HOW EFFECTIVE IS PROPERTY RIGHT TO DETER DEFORESTATION IN INDONESIA 2001-2005?*)

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Abstract

The rate of deforestation in Indonesia is higher than the world average. The lack of property rights could potentially result in overexploitation on forest resources. This paper argues that the presence of assigned property rights (natural forest concession) would prevent further deforestation in Indonesia. Using panel data estimation, the main result is that natural forest concession is negatively significant in influencing deforestation in Indonesia. This effect is explained by relatively high of the elasticity of deforestation rates with respect to area of assigned natural forest concession accounted for 0.33. This elasticity outweighs the positive significant effect of logs production in worsening deforestation in Indonesia.

Keywords: deforestation, property right, natural forest concession, panel data
JEL Classification: D23, Q23

INTRODUCTION

The Food and Agriculture Organization (FAO) in its Global Forest Resources Assessment 2005 reports that deforestation continuous in alarming rate. Deforestation occurs where there is a permanent forest conversion into non forest land uses such as agriculture land, arable land, waste land, and urban purposes. Since the forest serves various purposes ranging from biological, protective, productive and socio function, the deforestation could potentially influence human quality of life.

As the third largest rainforest in the world, Indonesia also faces that classical problem of forestry. Moreover, the rate of deforestation in Indonesia is higher than world average. During 2000 and 2005, the annual rate is 2.0 percent accounted for 1,871 million ha compared to only 0.18 percent of the world average. This figure is a 0,3 percent higher than previous decade (FAO, 2005).

Even though there is still no consensus about cause of Indonesian deforestation, several issues are identified as contributing factors to this problem. For the studies up to mid-90s, Sunderline and Resosudarmo (1996) comprehensively map the type causes of the rate of deforestation in Indonesia which in general classified the factors into two aspects, agent and underlying factors (Table 1).

Table 1: Studies of Causes of Indonesia Deforestation

Source	Type of Cause						
	Agent					Underlying	
	Smallholder			Plantation and tree crops	Timber industry	Government/ politics	Economic develop-ment
	Shifting cultiva-tion	Spontane-ous transmi-gration	Regular transmigr ation				
World Bank,1990							
FAO, 1990							
Dick, 1991							
WAHLI, 1992	effects overstated						
Barbier et al, 1993	growing population density most important						
Ascher, 1993						Govern-ment – MOF alliace	Economic diversifi-cation
Porter, 1994							
Dauvergne, 1994					effects under-stated		
Thiele, 1994	effects overstated				effects understated		
World Bank, 1994	effects overstated				effects understated		
Angelsen, 1995	effects overstated					govern-ment land claims	exoge-nous price effects
MOF, 1995	effects overstated						
Ross, 1996						ruling coalition	
Fraser, 1996	popula-tion density						
Hasanuddin, 1996	small-holder blameless						
Dove, 1996	effects overstated					natio nal political eco-nom ics	

shaded area indicates form of agency assumed to have the largest role in deforestation

source: Sunderlin and Resosudarmo, 1996

For the agent's aspect, smallholders play a part of deforestation problem for their activities like shifting cultivation (World Bank, 1990, and FA0 1990), and spontaneous transmigration (World Bank, 1990, FA0 1990, and Dick, 1991). Growing population density is also important factor in deforestation especially in it's contribution in increasing the population of the smallholders. (Barbier, 1993). The two other agents which also cause the problems are plantation and tree crops (MOF, 1995) and timber industry (WAHLI, 1992, Porter, 1994, Ross, 1996, and Hasanuddin, 1996). Government/politics and economic development is the other type cause of deforestation in Indonesia. Government and politics aspects which are underlying factor of deforestation are such as government-MOF alliance (Ascher, 1993), government land claims (Angelsen, 1995), and ruling coalition (Ross, 1996). While for economic aspect, factors likes economic diversification (Ascher, 1993) and exogenous price effects (Angelsen, 1995) play important rule in increasing rate of deforestation in Indonesia.

Recent studies on deforestation in Indonesia relate impact of economic crisis and implementation of the fiscal decentralization system which was firstly introduced in 2000. Especially for the deforestation post Indonesia economic crisis, this problem is worsened by the illegal logging activity. Palmer (2000) says that it is a kind of principal agents problem in Indonesia forestry sector where market and government failure exist (Palmer, 2000)Christanty et.al (2004) conduct early assessment of fiscal decentralization on deforestation in Indonesia. The lack of coordination between different levels of government has impeded the sound and secure property and tenure rights system in forestry sector. Decentralization is also not sufficient enough to empower local government employee to manage their forest sustainably.

From the studies on Indonesia deforestation, however, it is quite rare of macro study that specifically analysing the importance of property right in preventing the further deforestation in Indonesia. This study fills the gap of the scarce studies on the impact of assigned property right in deterring deforestation in Indonesia. Since the forest can be classified as a common-pool resource, it is highly subjected to overexploitation problems. The problem will arise if individual can freely exit and entry without any restrictions in withdrawal this resources. The individual only considers its private costs and does not take into account the costs imposed on other individuals. In this case, the absence of property right causes "the tragedy of the commons" (Grafton, et.al, 2004). Property rights are needed to prevent the overexploitation over natural resources. This paper argues that the assigned property rights in forestry sector can prevent further deforestation rates in Indonesia. Specifically, the objective of this paper is to analysis the effectiveness of forest concessionaries (Hak Pengusahaan Hutan, HPH) in influencing the rates of deforestation during period 2001 to 2005.

After this introduction, the next section is about data and methodology followed by the section about deforestation and natural forest management in Indonesia. After that, the result and discussion is presented before section on conclusion and policy implications.

METHODS

To address the problem, this paper uses ordinary panel data estimation. Three explanatory variables – forest concessionaires, logs production, and revenue sharing of forestry from central government to local governments, respectively – are to explain the rate of deforestation in Indonesia. The forest concessionaire is representative of assigned property right from the state to the private or

state-owned enterprises to harvest the forest resources. The second variables can be the best proxy of exploration of the main commodities of forestry which is logs or timbers. While the last variable is included in this analysis since the available data series of rates of deforestation is from 2001 and 2005 or the same period of the first five years of fiscal decentralization in Indonesia. Thus, inclusion of this variable in the recent case of deforestation is quite relevant.

The basic model is as follows:

$$Def_{it} = C + \beta_1 HPH_{it} + \beta_2 TIM_{it} + \beta_3 FOR_{it} + \varepsilon_{it}$$

where,

Def_{it} is rates of deforestation of region i at period t,

HPH_{it} is forest concessionaries of region i at period t,

TIM_{it} is log production of region i at period t, and

FOR_{it} is revenue sharing from forestry sector region i at period t.

i is index of regions, i = Sumatera, Kalimantan, Sulawesi, Bali and Nusa Tenggara, Maluku, and Papua

t is index of time, t = 2001, … , 2005

The limited availability of data series of deforestation in Indonesia or in other countries is one of the main constraints to perform macro studies of deforestation.. For the first time Indonesia published the data series of deforestation rates is in its 2006 Forestry Statistics of Department of Forestry Republic of Indonesia. This data covers the rate of deforestation of main islands in Indonesia between 2001 and 2005, inclusively. Those islands are Sumatera, Java, Kalimantan, Sulawesi, Bali and Nusa Tenggara, Maluku and Papua which Java is excluded in this paper. It is definitely very limited and aggregated since there are 33 provinces and more than 400 municipals in Indonesia All data of explanatory variables which is avail-

able in provincial or municipal level have to be aggregated into that island category in order to fit that island classification of deforestation. Consequently, the variability of each data is ignored. This is one of the main shortcomings of this paper.

Data on deforestation is based on the interpretation of SPOT Vegetation Image with spatial resolution of 1 Km obtained from Forestry Planning Agency, Department of Forestry Republic of Indonesia. Data on forest concessionaire is measured in area (Ha), while log production is in $M^3/Cu.M.$ Both of them are sourced from Directorate General of Forest Production Development, Department of Forestry Republic of Indonesia. Revenue Sharing from Forestry data is sourced from Directorate General of Fiscal Balance, Department of Finance.

RESULTS DISCUSSION

Forestry is one part of success story of development in Indonesia especially in the 60-80s. In the early period of rehabilitation under New Order regime, forestry was one of the primary sector in which Indonesia relied on besides agriculture and mining sector.

Indonesia became main exporter of timber product until in the mid 90s where the revenue from this sector composed 15 percent of total export Indonesia. Moreover this sector also provided a large employment for 700 thousand populations. However, this significance is declining considerably where the secondary and tertiary sectors like manufactures and services become more dominant in constituting the total GDP of Indonesia. Currently the share of forestry of the GDP is left only 0.91 percent of total GDP based on 1993 constant price. Even though the role of forestry is becoming less and less important, the commercialisations of forestry still grow rapidly. That such economic activity has costed much on sustainability of Indonesia forest. This real cost is a deforestation problem.

Figure 1 shows the recent rates of deforestation from period 2000/2001 to 2004/2005 for six main islands in Indonesia. There is similar pattern of deforestation rate for Sumatera, Kalimantan, Sulawesi, Java, and Maluku. For those islands, the peak of deforestation rates occurred in 2003. While Bali and Nusa Tenggara has decreasing rate of deforestation, deforestation rate in Papua tends to constant one.

By island, over five years period there is no much change in share of deforestation. From figure 2, it can be seen tation. From figure 2, it can be seen that deforestation in Indonesia is mainly contributed from deforestation in Kalimantan and Sumatera. These two together composed almost bit less half of the total in 2001 and more than half in 2005. Some islands have increasing rate of deforestation such as Sumatera (10%), Papua (4%), and Kalimantan (3%). This increasing, on the other hand, has reduced the rate in other islands like Java (8%), Bali and Nusa Tenggara (7%), Maluku (1%) and Sulawesi (1%).
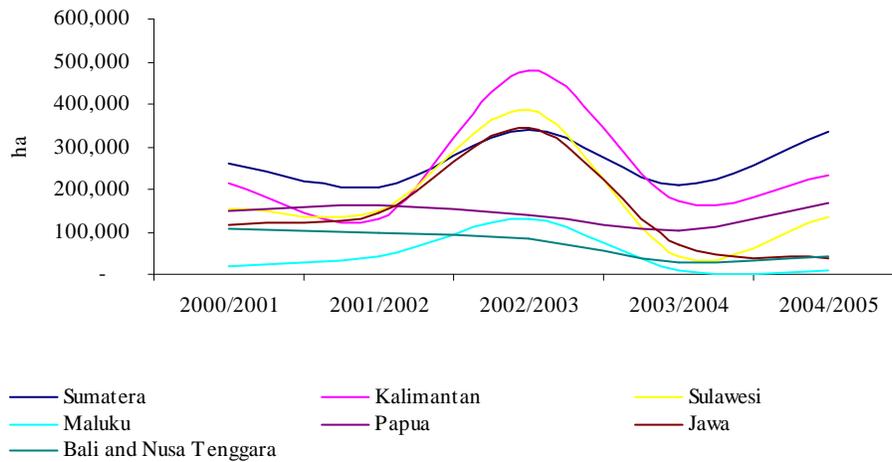
Source: Data processed from Forestry Statistic 2006, Department of Forestry, Republic of Indonesia

Figure 1: The Rates of Deforestation of 7 Main Islands in Indonesia, 2000/2001 and 2004/2005
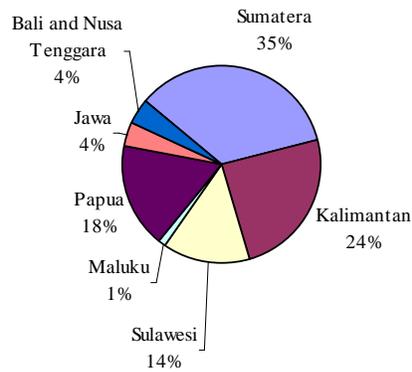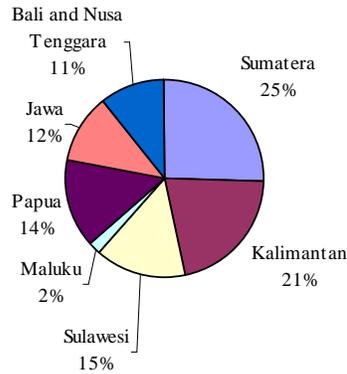
Source: Data processed from Forestry Statistic 2006, Department of Forestry, Republic of Indonesia

Figure 2:   The Share of Deforestation of 7 Main Islands in Indonesia, 2000/2001 and 2004/2005

Development of Natural Forest Concession
As stated in 1945 Indonesia Constitution, the public owns all natural resources and use all for improving social welfare. Government manages the allocation of all natural resources including forestry. In this sector, the planning and decision making is central-istic in central government. In deal with large-scale forest management, government assigns natural forest concessions to the private forest companies besides through its state-owned enterprises. Another significant number of concession is form of concession of industrial forest plantation.

Through the natural forest concession the assigned agents have exclusive rights of selective harvest of natural forest resource for over a 20 year period and can be renewed for another 15 year period. Table 2 and Figure 3 show the trend in number of natural forest concession over 1991 and 2006. Up to 2006, there are 322 units of natural forest concession with area occupation is 28.78 million ha. Compared to the period of 1991/92, this number is around half of number of unit in 1991/92. In terms of total area, natural forest concession covers around 28.78 million ha in 2006 or 50 percent of that in 1991/92. From the figure it can be seen that there is decreasing number of natural forest concession during the 90s either in terms of unit or area. However, in early 2000 its figures show increasing trends both unit and area but not the area/unit.

In its implementation there are four types of natural forest concession holders namely privates state owned enterprise, shared owned and joint owned concessionaires. However, the number of unit and area of concession is dominated by the private timber industry. Up to 2005, there were total 285 units of active natural forest concessions which were composed by 187 units private companies, 5 units of state-owned enterprises, 86 units of shared owned and 7 units of joint owned concessions. In 2005, private companies occupy 71 percent of total concessions while about 21 percent is for shared owned holders, and the remaining is distributed to state-owned enterprises and joint owned holders.

Table 2: Natural Forest Concession, 1991-2006

Year	Unit	Area (Ha)	Area/Unit (Ha)
1991/92	567	60.48	0.11
1992/93	580	61.38	0.11
1993/94	575	61.7	0.11
1994/95	540	61.03	0.11
1995/96	487	56.17	0.12
1996/97	447	54.09	0.12
1997/98	427	52.28	0.12
1998/99	420	51.58	0.12
1999/00	387	41.84	0.11
2000	362	39.16	0.11
2001	351	36.42	0.10
2002	270	28.08	0.10
2003	267	27.8	0.10
2004	287	27.82	0.10
2005	285	27.72	0.10
2006	322	28.78	0.09

Source: Data processed from Directorate General of Forest Production Development
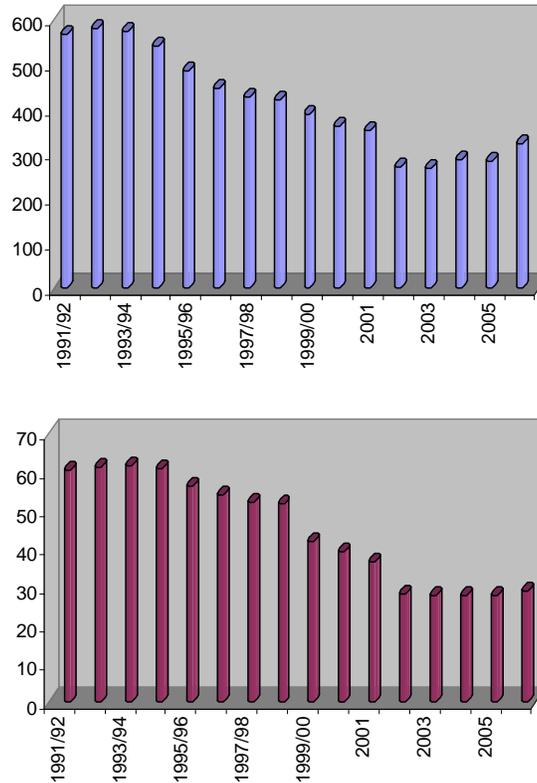
Source: Data processed from Directorate General of Forest Production Development
Figure 3: Natural Forest Concession, 1991-2006

The private concessionaries are unevenly distributed to all provinces in Indonesia except for Java. Table 3 shows the distribution and the growth of private and total natural forest concession over provinces in 2001 and 2006. Over this period, there is 11 percent increase in unit of private natural forest concessions in which the greatest increase is in North Sumatera and Central Kalimantan accounted for 200 percent and 127 percent, respectively. In contrast, the total number of concession is decreasing by 10 percent.

For the area of concession, it decreases in almost all provinces except for North Sumatera, Central Kalimantan, Central Sulawesi and East Kalimantan. In total the decreasing rate is around 12 percent. It also happened for total area of concession in Indonesia during that period.

Table 3: Distribution and Growth of Existing Natural Forest Concessions by Provinces 2001 and 2006

Province	Private						Total					
	Unit			Area (000 ha)			Unit			Area (000 ha)		
	2001	2006	growth	2001	2006	growth	2001	2006	growth	2001	2006	growth
Nangroe Aceh Darussalam	8	5	-38%	616	339	-45%	15	8	-47%	1112	525	-53%
North Sumatera	2	6	200%	97	338	248%	9	8	-11%	553	437	-21%
West Sumatera	4	4	0%	383	210	-45%	5	4	-20%	417	210	-50%
Riau	14	7	-50%	957	364	-62%	29	15	-48%	1827	812	-56%
Jambi	8	5	-38%	601	300	-50%	13	5	-62%	860	300	-65%
South Sumatera	5	1	-80%	375	56	-85%	9	1	-89%	1005	56	-94%
Bengkulu	1	1	0%	45	23	-49%	2	1	-50%	90	23	-74%
West Kalimantan	11	12	9%	1045	577	-45%	29	22	-24%	2376	1164	-51%
Central Kalimantan	11	25	127%	962	1854	93%	57	61	7%	5019	4570	-9%
South Kalimantan		1			18		5	6	20%	603	361	-40%
East Kalimantan	32	48	50%	3697	3871	5%	76	85	12%	9582	6734	-30%
North Sulawesi	6	2	-67%	317	61	-81%	8	2	-75%	443	61	-86%
Gorontalo		4			186			4			186	
Central Sulawesi	9	13	44%	670	846	26%	13	15	15%	935	992	6%
South-East Sulawesi	2	3	50%	416	386	-7%	2	3	50%	416	386	-7%
South Sulawesi	4			239			5			339		
West Sulawesi		5			245			6			293	
Maluku	24	9	-63%	1877	603	-68%	29	11	-62%	2364	815	-66%
North Maluku		14			835			15			922	
Papua		25		10877	4904	-55%		26		10877	5581	-49%
West Papua	51	24	-53%		4350		51	24	-53%		4350	
Total	193	214	11%	23206	20366	-12%	359	322	-10%	38851	28779	-26%

Source: Data processed from Directorate General of Forest Production Development

Table 4: Log and Processed Wood Productions, 1997/98 - 2006 (thousand M3/CuM)

	Logs	Plywood	Sawn timber	Wood Working	Block Board	Veneer	Particle Board	Chip wood	Pulp	Others	Moulding	Dowel
1997/98	29,520	6,710	2,613	142	601	1,129	443	174	2,424	471	920	4
1998/99	19,027	7,155	2,707	7	662	1,314	282	496	1,994	795	978	5
1999/00	20,620	4,612	2,060	10	427	1,035	188	203	1,194	648	634	4
2000	13,798	4,443	2,790	299	321	669	200	20	659	0	160	3
2001	11,155	2,101	675	278	388	94	297	385	702	37	139	1
2002	9,004	1,694	623	72	122	4,361	7	22	281	0	162	0
2003	11,424	6,111	763	162	436	289	94	127	4,662	727	322	0
2004	13,549	4,514	433	388	277	155	244	317	2,594	766	239	0
2005	24,223	4,534	1,472	131	403	1,012	125	352	988	360	273	4
2006	21,792	3,812	679	39	189	256	41	557	3,371	23	119	0
Total	174,112	45,686	14,815	1527	3,826	10,314	1,920	2,653	18,869	3,828	3,946	20
Share	61.85%	16.23%	5.26%	0.54%	1.36%	3.66%	0.68%	0.94%	6.70%	1.36%	1.40%	0.01%

Source: Directorate General of Forest Production Development and Forestry Provincial Office of Central Sulawesi

One of the main commodities of forest resources is log production. It composes 61.85 percent of total log and processed wood productions over the period 1997/98 to 2006 (Table 4). Other smaller productions are plywood (16.23%), pulp (6.70%) and sawn timber (5.26%). The remaining products have less than 5 percents of the total product of forestry.

Natural forest concession holders produce around 39 percent of total log production in 2001 to 2006. This number is composed by 27 percent from annual work plan and 12 percent from timber utilization concession (Table 5). It also can be seen that this production tends to increase over time especially from the timber utilization concession. Another large portion of log production sources from industrial forest plantation.

The result of panel data estimation on the effect of natural forest concession on deterring the rates of deforestation is as follows:

$$\text{Log(Def)}_{ij} = \quad 9.667 - 0.338\text{Log(HPH)}_{ij}$$
$$(14.986) \qquad (-1.737)$$
$$+ 0.175\text{Log(Tim)}_{ij}$$
$$(2.290)$$
$$+ 0.453\text{Log(For)}_{ij}$$
$$(1.590)$$

This explains that natural forest concessionar is negatively significant in influencing the rate of deforestation in Indonesia at 10 percent of significance level. The coefficient estimated is -0.338 which means that for every 10 percent increase of natural forest concession area, the rate of deforestation will fall 3.38 percent, while other factors are constant. Since this coefficient is also elasticity meaning, it suggests that the responsiveness of deforestation with respect to area of natural forest concession is relatively high.

Variable log production, on the other hand, is positively significant in affecting the deforestation in Indonesia at 5 percent of significance level. From the coefficient, it suggests that elasticity of deforestation rate with respect to log production is 0.175. It means that holding other factors fixed, 10 percent incremental in log production will contribute 1.75 percent increase in deforestation rate in Indonesia. This empirical result is quite similar with the 1990-2000 rate of deforestation in Indonesia which is 1.7 percent per year (FAO, 2005).

Table 5: Log Productions Based on Source of Production, 2002 - 2006

No	Year	Natural Forest		Forest Plantation		Other	Total
		AWP	TUC	SOE	IFP		
1	2002	3,020	183	1,559	4,243	-	9,005
2	2003	4,105	956	977	5,326	60	11,424
3	2004	3,511	1,632	924	7,329	154	13,550
4	2005	5,721	3,614	758	12,818	1,312	24,223
5	2006	5,589	3,434	338	11,451	982	21,794
Total		21,946	9,819	4,556	41,167	2,508	79,996
average share		27%	12%	6%	51%	3%	100%

Source: Data processed from Directorate General of Forest Production Development & Forestry Provincial Office of Central Sulawesi
AWP: Annual Work Plan, TUC: Timber Utilization Concession, SOE: State-owned Enterprise, IFP: Industrial Forest Plantation

The third variable, revenue sharing from forestry, has no statistically significant effect on deforestation rate in Indonesia during first five years of local autonomy. Briefly, the possible explanation is that since 2002 the forestry sector is no longer decentralized especially in issuing the harvesting permit for small scale of timber industry.

From the results above, it can be inferred that the positive effect of natural forest concession outweighs the negative effect of exploration of logs in Indonesian forest. In other words, the natural forest concession is effective policy tools to deter the rates of deforestation. However to infer that conclusion should be with some cautions since case of deforestation in Indonesia is quite specific. The following paragraphs will discuss the conclusion that natural forest concession is effective to slow down the rates of deforestation in Indonesia.

The key element of property right or natural forest concession in this context is its exclusivity embedded to this right. The government exclusively grants the rights to special parties to harvest using the ways the government requires for sustainability purposes. The one not assigned with this concession is excluded to harvest natural forest resources in Indonesia. In the natural forest concession, government rules a silviculture system based on the selectivity in cutting and enrichment planting or Tebang Pilih Tanam Indonesia system (TPTI). It enables for harvesting and regenerating tree in natural forest in order to emulate the original ecology of the explored natural forest. By this system it could be expected to control the rate of deforestation in Indonesia (Brown, 1999).

If that natural forest concession with its ideal system of harvesting is looks fit for forest sustainability reasons, the realization is often not the case. LATIN (1998) in their studies find that the rotation time, which rules cut tree with minimum 50cm diameter is violated by cutting the smaller diameter. In addition, the operation area of concession often permitted area of natural concession sometimes exceeds the permitted area of concession like operating in buffer area. It is the common case to disobey the requirement of reforestation on ex concession area. The limited human resources are the argument for the lack of control of such large operation area of natural forest concession. This reason is one of the underlying factors of ineffectiveness of natural forest concession to deter deforestation in Indonesia.

Table 6: Ranking of Timber Groups of Concession Holder, 1997/98

Group name	Unit of Concession	Percentage	Area (ha)	Percentage
Barito Pacific	52	11%	5,043,067	10%
Djajanti	29	6%	3,365,357	7%
KLI	19	4%	2,806,600	5%
Alas Kusuma	19	4%	2,661,376	5%
Inhutani I	3	1%	2,609,785	5%
Bob Hasan Group	12	3%	2,131,360	4%
Armed Forces/Army	7	2%	1,819,600	4%
Korindo	8	2%	1,589,228	3%
Kodeco	3	1%	1,081,700	2%
Sumalindo	9	2%	1,057,678	2%
Top 10 groups	161	35%	24,165,751	47%

Source: Brown (1999)

Indonesia natural forest concession yields enormous rent in form of forest royalty for the government. One of the significant allocations of this royalty revenue is for reforestation fund. However, the above normal profit has also created an incentive for rent seeking behaviour or rent addicted which in turn distorts the effectiveness of natural forest concession rates in preventing deforestation in Indonesia. Brown (1999) says that the concession is highly subject to collusion between the holders and the corrupted government. So that the concession is discretionally granted to certain privileged companies of interest. This negative coalition has resulted uneven distribution of natural forest concession only for a small number of groups. Table 6 shows that top ten groups of natural forest concession holders or equivalent to 11 percent of total concessions occupied 47 percent area of concession in 1997/98.

Other factors that should be considered to assess the effectiveness of that property right of natural forest concession are the weak institutional arrangement such as lack of law enforcement. This can be seen from the increasing number of illegal logging practiced by the holder of natural forest concession. This problem is getting serious since economic crisis in Indonesia 1997/1998. The ministry of forestry reports that recent illegal logging has costed US$ 3.7 billion annually.

CONCLUSION

The property right in Indonesia forestry sector in form of natural forest concession is statistically significant in deterring the rates of deforestation. Moreover this effect outweighs the negative impact of exploration of log products. In reality, the implementation of natural forest concession faces the complexity structural problem. The three principal problems such lack of human resources and control, rent seeking behaviour as well as lack of law enforcement potentially costs the effectiveness of the positive impact on slowing down deforestation.

In order to reduce the rate of deforestation in Indonesia, the application of natural forest concession should be accompanied by the structural reforms on those problem areas. Empowering human resource with the specific skill and technology is required to control and monitor the operation of natural forest concession in the right ways. Strong law enforcement especially for illegal logging activity and any infringements of the holder will improve the effectiveness of the concession. These such institutional reforms would not only create effectiveness but also efficiency of natural forest concession in stopping the rates of deforestation in Indonesia.

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