timber flows from forest resources to forest industries for processing and then sell them to market. The second category is 'Actor'. The model specified how money flows from activities in the 'Structure' to the government, firms and labors both legally and illegally. The last category is 'Institution', which means 'rules in use'. It comprises regulations in use, policy and the role of organizations such as ITTO (International Tropical Timber Organization), ILO, and KAHUTINDO (Indonesian Forest Worker Union).

[4] BAPPENAS, quoted by Kompas on 6 December 2005

Figure 3
The structure of the model

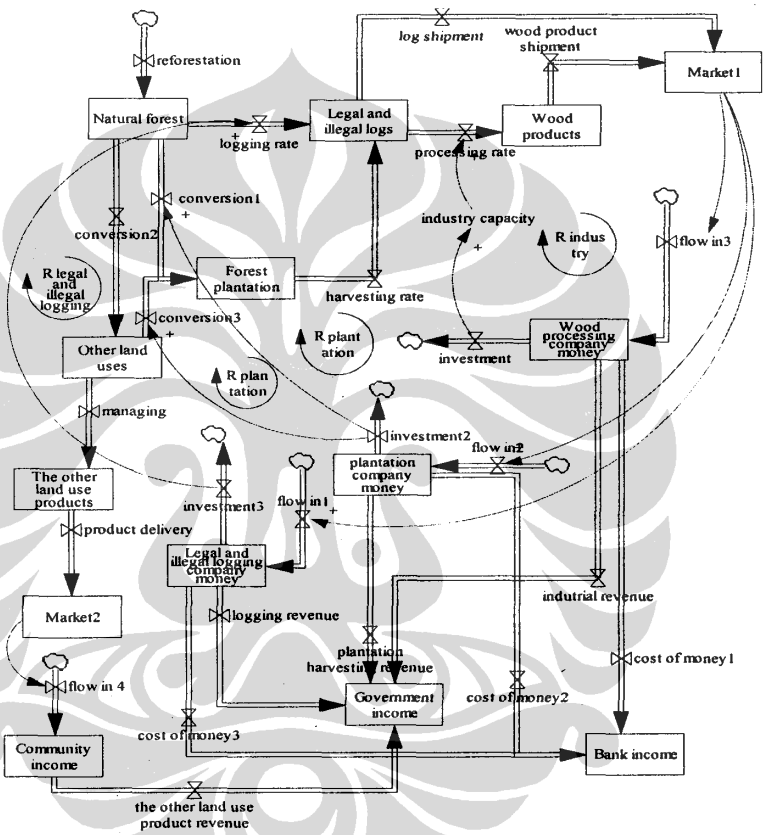


The dynamic of the conceptual model is described with stocks and flows (**Figure 4**). The natural forest is logged with certain logging rate, both legal and illegally, into logs and processed into wood products. The logs and wood products then are delivered to domestic and overseas markets. The natural forests have capacity to re-grow if they are well managed. The government also implement reforestation program through for instance GERHAN (national movement for reforestation and land rehabilitation). The natural forests are converted into forest plantation and other land uses such as oil palm and rubber plantations, which generate incomes for communities and governments.

Investments of logging companies influence rate of logging on natural forests. This is true both for legal and illegal logging companies. The revenues generate from these companies flow to companies themselves, government as tax, and banks, which finance the investment. The investment in plantation companies increase conversion of natural forest and planting of deforested areas. The investment in wood processing industries will increase the capacity of industries to increase the processing rate of wood. All material transfers, symbolized with valve, produce employments. Employment can be generated through activities of logging forest, wood processing industry, reforestation program, plantation, community logging etc. Both legal and illegal forest

activities create jobs.

Figure 4
Stocks, flows and their causal loops of the forestry employment conceptual model[5]



4.2 Specification and Assumptions

The model focuses on three areas, i.e. Riau, East Kalimantan and Papua. These areas represent provinces with richest natural resources in

5 'R' symbolizes reinforcement or positive loop, and 'B' symbolizes balancing feedback or negative loop.

Indonesia including mining and forest as well as complex social and political contexts. Since it is a 'white box' modelling process, the developed model may suffer from high quality and locality of data. We used forestry employment case study findings in Riau (Obidzinski and Barr, 2003) as standard parameter of forestry employment for the other two provinces. It might not be true, but the model aims at providing general pattern of forestry employment in Indonesia, not predicting the future of the forestry employment. This provides understanding of global figure, experiencing scenarios, and generating policy recommend'ation.

Forestry sector is simply defined as the sum of ISIC[6] Divisions 02, 20 and 21. For brevity, these three sub-sectors of divisions are refereed to as "forestry", the "wood industry" and the "pulp and paper industry" hereafter, while the combination of all three sub-sectors is referred to as the "forestry sector" (Lebcdys, 2004).

Table 2 provides employment by sectors per unit of land and per iinit of production. In Forestry Sub-Sector, IPK[7] land clearing and undocumented logging absorb the biggest employment as many as 134 persons per 1000 ha, followed by industrial pulpwood plantation and RKT[8] logging. However, per cubic meter of wood, pulpwood plantation absorb the biggest employment, followed by RKT logging, and IPK land clearing and undocumented logging. This is due to both IPK land clearing and undocumented logging produce wood more than the others. In Wood Industry and Pulp and Paper Sub Sectors, plymills and woodworking absorb the biggest employment per cubic meter of raw material consumed, then followed by licensed sawmills and unlicensed sawmills.

Revision 3.0, The draft of Revision 4 (August 2005) provides some different classification codes of forestry sub-seclors. The draft has not been widely used.

Ijin Pwnanfantan Kayu or land clearing permit. The MoF (Ministry of ForestryJ's English term is timber utilization concession.

Rencana Karya Tahunan or annual logging plan approved by the government authority. The MoF's English term is annual work plan.

Table 2 *Employment absorption per unit of* ***land and per unit of production***

Sub-sector	ISIC	Activities	Employment per 1,000 ha land	Employment per 1000 m^3 of production	Employment per 1000 m^3 raw materials
Forestry	Division 20	RKT logging	1.82	17.97	-
		IPK land clearing	134.47	1.03	-
		Undocumented logging	134.21	1.03	-
		Industrial pulpwood plantation	44.46	59.08	-
Wood industry	Division 20	Licensed sawmills	-	10.53	5.26
		Unlicensed sawmills	-	3.05	1.52
		Plymill and Woodworking[9]	-	25.25	12.63
Pulp and paper industry	Division 21	Pulp and paper (Adt)	-	2.17	0.44

World Agroforestry Center[10] studied labor requirement comparison of several land uses including forest plantation, rubber, coffee, cinnamon and oil palm as described based on methods outlined by Kydd et al. (1997). Rubber and Multi-strata Coffee systems generate labor more than forest and oil palm plantation. For each land use, different scenarios create different labor requirement. More inputs and technology to be used more labors are needed. For example, Cinnamon system, it requires 177 or 184 person-day/ha/year if it uses high fertilizer and pesticide compared one third if it does not use them (ICRAF 2005).

4.3. Model Implementation

The model was implemented with STELLA 8.0, a system dynamic tool. The detail of the model is provided in Annex 1. STELLA likes other system dynamics tools such as VENSIM, SIMILE and POWERSIM uses stocks, flows and influences to mimic real systems. It is difficult to say that STELLA is superior compared to the other programs. STELLA,

[9] *Including ISIC Class 3610: Manufacture of furniture*

[10] *World Agroforestry Center is a new name of International Center for Agro-Forestry Research (ICRAF). However, it maintains the old acronym for the new name.*

however, is more well-known, so that it is easier to discuss and exchange a model with other modelers.

The mode! implements an array to handle provinces. Provinces of Riau, East Kalimantan and Papua fill the array in the current model. The other 27 provinces of Indonesia can fill the array in the future. The summation of these 30 provinces will form the Indonesia figure on Indonesian forestry employment. Users and others can ask a free copy of the model to the author via email. The users might play, modify and adapt the model freely.

4.4 Model Evaluation

Adequate testing relies on the comparison of observed and simulated outcomes as well as careful consideration of the logic and behavior of the model. Several researchers (e.g. Vanclay 1994, Grant el at, 1997) have advocated the terminology 'model evaluation' instead of 'model validation'. This emphasizes relative utility: a model that is useful for one purpose might be misleading for other purposes. The present model was evaluated using three criteria: the logic of the model and its outcomes and the agreement between projections and expectations.

We found die model was reasonable based on systematic scrutiny of all the relationships within the model, from the simplest sub-model (forest standing stock increment), to the more complex sub-models (e.g. the interrelationship between logging, industry and finance). Finally, the overall model performance was assessed. This assessment led to the conclusion that the model complied sufficiently with the basic principles of forest management and economics, to provide a basis for discussion of alternative courses of action.

V. MODEL USES

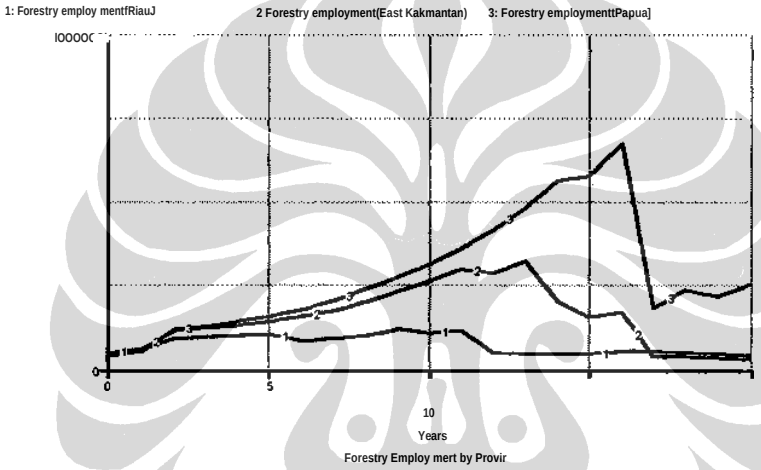
This section examines some of the insights gained from the process of constructing the model and examining its outputs including dynamic of employment level, compensation to labor and impact to employment on massive planting, alternative land uses and regional trade. Annex 2 illustrates the model interface, which consists of the structure of the model, baseline simulation and future scenario development.

5.1 Trends of Forestry Employment Levels

This section refers to the baseline simulation, which explains what the situation will be in the next 20 years if the assumed current situation does not change. The future cumulative employment will experience with

growth and collapse due to the shortage of wood extracted from the natural forests. Currently the total employment in the province of Riau, East Kalimantan and Papua is 160,000 persons, which will grow to about 1,000,000 persons and then fall down (Figure 5). Each component of forestry employment will be explained in the following sections.

Figures
The cumulative forestry employment of Riau (curve 1), East Kalimantan (curve 2) and Papua (curve 3)



5.2 *Future Scenarios*

***T*he users of the model can play with different future scenarios and exercise their parameters. Below are the examples of the future possible setting, parameters and their impacts to the employments in forestry and in alternative land uses.**

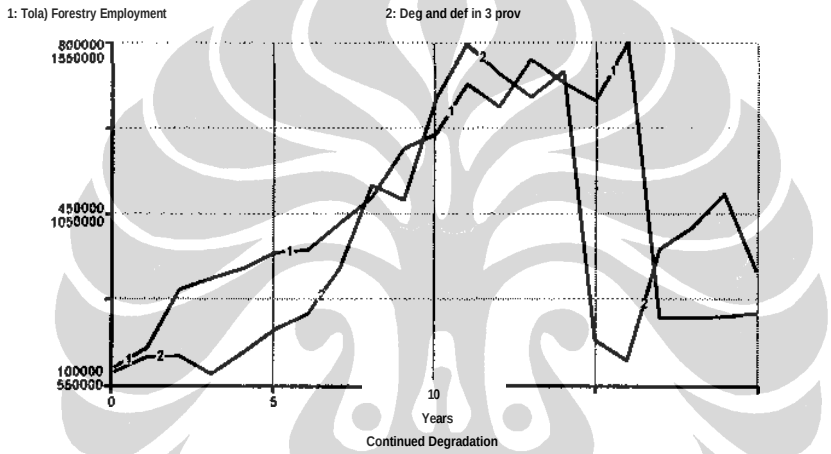
5.2.1 Continued degradation

Lack of law enforcement and pro-environment government policy will make degradation continue to occur. Illegal logging and forested land clearing to make forest and oil palm plantation will increase. Under the assumptions of RKT logging decrease 2.5%, IPK land clearing grow 20%, undocumented logging grow 10 percent, stable of the plantation grow then degradation and deforestation increase from more than 500,000 ha/year to 1,500,000 ha/year. Therefore, firstly forestry activities and industries will increase due to increasing availability of wood, but then

after 15 years they will collapse due to shortage of wood. This pattern of boom-and-bust is followed by forestry employment with a certain time lag, starting from 134,000 persons increasing to the peak of 800,000 persons, then falling down and stable at 245,000 persons (Figure 6). Forestry employment will not be totally collapse since forest plantation and RKT logging employments and their related industries will able to absorb employments.

Figure 6

Continued degradation and its impact to the employment (curve 1 is forestry employment; curve 2 is the extent of degradation and deforestation area)



Forest degradation could provide employment in relatively short time period in the expense of loosing forests and employment in longer period. There is no government actually in the world formally agrees on letting forest to degrade through illegal logging and land clearing. However, most government understands that illegal logging, for instance, provides jobs to many people along the timber market chain. So that, any government must think in longer term to deeply understand that it is not a good strategy at all for the sake of its country survival in the world.

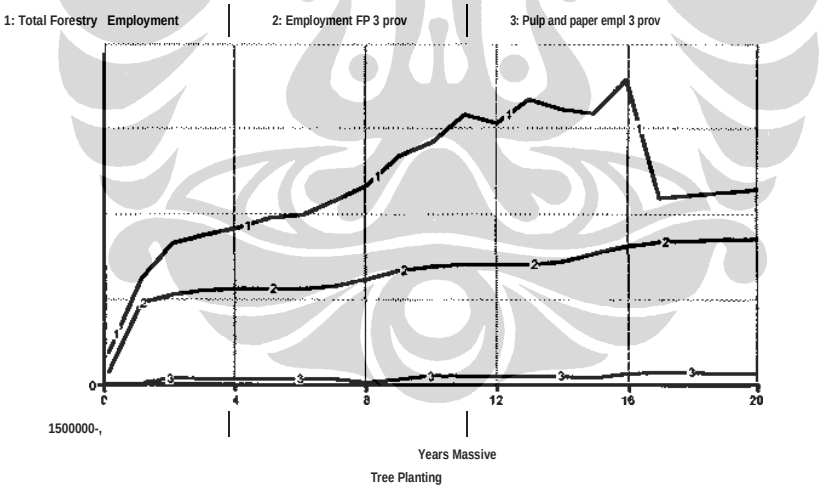
5.2.2 Massive Tree Planting

If we plant trees massively amounting to 500,000 ha per year in non-forested areas of production and conversion forests of Riau, East Kalimantan and Papua in form of big-scale pulp plantation, then the

employment will increase as shown in Figure 7. Employments at the plantation will reach 600,000 persons and at pulp and paper industry will increase to about 75,000 persons as depicted by Curve 2 and 3. Overall it will boost to the total forestry employment in the three provinces (Curve 1) about one and half times of the baseline forestry employment (Figure 5). As illustrated in Figure 5, in year 16th the forest employment in the three provinces, which mostly supported by natural forest, will fall down to about 250,000 people. This massive tree planting can ease the employment fall down to above 750,000 people in year 17th.

The massive tree planting through the big-scale pulp plantation can significantly absorb the employment in all the time. It is a good choice as long as it is implemented in degraded land. However, it is not necessary to be the best choice of creating employment through forestry.

Figure 7
Massive tree planting and its impact to the employment (curve 1 is forestry employments in general; curve 2 and 3 are massive tree planting impacts to forest plantation employment and pulp and paper employment)



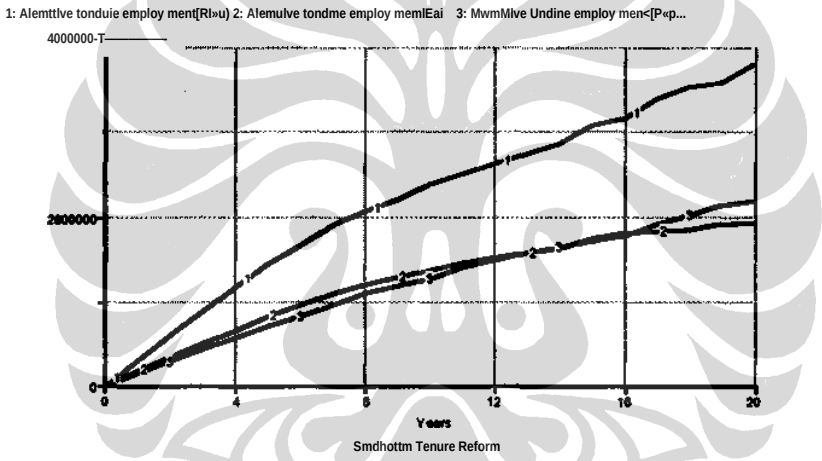
5.2.3 Smallholder Tenure Reform

Land tenure reform here means allocating annually of 500,000 ha of non-forested areas of production and conversion forests in each province of Riau, East Kalimantan and Papua to communities. The communities have options of making small-scale forest plantation, Rubber plantation, small-scale Oil Palm plantation, community forestry, Coffee multi-strata

Cinnamon systems, and plantation for carbon trade. We can play with different setting of land-uses from tenure reform in the model. An example of the impact of this land tenure reform to employment is given in Figure 8. The land reform boost employments in three provinces amounts to 8 millions. The tenure reform provides land for local communities to grow trees and plants. These small-scale activities, which are labor intensive business, absorb employments much higher than big-scale forest plantations, which are more capital intensive business.

Figures

Smallholder land tenure reform impact to the employment (Curve 1 for Riau, Curve 2 for East Kalimantan and Curve 3 for Papua)



5.2.4 Impact of Establishing Two and Half Millions ha of Forest Plantation

This section discusses the impact of establishing 2.5 million ha plantation, as targeted by Ministry of Forestry (MoF) in the next five years, out of existing uses and into forest plantations. However, there is no certainty where and what type of land will be allocated. Sometimes the government allocates traditional community land, which is already planted and absorbs local employments, for new forest plantations. Big-scale plantations are likely to be the primary scale of plantation establishment. The impacts of establishing plantation to employment absorption and livelihood are given in Table 3. If the land is converted into big plantation then it will reduce employment and livelihood for the

communities. But if the land is converted into the small plantation it will create better employment and livelihoods.

Table 3 *Impacts of establishing plantation from existing different land uses*

Land use alternatives for tenure reform	Employment absorption			Livelihoods (million Rupiah/year)		
	Riau	East Kalimantan	Papua	Riau	East Kalimantan	Papua
Assumption of existing land uses						
Rubber plantation	25,862	8,621	0	74,837	24,946	0
Community forestry	15,625	31,250	26,563	45,214	90,428	76,863
Coffee multi-strata	10,870	0	0	31,453	0	0
Cinnamon systems	5,556	0	0	16,076	0	0
Degraded land	0	0	0	0	0	0
Total	57,912	39,871	26,563	167,579	115373	76,863
Alternative future uses						
Big-scale forest plantation	21,552	21,552	4,310	62,364	62,364	12,473
Small-scale forest plantation	142,857	142,857	28,571	413,383	413,383	82,677
Impacts of						
Converted to big-scale plantation	-36,360	-18,319	-22,252	-105,216	-53,009	-64,391
Converted to small-scale plantation	84,945	102,986	2,009	245,804	298,010	5,813

VL DISCUSSION

6.1 Method and Outputs

The baseline simulation simply projects the future under several assumptions. It produces stable (RKT logging), grow and collapse (IPK and undocumented logging) and oscillated (forest plantation). In the baseline simulation time, there is no corrective action to adjust the amount of the logs with harvestable resources. Corrective actions can

feed back each logging type. Corrective actions occur due to strong rule of law to combat illegal logging for instance, lower wood demand from wood based industries or regional trade, or strong control of the overall annual allowable cut in all forest functions. Corrective actions can also take a form of enforcement of installed capacity of wood based and pulp and paper industries. If they are aligned with carrying capacity of forest and enforced, they can provide 'balancing feedback' to avoid the collapse of the industries. But, this must be equipped with the control of log smuggling and illegal wood industries such as unlicensed sawmills.

Given that domestic and regional demand of timber are increasing, land demand for other uses are increasing, increasing oil price, and massive unemployment, then we unlikely can stop land conversion and undocumented logging in the next 5-15 years before the forest resources themselves collapse. The model reminds us that in terms of employment, undocumented logging provides employment more than twice of RKT logging. IPK land clearing provides employment as many as RKT logging, but IPK land clearing absorbs more employment in the future.

6.2. Scenario Planning

The Minister of Forestry MS Kaban mentioned that the total degraded land in Indonesia due to illegal logging is 60 millions ha, which is about 10 times of Java island area. Due to illegal logging Indonesia is losing 30 trillion Rupiahs annually or 83 billion Rupiahs per day. Forest in Sumatra will disappear in 5 years and then followed by Kalimantan in 10 years.[11]. It is consistent with Figure 5 of grow and collapse of undocumented logging employments and the patterns of the other forestry employments. However, he probably does not realize its impacts to the employment.

The 'Kabinet Indonesia Bersatu' targeted to create 15.58 million new jobs in the next period of 2004-2009. Smallholder tenure reform will approach this number as depicted in Figure 8. The reform of 0.5 million ha of degraded land in only three provinces annually will create employments up to 2.6 millions in four years and eight millions in 20 years. These three provinces have non-forested areas in all forest functions amount to 10.8 million ha, and outside conversion forest is 6.3 million ha. Therefore, if 60 million ha lands are reformed then the Cabinet's target to create 15 millions employments in the next four remaining years can be approached.

Table 4 outlines the scenarios of reform of 60 millions ha land of degraded and deforested land. Under Scenario 1, the lands are used for forest and agro-forest and small-scale plantations as well as of community based natural forest management. The total investment of Scenario 1 is 178 trillions Rupiah, and it will generate 12 millions permanent jobs. Under Scenario 2, the lands are used for small-scale forestry. The total investment of Scenario 2 is 90 trillion Rupiah, and it will generate 13 millions permanent jobs. The tenure reform can play role of 78% of employment creation targeted by the government.

Table 4 ***Scenarios of land tenure reform of 60 million ha degraded and deforested lands***

Land use alternatives for tenure reform	Scenario 1				Scenario 2			
	Land use preference		Investment for the establishment (million Rupiah)	Generated employment	Land use preference		Investment for the establishment (million Rupiah)	Gene emplo
	%	(million ha)			%	(million ha)		
Small-scale forest plantation	23	14	21,061,810	4,000,000	50	30	45,132,450	8,5;
Rubber plantation	7	4	16,809,696	1,379,310	0	0	0	
Small-scale oil palm plantation	25	15	106,424,325	2,380,952	0	0	0	
Community forestry	38	23	17,300,773	3,066,667	40	24	18,052,980	3,2C
Coffee multi-strata	2	1	11,388,742	434,783	0	0	0	
Cinnamon systems	2	1	1,738,266	222,222	0	0	0	
Forest for carbon trade	3	2	2,256,623	277,778	10	6	6,769,868	83
Total	100	60	176,980,234	11,761,712	100	60	90,264,900	12,60

This amount of investment is not necessary provided by the government. Although, 90 trillion Rupiah is only equal to three years of money losing due to illegal logging. Our findings in Gorontalo, Sulawesi mentioned that the most importance for the communities is the security of land. They have prominent knowledge and can find a way by themselves how to generate capital and labors to plant trees. It is

consistent with the findings of Millennium Ecosystem Assessment (2001), which is local communities are far more likely to act in ways that conserve natural resources if they have real influence in the decisions on how they are used, and if they end up with a fairer share of the benefits. Otherwise, local communities will be marginalized as described by the case of Myanmar forest inhabitants along Myanmar-China share border (He & Barr, 2004).

If the government could legalizes/allocates right to manage over deforested and degraded lands to local communities and unemployed forest workers in 70-100 years and monitor them, then deforestation will be solved, huge employment will be generated and forestry will be revitalized. The local communities are selected to be the primary target land allocation due to the proximity to the land, knowledge of planting system and cultural values. While unemployed forest workers have already internalized planting knowledge system (Purnomo, *et al,* 2005[a]) and they are usually located close to the forest area. This proximity and planting knowledge will reduce the cost of forest planting.

The government may take back the land from them if it is not reforested or planted. The right to manage land under the current political contexts is more possible compared to give the full ownerships. Conflict over land will be highly reduced and livelihood is secured if the communities manage the land. This spirit is in line with co-management and new forest zoning arrangement as proposed by Purnomo *et al.* (2005[b]) and by Contreras-Hermosilla & Fay (2005). Producing raw material absorbs many labors and along with the supply chain it will create value added to increase national gross domestic products (Lebedys, 2004).

This is only a simple calculation. In the reality complex interaction among structures, actors and institutions may produce policy resistance to any intervention to reduce deforestation and create massive jobs. Each actor has capacity to adapt the change to sustain their interests and goals. The competition between big and small actors is occurring. The big actor would prefer to manage the millions of land for the big scale plantation. As illustrated in **Table** 3, if the government prefers the big actor to manage land then creation of employment will be far away from the government target itself. It is consistent with Barr (2001), who mentionied the reorientation from large-scale plantation programs to the development of small-scale, locally managed out-grower schemes.

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VII. CONCLUSION

This study aims at generating projection of the forestry employment in Indonesia in relation to the dynamics of forestry sector, unemployment, deforestation and land tenure reform. The overall output of this study is the model itself, where different users can adapt, calibrate and play. Under several assumptions putting in the model, we among others find that,

1. ***The current practice of forest management will experience with growth and collapse of employment, starting with Riau followed by East Kalimantan and Papua.***
2. ***Massive forest planting will benefit local communities if it is located in deforested land, but if it is located in land with different existing trees it may jeopardize the employment and community's livelihoods.***
3. ***Land tenure reform can boost the employment to meet the overall government target on unemployment level of 5.11 in year 2009. Small-scale forestry will absorb employment much bigger than big actors.***

However, the policy makers should experience the model themselves and analyze the results. For this matter, we keep the model as simple as possible. If the policy makers could not completely understand the model structure and behavior, then its outputs might not be internalized and unlikely to be implemented in the field.

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