



Economic Costs and Benefits of Allocating Forest Land for Industrial Tree Plantation Development in Indonesia

Julia Maturana

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Abbreviations and acronyms

AA	Arara Abadi—Plantation Company associated with IKPP pulp mill and APP Group
APP	Asia Pulp and Paper
APRIL	Asia Pacific Resources International Holdings
DR	<i>Dana Reboisasi</i> (Reforestation payment)
EB	economic benefit(s)
EC	economic cost(s)
GOI	Government of Indonesia
HTI	<i>Hutan Tanaman Industri</i> (Industrial Timber Plantation)
IIR	Inti Indo Rayon—Plantation Company associated with TPL pulp mill and RAPP Group until 2002
IKPP	Indah Kiat Pulp and Paper mill
MAI	mean annual increment
MHP	Musi Hutan Persada—Plantation Company associated with TEL mill and Barito Pacific Group
MHW	mixed hard wood
MWP	mean wood production
NGO	non-governmental organization
NTFP	non-timber forest product
PSDH	<i>Provisi Sumber Daya Hutan</i> (Government tax for logged/harvested wood)
RAPP	Riau Andalan Pulp and Paper Group
SMG	Sinar Mas Group
SPK	<i>Sumbangan Pihak Ketiga</i> (Payment to third parties)
TEL	Tanjung Enim Lestari mill
TEV	total economic value
t	tonne (metric ton)
TPL	Toba Pulp Lestari mill
WKS	Wira Karya Sakti—Plantation Company associated with Lontar Papyrus pulp mill and APP Group

Glossary

<i>belukar</i>	Indonesian term to refer to old fallow or degraded secondary forests
existence value	the value attached to maintaining the inherent value of nature for future generations
externality	benefits or costs generated as the result of an economic activity that do not accrue directly to the parties involved in the activity; for example, environmental externalities are benefits or costs that manifest themselves through changes in the physical or biological environment regardless of the relationship of the parties to the environmental regime impacted
harvest	extraction of products from plantations
jungle rubber	rubber trees (<i>Hevea brasiliensis</i>) planted as enrichment in fallow
logged-over forest	forested areas from which the timber with commercial value has already been extracted
marginal costs	the change in total cost associated with producing each extra unit of output; calculated by dividing the change in total cost by the change in output
marginal utility	the added utility or satisfaction derived from the consumption of an additional unit of a good
mean annual increment (MAI)	the total increase of volume growth of trees per unit area (ha) up to the end of the rotation period, divided by the number of years in the rotation
monopsony	a structure for an input (pulpwood) market for which there is only one buyer—the (pulpwood) supply curve has a positive slope; ‘monopsony power’ is in the hands of the buyer that can force prices down by restricting purchases
opportunity cost	the cost of a resource X calculated at the best alternative use of it. It actually represents the minimum amount of money that a given agent will be willing to accept for the resource, and is therefore a measure of the value of such resource
optimal allocation	resources are optimally allocated if they are in the ‘optimal situation’ and any change in such allocation diminishes the welfare of at least one of the agents involved in the decision; thus, the allocation of resources is such that all agents are in their best possible option
option value	value attached to maintaining the natural landscape and its resources so that future generations have the social option to select the species best suited to their needs
shadow price	adjusted price that takes into account market price distortions and government objectives; also known as ‘accounting price’; represents the opportunity cost of producing or consuming the resource
social costs	those costs met by society when goods are produced, e.g. pollution

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Abstract

In the late 1980s, large amounts of money and areas of Indonesia's forestland were allocated for the development of fast-growing pulp plantations. The "financial" costs and benefits of this action—representing only a portion of the actual totals can be easily accounted, while the full "economic" benefits and costs remain hidden. Knowing the net economic benefits can provide useful inputs for the Government of Indonesia and other interest groups to revise current policies or regulations and setting new directions for future plantation projects that benefit the national economy in the long term.

This paper examines the total economic costs and benefits of five large pulp plantation projects in Sumatra, Indonesia. Four of the five plantation projects generate economic costs above their economic benefits. The estimated economic costs represent over 30 times the actual financial payments the Government receives from each company.

The allocation of over 1.4 million hectares of forestland for conversion into tree plantations generates net losses of over US\$3 billion for the country. This analysis clearly demonstrates that the Government of Indonesia should not allocate any more forestland for conversion into HTI pulp plantations.

INTRODUCTION

Pulp industries developed rapidly in Indonesia after large investments in this sector in the late 1980s. The total pulp production in the country rose from 3 million tonnes per year in 1997 (Barr 2001) to 5.6 million tonnes per year by 2002 (FAO 2003).

Large areas of State-owned forestlands were allocated through Industrial Timber Plantation (HTI) permits and nearly US\$100 million of State-owned capital was allocated to promote the development of industrial timber plantations in the country (Barr 2001). The total area allocated for the development of such plantations up to 2002 was 5.38 million ha (DEPHUT 2003), with approximately 41% of this concentrated on the island of Sumatra.

The large areas of forest land given in concessions comprise dryland logged-over forests and jungle rubber; swamp forests; some smallholders' rubber and oil-palm plantations; grasslands, and areas of agricultural fields and village settlements. The forest plantation companies were expected to produce the raw material required by the national pulp industries producing pulp for paper for both export and internal consumption. Pulp and paper exports generated US\$2 billion in export earnings for the country in 1997 (FWI and GFW 2002).

While the Government of Indonesia (GOI) can easily account the financial gains and losses that its investments in the pulp mills and related plantation companies have achieved, the economic benefits and costs remain hidden. The financial costs represent only a small portion of the actual total costs, leading to the perception of greater net benefits than is actually the case. The real costs include the direct financial costs of the investments and running the pulp mills and pulp plantation companies *plus* the costs—borne by the local people, Indonesia and the world—of the large areas of forest land allocated for the HTI projects.

Although several studies have looked at

the financial and economic aspects of the pulp and paper industry and analysed HTI plantations in Indonesia (Davis 1989; MoF 1994; Potter and Lee 1998; Kartodihardjo and Supriono 2000; Barr 2001; van Dijk 2003), there has been no study of the economic impacts of these HTI plantations on the country.

In this paper, I aim to calculate the total economic costs and benefits of five large HTI projects in Sumatra, Indonesia, taking into account the differences in the types of forest and landscape of the areas given in concession and the production capacity of their associated pulp mills. Specifically, I determine the main economic effects and impacts generated by the projects; analyse and compare the economic performance of five forest plantation case studies, and highlight the main elements determining their performance. The results provide useful inputs for the GOI and other interested parties to assess the net economic performance of the HTI projects for the country and revise current policies or regulations that guide new plantation projects targeting higher economic (not only financial) benefits for the country.

Proposed Approach

A graphical analysis is used to show the impacts of the HTI projects and the related goods and services affected. Market or shadow prices¹ are used to quantify such impacts when a market exists, otherwise a value is assigned using existent estimations of the value for the non-market products or services related to the areas under assessment.

Positive and negative impacts related to the HTI timber plantation companies are identified and measured in their respective markets in terms of goods produced and cost incurred, to allow comparisons among the cases.

¹ For definition see Glossary.

CONCEPTUAL FRAMEWORK

Economic Assessment

Economics, optimisation and scarcity are three interrelated concepts. Human needs increase over time and the way to satisfy such needs is to consume resources. Social development has been based on the consumption of resources. For various reasons (e.g. biophysical differences, natural extinction processes, high rates of consumption, social accumulation), some resources have become scarce—sometimes generally scarce, sometimes scarce in specific areas, and sometimes scarce for certain groups. Economic science has developed as a response to the need to optimally allocate scarce resources to satisfy the increasing needs of society. Optimal allocation is observed when there is no option to improve the situation for the agent or group of agents analysed given a specific amount of resources at a given moment².

When an investment project or a policy to guide investments is established, the decision-maker is targeting specific objectives—for example, a family makes investments to assure its present and future welfare, a firm intends to maximise benefits, and governments invest public money to achieve specific socio-economic objectives to improve the welfare of society. Any policy or programme, or any economic decision must be assessed in terms of the impact pursued. Economic assessment is the tool that analysts have to guide national-level decision processes and to analyse economic policies. It evaluates the contributions of a given policy, project or decision to the welfare of society. The value of any good, factor or resource to be used or produced by the project is valued in terms of its contribution to national welfare.

Reasons for Using Economic Assessment

Such economic and society welfare improvements are difficult to measure. Any action implies gains and losses, a given policy or investment decision can lead to opposite effects and impacts on different groups. A given action can improve the welfare of some, but reduce that of others; or it could increase the level of consumption of all the inhabitants (welfare improvements), but increase pollution in the country (welfare losses). If a given policy has no negative effects on any group, that policy is undoubtedly good for the people; however, such cases are rarely, if ever, observed in the real world. What we usually observe are some positive and some negative impacts. The important thing then is to know if the result of the combined impacts is leading society (as a whole) to a better-off or a worse-off situation.

Economic theory suggests that we add up the gains of all the agents who would be in a better situation, and all the losses of the agents who would be in a worse situation. If the result is a net gain, the policy or action should be applied, otherwise it should not. This economic assessment is conceptually based on ‘welfare theory’³ and its definitions of welfare, utility and social behaviour.

Consequently, we analyse the total economic benefits (EB) caused by the production of the project (EB of the production) and the economic cost (EC) of inputs and factors used (EB and EC are usually analysed separately on their respective markets). The analysis focuses on consumption changes for different goods and services, and on the use of resources, inputs and productive factors. Instead of focusing on the effects on different consumers, it focuses on the effects on aggregated consumption and production. This analysis is also known as

² For definition see Glossary.

³ For a broad study of welfare theory, refer to Just *et al.* (1982) and Mishan (1988).

benefit-cost analysis using ‘efficiency or shadow prices’.

The use of observed prices can lead to wrong (over- or under-valued) estimations⁴ of benefits and costs when we are working in a ‘distorted’ economy, characterised by market failures such as subsidies, taxes, monopolies, and externalities⁵. Nevertheless, the problem can be ‘corrected’ by analysing each market failure, and the effects on prices and traded quantities for a given good in a given market.

Types of Impact Included and Their Effects on Welfare

To value (put a price on) the benefits or costs of a given investment or action, taking into account all economic benefits, the theory suggests measurement of the changes in consumption (present and future) for all goods and services (market and non-market). Positive impacts on these goods and services are considered social benefits and negative impacts are considered social costs. Positive impacts on consumption are the result of a project generating goods or

services, while negative impacts would result from a project requiring a scarce input or factor. The latter is accounted as a cost, because the consumption of such elements is only possible if other agents in the society release them, thereby losing in economic terms.

Other positive and negative impacts are linked to the use of resources (indirect impacts on consumption) such as release or consumption of resources through substitution, savings, use or compromise of productive factors and inputs. These resources are valued in terms of the opportunity cost⁶ of using such resources.

Positive and negative impacts to identify correspond to (Castro and Mokate 1998):

- Increase/reduction in the consumption of market and non-market goods and services;
- Increase/reduction in exports (foreign exchange earnings increased or reduced);
- Reduction/increase in imports (foreign exchange savings or expenditure);
- Release/compromise of productive resources.

⁴ When perfect competency is observed, price reflects the marginal costs (for the producers) and the marginal utility (for the consumers). The existence of market failures results in observed prices not reflecting either marginal costs or marginal utility. In such cases, the price does not represent a true reflection of economic costs or benefits.

⁵ For definition see Glossary.

⁶ For definition see Glossary.

STUDY CASES

Determining the Economic Impacts at the Aggregated Scenario

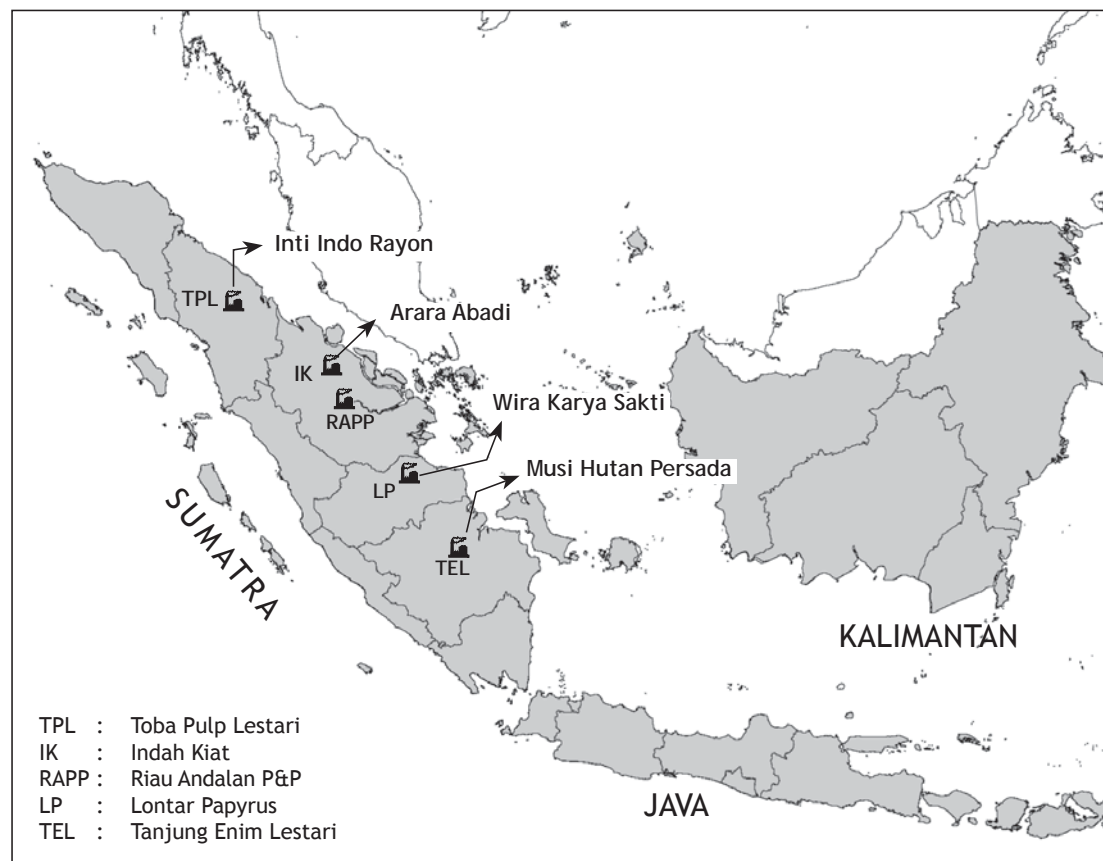
Between 1984 and 1996, the GOI allocated a total area of nearly 1.4 million ha of forest land to five plantation companies in Sumatra (Fig. 1), to harvest (clear cut) the areas for the production of pulp wood and establish tree plantations. These concessions were granted to groups that were developing or expanding pulp or pulp and paper mills with the purpose of sustaining their production⁷. From 1984 onwards, the related pulp mills initiated operations and increased their installed capacity to make use of the large sources of raw material made available for their pulp production.

Supply and demand are integrated as a result of the fact that the same groups own both the mills and the companies holding the

HTI concessions. Consequently, the volume of pulpwood produced depends on the amount required by the pulp mills; so, supply volume is matched to the level of the demand. This implies that the price is not determined by market forces, but by the profit maximisation of the group managing the integrated chain of production. Since the system works as a monopsony, the pulpwood is undervalued (there is no other market), resulting in a transaction price (at the pulpwood market) below the optimal price.

The aggregated effect, observed at the pulpwood market, can be represented graphically (Fig. 2). The projects cause an increase in the supply of pulpwood, represented by a movement of the original supply curve from S to S' . The demand is also increased through

Figure 1. Location of the five pulp-plantation companies included in the study



⁷ Three pulp and paper mills, one pulp and rayon mill, and one pulp mill.



Log-yard of one of the HTI plantation companies in Sumatra (Photo by Julia Maturana)

the creation of the pulp mills and increases in installed capacity, represented with the movement of the demand curve from D to D' . The price of pulpwood remains unchanged, because the increase in supply is not observed—

the five pulpwood producers sell their product to their own mills.

The supply curve is inelastic with respect to the price because of the integrated nature of the market (i.e. producers and buyers are

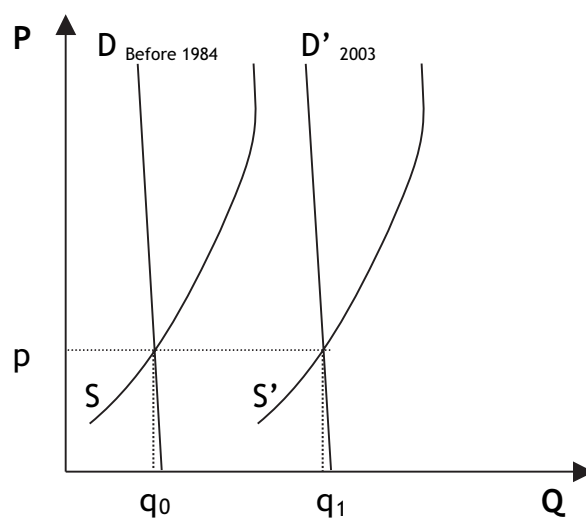


Figure 2. Pulpwood market

Key: D = original demand (in this case before 1984, before concessions); D' = later demand (in this case in 2003); P = price axis; p = transaction price (assumed static over time); Q = quantity (of pulpwood) axis; q_0 = quantity (of pulpwood) produced (pre-1984); q_1 = quantity (of pulpwood) produced (in 2003); S = supply curve (pre-1984); S' = supply curve (2003).

linked). The final portion of the curve should be vertical once the maximum production allowed by the ecosystem (including plantations) has been reached. The demand curve is also drawn as a very inelastic line with respect to price and it is mainly determined by the installed capacity of the mills. The price elasticity of the demand for the pulpwood market in Indonesia calculated by FAO (1996) with large series of data is -0.09 (scale: 0 = totally inelastic; 1 = totally elastic).

Economic costs are related to the large amount (over 1.4 million ha) of forest land used. The effects can be observed in the forest land's (hypothetical) market. The price for the resource (concession-related costs) is established by the GOI taking into account non-market considerations given the non-existence of a market for the State forest land. The allocated HTI licenses (concessions) for these projects result in an increase in the demand for State forest land from q_0 to q_1 (shown in Fig. 3) by a movement of the demand curve from D to D' . The supply is represented as a horizontal curve capturing the fact that the area of State forest land offered does not depend on its demand but on the existing (available) area. The final vertical portion represents the limit for the supply of State forest land. The aggregated impacts of the HTI allocated area in concession would be the result of summing positive (economic benefits) and negative (economic

costs) impacts, for which it is necessary to express them in numerical terms.

Estimation of Economic Benefits and Costs

All the plantation companies in the analysis obtained rights over approximately 300 000 ha of State forest land for similar periods of time (>40 years). Three of the concession areas were mainly covered by logged-over forests of mixed hard wood (MHW); one by pines and logged-over forests of MHW, and one mainly by grasslands (*Imperata cylindrica*) and degraded forests (*belukar*).

Economic benefits and costs are calculated for the period from 1984 to 2038. Three discount rates (4%, 8% and 12%) are used to show the values at year 0 (1984) to allow comparisons. All costs and prices are quoted in US dollars (2003). Three scenarios were created to test the sensitivity of the analysis: an initial scenario of stability; an optimistic scenario with increasing prices of the pulpwood and area planted; and a pessimistic scenario with decreasing prices and area planted.

Economic Benefits

The increase in the supply of pulpwood observed after the allocation of the State forest areas is matched by the demand from the mills (actually

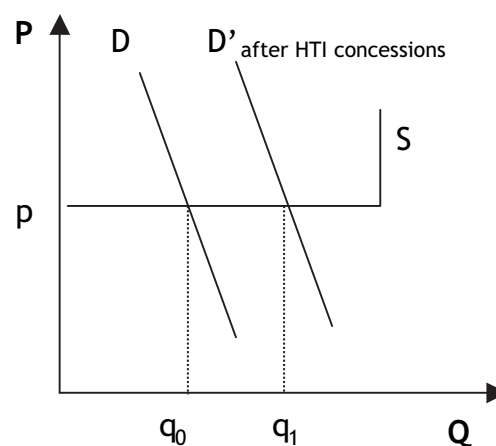


Figure 3. State forest land (hypothetical market)

Key: D = original demand (in this case before 1984, before concessions); D' = later demand (in this case in 2003); P = price (of forest land) axis; p = transaction price; Q = quantity (of forest land) axis; q_0 = quantity (of forest land) demanded (pre-1984); q_1 = quantity (of forest land) demanded (in 2003); S = supply (of forest land) curve.

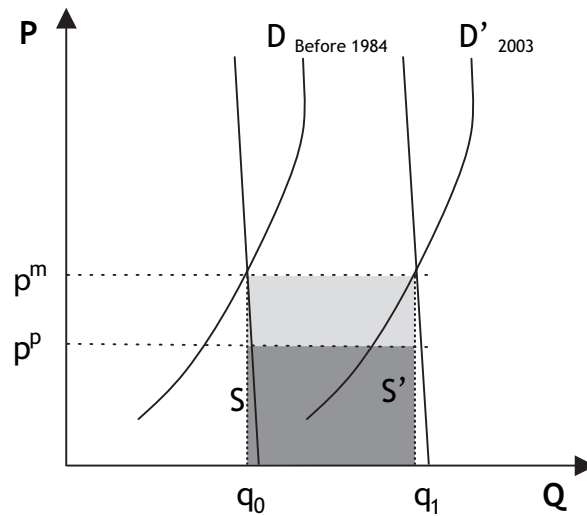


Figure 4. Pulpwood market

Key: see Figure 2; p^m = market price; p^p = perceived price.

Notes: $q_1 = q_0 + 27$ million m^3 /year.

The dark grey area represents the financial influx for the plantation companies, determined by the perceived (actual) price and the quantities traded. The light grey area represents the non-perceived benefits and is determined by the undistorted price (US\$40) that represents the market value of the pulpwood. The economic benefit resulting from the increase in annual consumption (demand) of nearly 27 million m^3 of pulpwood is obtained by summing the two areas.

the demand is determining the supply). The related benefits may be accounted as the area coloured in Figure 4 or by approximation:

$$EB_T = \sum_{t=1}^T (q_1 - q_0)_t \times p_t^m$$

The price to be used corresponds to the observed transaction (market) price (p^m) of the pulpwood each year (t). As mentioned before, the pulpwood market for these plantation companies is not a 'perfect competence' situation; on the contrary, the supplier faces a monopsony in the demand, which reduces the perceived price (p^p) to a level below the 'competence' price⁸ ($p^p < p^m$). Using the actually perceived price would lead to an underestimation of the benefits of the projects. In fact, the transaction price paid to Arara Abadi plantation company by its related pulp and paper mill, Indah Kiat, in 1998 and 1999, was about US\$8/ m^3 compared with the US\$42/ m^3 paid for external logs at the mill gate (Ometraco 2000), and wood costs in 2002 quoted by APP for both of its pulp and paper mills ranged between US\$34 and US\$36 per m^3 (APP 2002). Using this information as reference, the price

used in the analysis was US\$40/ m^3 for the five plantation companies.

The quantities $(q_1 - q_0)_t$ correspond to the total volume of pulpwood traded each year by the five plantation companies. These volumes were calculated from the production capacities of the related pulp mills.

Economic Costs

The related costs are accounted in terms of the resources required to sustain the increase in the supply of wood: the 1.4 million ha of MHW, pine forests, degraded forests and grasslands allocated to the projects, valued in their respective markets. By approximation:

$$EC_T = \sum_{t=1}^T (q_1 - q_0)_t \times p_t^s$$

The price actually paid for the use of these forests (logging/harvesting permits, concession payments, fees and taxes, etc.) represents the current financial costs for the plantation companies and it is represented as p^c (current price) in Figure 5, determining the current costs (dark grey area) of using these resources. These

⁸ The monopsony sets the price for the inputs on the basis of its profit-maximisation framework, thereby forcing the price down.

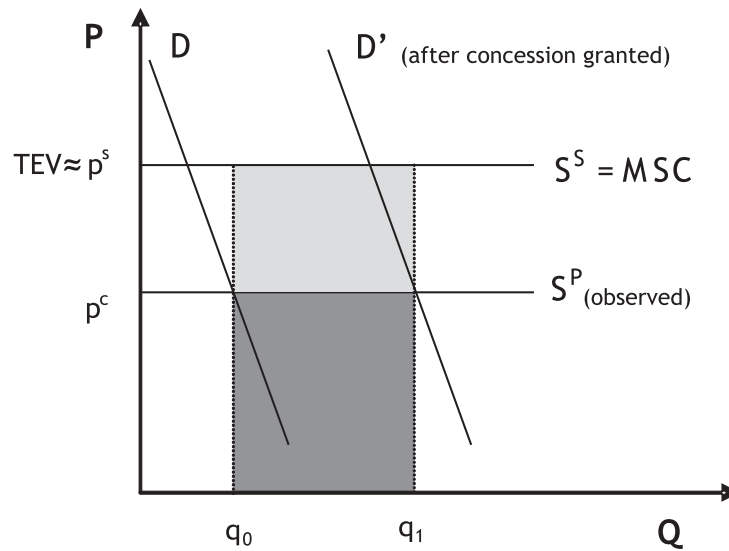


Figure 5. State forest land (hypothetical market)

Key: see Figure 3; p^c = current price; p^s = social price; S^P = supply curve (private); S^S = supply curve (social); MSC = marginal social cost; TEV = total economic value.

Notes: $q_1 = (q_0 + 1.4 \text{ million ha})$

The dark grey area represents the financial outflow of the plantation companies (current costs), determined by the p^c and the area in concession. The light grey area represents the non-perceived costs and is determined by the difference between the TEV and the p^c . The economic cost resulting from the compromise of over 1.4 million ha of State forests are obtained by summing the two areas.

costs range from US\$15 000 to US\$99 million per year per company, estimated from the payments per volume established by the GOI (PSDH, SPK and DR).

Given the non-existence of a market for the State forests, no market price can be observed. If a market existed, its price would reflect the value of such areas. Nevertheless, this market price would also fail to value the range of positive social benefits associated with the positive externalities of these forests, such as wilderness and biodiversity protection, recreation, pollination, biological control, habitat functions, historical information. Such values are recognised through the total economic value ($TEV \approx p^s$) estimation. The TEV for Indonesian logged-over forests determined by Simangunsong (2003) using a series of estimations from different authors correspond to US\$1283/ha per year.

The quantities $(q_1 - q_0)_t$ correspond to the total area of State forests given in concession to the plantation companies.

Estimations Case by Case

To calculate the aggregated economic costs and benefits of these projects, the individual quantities of pulpwood produced and areas of forests used by each company are determined. In doing this, the following assumptions were made.

The area to measure the economic cost $EC(q_1 - q_0)$ has been determined as a function of the logged volumes of wood:

$$Economic\ Cost_t = Area\ Logged_t \times TEV_t$$

The TEV was obtained from Simangunsong (2003) who determines the TEV for logged-over forests in Indonesia. The categories included are: direct use value (timber, fuelwood, non-timber forest products [NTFP] and water consumption); indirect use value (soil and water conservation, carbon sink, flood protection and water transportation); and non-use value (option and existence values⁹).

⁹ For definitions see Glossary.

$$\text{Economic Benefit}_t = \text{Volume of Production}_t \times \text{Price}_t$$

The price corresponds to a fixed market price for the pulpwood estimated at US\$40/m³. This price changes for the optimistic and pessimistic scenarios.

The volume of production includes the total volume of wood logged from the natural areas, harvested from the plantations, and obtained from other sources:

$$\text{Volume of production}_t = \text{Logged volume}_t + \text{Harvested volume}_t + \text{Other sources}_t$$

Plantation companies match mill requirements with natural wood before their tree plantations are ready to harvest, and it is assumed that they prefer to use logged wood even if their plantations are ready. This assumption is made taking into account that costs of logging from natural forests are almost half of those of harvesting from plantations (van Dijk 2003), so:

$$\text{Logged volume}_t = \text{Mill requirement}_t \quad (\text{if Available Natural Forest}_{t-1} \geq \text{Mill requirement}_t)$$

$$\text{Logged volume}_t = \text{Available Natural Forest}_{t-1} \quad (\text{if Available Natural Forest}_{t-1} < \text{Mill requirement}_t)$$

Where:

$$\text{Available Natural Forest}_t =$$

$$\frac{\text{Area}_t \times \text{Feasibility}_t \times \text{MWP}}{\text{Conversion Rate}_t}$$

(If $\text{Logged volume}_t = 0$)

or

$$\text{Available Natural Forest}_t =$$

$$\frac{\text{Area}_t \times \text{Feasibility}_t \times \text{MWP}_t}{\text{Conversion Rate}_t} - \text{Logged Volume}_t$$

(if $\text{Logged Volume}_t \neq 0$)

Where, *Area* corresponds to the number of hectares given in concession; the term *Feasibility* captures changes in the amount of area that can be actually logged and it depends on the size of the area kept as conservation and people's settlements and crops; the mean wood

production (*MWP*) value represents the wood productivity of the area and corresponds to the volume of wood that can be logged from each hectare of natural forest (average). This value was obtained from the plantation companies information and cross-checked with data available for each of the areas when possible.

$$\text{Mill requirement}_t = \text{Production capacity}_t \times \text{Quota}_t \times \text{Running}_t$$

The production capacity was obtained from actual data up to 2003 and then adjusted by the expected increases with the information from each company or maintained at current levels. The *Quota* captures whether there are one or more plantation companies supplying raw material to the related pulpwood mill. The *Running* value shows whether or not the mill was running at full capacity in each year.

The harvested volume will depend on the planted area and the remaining mill requirements:

$$\text{Harvested volume}_t = \text{Harvestable volume}_t \quad (\text{if Mill requirement}_t - \text{Logged volume}_t - \text{Other sources}_t > \text{Harvestable volume}_t)$$

or

$$\text{Harvested volume}_t = \text{Mill requirement}_t - \text{Logged volume}_t - \text{Other sources}_t \quad (\text{if Mill requirement}_t - \text{Logged volume}_t - \text{Other sources}_t \leq \text{Harvestable volume}_t)$$

Where:

$$\text{Harvestable volume}_t = \text{Harvestable volume}_{t-1} - \text{Harvested volume}_{t-1} +$$

$$\frac{\text{Planted Area}_{t-7} \times \text{MI}_{t-7} \times \text{Survival Factor}_{t-7}}{\text{Conversion Rate}_{t-7}}$$

The Planted Area was obtained directly from each plantation company and represents the area quoted by them as planted each year from the first year of operations up to 2003. The values after 2003 represent the maximum average value obtained from the period previously quoted and are restricted by the total area of land that it is feasible for each company to plant. The mean of increment (*MI*) was derived from the mean annual increment (*MAI*)¹⁰ of each plantation company for each of the planted species and landscape units (peat or dryland areas)—it changes over time according

¹⁰ For definition see Glossary.

to the information of each company. The Survival Factor was also obtained from each of the plantation companies for each planted species and each of the landscape units. The Conversion Rate is the calculated factor to convert 1 m³ of wood into 1 tonne of pulp—it changes depending on the type of raw material (planted or logged wood) and for each of the planted species. The term ‘*t-7*’ captures the rotation period of the planted species in analysis—for most of the cases it is seven years except for one case where the rotation period varies.

Inti Indo Rayon in North Sumatra

A total area of 284 060 ha was conceded in 1984, 1992 and 1994 to the plantation company Inti Indo Rayon in North Sumatra through HTI permits allowing clear cutting and settlement of industrial tree plantations.

The concession areas are distributed among five districts, with about 50% of the area concentrated in the district of Tapanuli Utara. The areas were covered by pines (30%), MHW

(68%) and nearly 6000 ha of grassland (2%).

The plantation company initiated operations in 1988 to supply the related pulp mill company Indorayon (now Toba Pulp Lestari). The mill’s demand was about 800 000 m³ of pulpwood per year until 1993, when it increased its demand through expansion to nearly 1 million m³.

Around 70% of the allocated area corresponds to cropland and settlements, and a conservation zone, leaving only about 86 000 ha feasible for logging and conversion.

The average area planted up to 2003 was near 5000 ha/year with a total area planted of about 53 000 ha.

The mill faced social difficulties in 1998 during the economic and political crisis, and it was closed down from 1999 until the beginning of 2003, when it resumed operations.

The economic benefit (EB) of the TPL concession project for the Indonesian society for a total period of 48 years (1988-2035) was calculated for each year (see Annex I.1) and then brought to the year-0 (1984) value (in US dollars):



Inti Indo Rayon *Eucalyptus* sp. plantation in North Sumatra (Photo by Julia Maturana)

$$EB_{(4\%)}^{TPL} = \text{US\$}511,588,592$$

$$EB_{(8\%)}^{TPL} = \text{US\$}241,626,464$$

$$EB_{(12\%)}^{TPL} = \text{US\$}138,027,774$$

The economic costs (EC) at the three discount rates are:

$$EC_{(4\%)}^{TPL} = \text{US\$}1,398,888,431$$

$$EC_{(8\%)}^{TPL} = \text{US\$}557,121,027$$

$$EC_{(12\%)}^{TPL} = \text{US\$}263,921,323$$

The estimated benefit-cost ratios for this project are 0.37, 0.43 and 0.52 for the three different discount rates (4%, 8% and 12%, respectively).

Arara Abadi in Riau

A total area of 299 975 ha was conceded in 1996 to the plantation company Arara Abadi (AA) in the province of Riau, though the Forestry Division of the related pulp and paper mill

Indah Kiat made the first plantations in 1984 with provisional permits from the GOI.

The concession areas are distributed among seven districts, with about 72% of the area allocated in the districts of Siak and Pelalawan. The areas were covered by MHW species with about 60% being swamp forests with an average wood production of > 150 m³/ha (AA personal communication).

The plantation company supplies the related pulp mill's demand, which has risen from near 540 000 m³ of pulpwood/year in 1984 to near 9 million m³/year in 2003.

From the total allocated area, some 28% comprises crops, settlements and a conservation zone, leaving about 216 000 ha feasible for logging and conversion.

The maximum average area planted up to 2003 was near 18 000 ha/year, with a total area planted of about 228 000 ha (including replanted areas).

The economic benefit of the AA concession project for the society for a total period of 55 years (1984-2038) at the year-0 (1984) value in US dollars, corresponds to (see also Annex I.2):



IIR trucks carrying logs in North Sumatra (Photo by Julia Maturana)

$$EB_{(4\%)}^{AA} = \text{US\$}1,935,837,869$$

$$EB_{(8\%)}^{AA} = \text{US\$}793,918,705$$

$$EB_{(12\%)}^{AA} = \text{US\$}398,513,520$$

The economic costs at the three discount rates are:

$$EC_{(4\%)}^{AA} = \text{US\$}3,169,867,526$$

$$EC_{(8\%)}^{AA} = \text{US\$}1,169,452,455$$

$$EC_{(12\%)}^{AA} = \text{US\$}533,947,366$$

The estimated benefit-cost ratios for this project are 0.61, 0.68 and 0.75, respectively.

Riau Andalan Pulp and Paper in Riau

A total area of 330 000 ha was allocated in concession to the plantation company associated with the Riau Andalan Pulp and Paper Group (RAPP) pulp and paper mill in Riau.

The allocated areas are distributed among five districts, with about 70% of the area concentrated in the districts of Pelalawan and Kuantan Singingi. The areas were covered by

MHW logged-over forests with about 70% of those in swamp areas.

The company initiated its plantations in 1993 and began supplying pulpwood to the related pulp and paper mill in 1995. The mill's yearly demand was about 3 million m³ of pulp wood in 1995 increasing to 9 million m³ in 2003.

A total area of about 251 000 ha could be converted into raw material for the mill, while nearly 79 000 ha (24% of the concession area) comprises crops, settlements and conservation area.

The maximum average area planted up to 2002 was near 14 000 ha/year, with a total area planted of about 110 000 ha.

The economic benefits of the RAPP concession project for the Indonesian society (in US dollars), for a total period of 44 years (1995-2038) calculated at the year 1984 value (Annex I.3) are:

$$EB_{(4\%)}^{RAPP} = \text{US\$} 1,336,119,511$$

$$EB_{(8\%)}^{RAPP} = \text{US\$} 556,385,589$$

$$EB_{(12\%)}^{RAPP} = \text{US\$} 269,709,028$$

The economic costs at the three discount rates are:



The MHW logged-over forests allocated for HTI development were still rich in forest products. Here some villagers are extracting logs for selling to the sawmills in Riau (Photo by Nicholas Hosgood)

$$EC_{(4\%)}^{RAPP} = \text{US\$}3,547,376,172$$

$$EC_{(8\%)}^{RAPP} = \text{US\$}1,222,022,515$$

$$EC_{(12\%)}^{RAPP} = \text{US\$}495,253,977$$

The estimated benefit-cost ratios for this project are 0.38, 0.46 and 0.54, respectively.

Wira Karya Sakti in Jambi

The plantation company Wira Karya Sakti in Jambi initiated its logging operations in 1989 through special permits for conversion of small areas until 1996 when a formal concession permit was obtained.

The final land allocation was 203 449 ha distributed among four districts, with over 60% of the total area concentrated in the district of Tanjung Jabung Barat. The areas were covered by MHW logged-over forests with about 70% of these being swamp forests.

Lontar Papyrus pulp and paper mill's initial demand was about 2 million m³ of pulpwood per year in 1994 and has increased to over 3 million m³ in 2003.

A total area of nearly 161 000 ha is available for conversion, while nearly 43 000 ha (21% of the concession area) comprises settlements and crops, and conservation areas.

The maximum average area planted from 1992 to 2003 was near 13 000 ha/year, with a total area planted of about 96 000 ha.

The economic benefits of the WKS concession project for the society for a total period of 45 years (1994-2038) calculated at the year 1984 value (in US\$), correspond to (Annex I.4):

$$EB_{(4\%)}^{WKS} = \text{US\$}1,106,100,135$$

$$EB_{(8\%)}^{WKS} = \text{US\$}426,455,511$$

$$EB_{(12\%)}^{WKS} = \text{US\$}196,769,551$$

The economic costs at the three discount rates are:

$$EC_{(4\%)}^{WKS} = \text{US\$}2,257,196,475$$

$$EC_{(8\%)}^{WKS} = \text{US\$}780,475,981$$

$$EC_{(12\%)}^{WKS} = \text{US\$}319,480,269$$



Mixed hard wood logs extracted from swamp forests in Jambi (Photo by Julia Maturana)

The estimated benefit-cost ratios for this project are 0.49, 0.55 and 0.62, respectively.

Musi Hutan Persada in South Sumatra

The plantation company Musi Hutan Persada, in South Sumatra, initiated its plantations in 1991 and obtained concession rights over a total area of 296 400 ha in 1996.

The areas are distributed over five districts, with over 50% of the area concentrated in the district of Muara Enim. The areas were covered by nearly 50% of highly degraded forests (*belukar*) and 50% grassland.

In 1999, the plantation company started to supply the associated Tanjung Enim Lestari pulp mill, which had a yearly requirement of near 2 million m³ of pulp wood. Mill requirements increased to reach 4.5 million m³ of pulp wood/year in 2003.

Nearly 32% of the concession comprises crops, settlements and conservation areas. From the remaining 68%, and taking in to consideration the area of grassland, some 100 000 ha are considered feasible for logging and conversion with a very low wood production rate of 20.3 m³/ha. (This production rate was calculated using the average standing volume increment for Indonesian forests quoted by Simangunsong (2003) and a period of 10 years.)

The average area planted is near 24 000 ha/year, with a total area planted of 193 500 ha from 1991 to 1998 (including replanted areas).

The economic benefits of the MHP concession project for the society (in US dollars), for a total period of 41 years (1998-2038) calculated at the year 1984 value correspond to (Annex I.5):

$$EB_{(4\%)}^{MHP} = \text{US\$1,789,920,969}$$

$$EB_{(8\%)}^{MHP} = \text{US\$594,828,448}$$

$$EB_{(12\%)}^{MHP} = \text{US\$232,016,988}$$

The economic costs at the three discount rates are:

$$EC_{(4\%)}^{MHP} = \text{US\$770,295,134}$$

$$EC_{(8\%)}^{MHP} = \text{US\$271,596,775}$$

$$EC_{(12\%)}^{MHP} = \text{US\$112,471,049}$$

The estimated benefit-cost ratios for this project correspond to 2.32, 2.19 and 2.06, respectively.

Aggregated Economic Benefits and Costs for the Country

The aggregated impacts for Indonesia for the allocation of over 1.4 million ha of State land to these five plantation companies for the production of pulpwood are negative (Table 1 and Fig. 6). The economic costs are much higher than the related economic benefits.

The economic benefits of these projects, related to the production of nearly 554 million m³ of wood, valued at 1984 prices with the three different discount rates (12%, 8% and 4% per year) represent from US\$1.2 billion to US\$6.7 billion. The economic costs associated with the conversion of nearly 815 000 ha of logged-over forests, pine and highly degraded forests, range from US\$1.7 billion to US\$11.1 billion.

Table 1. Economic costs and benefits (US\$ million) for each plantation company and aggregated (stable scenario)

Disc.	TPL		AA		RAPP		WKS		MHP		Aggregated			
	EB	EC	EB	EC	EB	EC	EB	EC	EB	EC	EB	EC	EB/EC	
12%	138	264	399	534	270	495	197	319	232	112	1,235.036	861	1,725.073	0.72
8%	242	557	794	1,169	556	1,222	426	780	595	272	2,613.214	717	4,000.668	0.65
4%	512	1,399	1,936	3,170	1,336	3,547	1,106	2,257	1,790	770	6,679.567	076	11,143.623	0.60

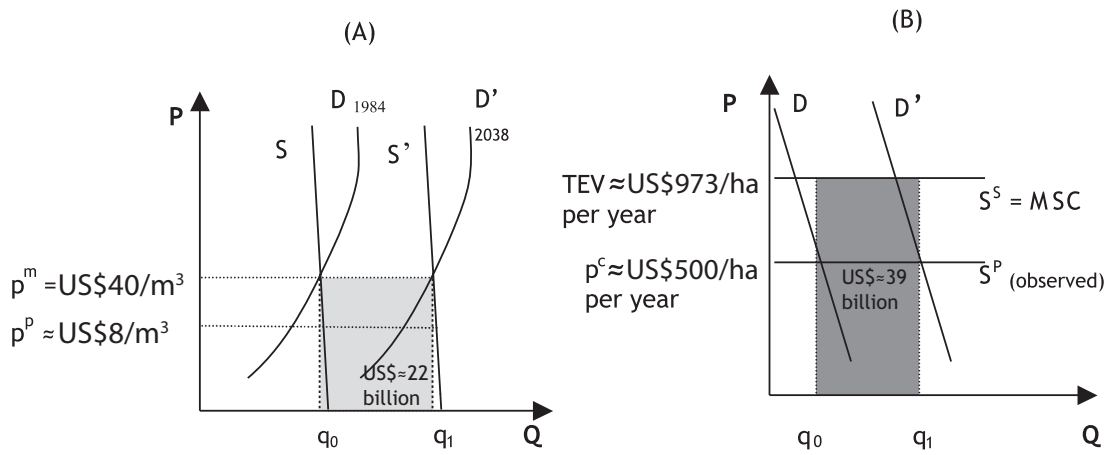


Figure 6. (A) Pulpwood market, and (B) State forest land (hypothetical) market

Key: see Figures 2, 3, 4 and 5.

Notes: Pulpwood $q_1 = q_0 + 554$ million m^3 .

State forest $q_1 = q_0 + 815$ 000 ha logged-over forest.



Natural forest area recently logged and planted with *Acacia* sp. in Sumatra (Photo by Julia Maturana)

DISCUSSION

Economic Benefits

The economic benefits were calculated using the volume of pulp wood (m³) produced per year for the length of each of the concession periods. This volume was calculated by adding the logged (from the available resources) and harvested (from the plantations) amounts of wood available each year, taking into consideration (for each specific area) the standing volume of logged-over forests, the percentage of forested area, the percentage of previously occupied area, the mean annual increment (MAI), tree mortality rates, conversion factors and mill requirements.

The price used to value the pulpwood corresponds to the market price for this product when sold on the open market. It was obtained from information of purchased pulpwood in Sumatra from external sources (not the integrated plantation companies). Rather than making assumptions on the behaviour of pulpwood prices in the future, a fixed price of US\$40/m³ was used to determine the economic benefits for each year and each plantation company. Depending on whether the real price each year is higher or lower than the price used here, it would increase or reduce the total economic benefits of these projects for the country. Maintaining a fixed price is over- or under-estimating the actual economic benefits, but this has no relevance for the purpose of comparing among the plantation companies.

Using the real market price, instead of the price actually paid by the pulp mills to the related plantation companies, captures the economic value of this product for Indonesian society and, therefore, it is the right price to use for the economic valuation of these resources. Using the 'paid' price would seriously underestimate the benefits of these projects for the country.

Discount rates of 4%, 8% and 12% were used to calculate the year-0 values of the total economic benefits of the projects. These rates cover a range of rates used in former studies (Shyamsundar and Kramer 1996; Kremen *et al.* 2000; Ferraro 2002; Beukering *et al.* 2003;

Simangungsong 2003) looking at the valuation of forest resources or areas in Indonesia and other low-income nations¹¹. Increments in the discount rate (from 4% to 8% and 12%) reduce the base-year value of the economic benefits calculated.

Decreases in the MAI of the tree plantations and tree survival factor (the percentage of planted trees that survive to harvest) were not considered for successive rotations; on the contrary, the MAI used (companies' information) increases with the time to reach a maximum expected MAI that remains constant until the end of the total period in consideration. Given the fact that it is very improbable that yields will not decline during successive rotation periods (SAM 2004), the economic benefits calculated here may well be at the higher limit or overestimated.

Additional benefits of these projects related to the protection of conservation areas within their concessions are not accounted here. None of the five plantation companies acknowledged having taken any action to protect the conservation areas from illegal logging or other objective incursions; furthermore, some of these plantation companies are accused by NGOs and other observers of encouraging illegal logging in these areas for their own benefit.

The possible benefits of planting trees are not accounted either. Most of the companies' areas for developing tree plantations are converted from natural forests, resulting in associated economic benefits below the economic costs of deforestation. On the other hand, the conversion of grasslands into tree plantations is not necessarily economically beneficial; grassland areas act as carbon sinks and are also important for soil conservation—both functions lost and damaged during the process of plantation (WRM 2000, 2003; Cossalter and Pye-Smith 2003). The rotation period of the tree plantations under consideration is also too short (7-8 years) to allow the capture of any of the benefits related to tree establishment: no fuel wood or NTFPs are available from these plantations; the soil and water might be more

¹¹ Discount rates used in the cited studies were: 3%, 5%, 6%, 7%, 8%, 10%, 15% and 20%.

damaged by the heavy machinery, fertilizers and pesticides, and drying techniques (for the swamp areas) than conserved; carbon is released with the first conversion and with subsequent conversions of the areas, resulting not only in a reduction in the ability of the ecosystem to fix carbon dioxide, but also in its absorption capacity (WRM 2000); and no option or existence values are attained.

Economic Costs

The economic costs were calculated using the total economic value (TEV) of Indonesian logged-over forests and the total area logged, by each company, each year. The TEVs were estimated by Simangunsong (2003) taking in to consideration the values related to timber, fuelwood and NTFPs; water consumption; soil and water conservation, carbon sink, flood protection and water transportation functions; option value, and existence value. All these values were considered to remain present as a characteristic of the logged-over forests given in concession and to be lost with the concession, logging and conversion of such areas.

The number of functions included in the estimations of the TEV is well below the total number of functions that these forests serve or provide. There are at least 23 different functions that these forested areas retain (Petrick and Quinn 1994; Groot *et al.* 2002; Rose and Chapman 2003) of which only a few are included in the TEV estimated by Simangunsong (2003). Additionally, the TEV calculated for the functions included is very conservative compared to estimated TEVs for other areas. The TEV estimated by Simangunsong (2003) for the Indonesian primary forests, which is used as a reference to derive the TEV for the logged-over forests, is below several TEVs calculated for similar functions in other areas (see, for example, Aylward *et al.* 1995; Norton-Griffiths and Southey 1995; Reyes *et al.* 2002; Pearce *et al.* 2003; Beukering *et al.* 2003).

The above suggests that the economic costs calculated for the five plantation companies in this analysis are low; using other TEVs as reference would lead to higher calculated economic costs of these projects.

On the other hand, the economic costs are calculated using only the area (number of hectares) logged by the plantation companies,



Natural forests given in concession for the development of HTI plantations in Sumatra (Photo by Julia Maturana)

excluding those areas considered to be grasslands, croplands and settlements, as well as the areas that should remain (by law) as conservation forests. Such reductions lead to the valuation of about half of the total area of State land given in concession to these projects. The inclusion of the grassland areas and their valuation with a positive price would result in higher economic costs of these projects, mainly for MHP in South Sumatra. Values of grassland areas are related to their carbon-sink functions and agricultural uses, among others (WRM 2003).

Labour and the allocated financial amounts are also important inputs (costs) that were required for developing these plantation projects. The labour required by these projects is only accounted as an economic cost if it is considered to be a 'scarce' resource in the country. As labour is abundant in Indonesia and it is not being displaced from other productive activities, it does not represent a cost for the society. It is not accounted as an economic benefit either. These projects are not 'generating' labour, but generating jobs and so the people are only shifting from their former economic activities (not necessarily as employees). It is only a flux in the economy and, therefore, not accounted as an economic benefit. The financial amounts required to set up these projects also represent a flux in the economy and it are not accounted per se; they are, however, accounted indirectly in the evaluation of the economic impacts of these projects.

Comparing the Five Plantation Projects

The benefit-cost ratios of all the projects, with the exception of MHP, are closer to unity for the higher discount-rates used. Higher discount-rates imply a higher valuation of the benefits perceived in the present and lower valuation of the benefits in the future. The behaviour of the benefit-cost ratios is explained by the benefits tending to decrease over time, while the costs tend to increase. However, when both increase, costs increase relatively more than the benefits. All the companies in this analysis, with the exception of MHP, are performing badly in economic terms—TPL being the company with the worst performance.

The TPL plantation company is causing high economic loss to Indonesian society, with economic costs being almost three times the

obtained economic benefits for the lowest discount rate (4%). The economic costs of this project are about half or even one-third of the costs of the other projects (with the exception of MHP), but unlike the other companies, TPL brings very little economic benefit to the country, showing the lowest benefits of the five plantation companies in this analysis. The reason for this very low economic benefit is explained by the size of the area planted: this company is generating costs from logging and using over 80 000 ha of land, while producing benefits from an average area planted of less than half of that. This is having a direct effect on the benefits related to the production. As mentioned earlier in this document, the area planted each year (for 2004 onwards) used in the analysis was calculated as the maximum average of area actually planted up to 2003. These estimations were made using actual data for each company and it assumes that the company will perform (in the near future) similarly to how it has performed until 2003.

RAPP, WKS and AA follow (in that order) after TPL, with economic costs being 2.65, 2.04 and 1.64 times their economic benefits (Table 1). The differences are mainly due to the size of the area logged, compared to the size of the area planted.

The only company appearing to have positive economic returns for the country is MHP, with economic benefits being double their economic costs. This company shows the second largest economic benefits, generating over US\$1.7 billion for the country (with the lowest discount rate) and the lowest economic costs (half or one-third of those of the other companies). The main reason for these low economic costs is the difference in the kind of natural coverage of the areas allocated in concession to this company. While the other companies obtained concessions over areas largely covered with logged-over forests, swamp forests and pines, the MHP area was half grassland and half highly degraded forests. Given the nature of the TEV used to value the areas in this analysis, the conversion of grasslands has no attached economic cost, and the 'highly degraded forests' of South Sumatra are valued at about half of what the logged-over forests and pine areas of the other companies are. The value attached to timber as a product to be obtained from these areas was not considered, neither were the option or existence values; the carbon-sink value was reduced by half. However, this company is performing the best

in terms of planted area, which has an effect on the volume of pulpwood produced and, hence, on the economic benefits.

Data and Assumptions

The area planted each year corresponds to actual data until 2003 and it was obtained from each of the plantation companies. From 2004 onwards, the maximum average for the former period was used. Other factors, such as the mean annual increment (MAI), survival rate and conversion rate were also obtained from each plantation company. The production capacity corresponds to the actual installed capacity of the related mills each year until 2003, remaining stable from that year onwards, except for WKS, for which an increase of 50 000 tones of pulp from 2007 onwards is accounted. This is based on Lontar Papyrus's (the mill associated with WKS) own plans for increases in their installed capacity. All the mills are accounted as running at 98% of their installed capacity.

The area feasible for logging was calculated excluding the area acknowledged to be kept for conservation, settlements and crops. This information was also obtained from each of the plantation companies. The mean wood production (MWP) of the logged-over forests in Riau and Jambi was estimated at 75 m³/ha for the drylands and 150 m³/ha for the swamp areas; for the areas of North Sumatra, an MWP of 91.5 m³/ha for the MHW and 200 m³/ha for the pine forests was used; the areas in South Sumatra were estimated to produce 20 m³/ha on average. These numbers are based on the companies' statements of their actual MWP and taking into consideration the standing stock of logged-over areas in Indonesia (Simangunsong 2003).

Changing the assumption that plantation companies match mill requirements with natural wood to a case where the companies use natural wood only if they do not have

planted wood available does not significantly change the results. The benefit-cost ratios of RAPP and WKS remain unaltered and those for IIR and AA improve but remain less than 1. At the aggregated scenario, the benefit-cost ratios change from 0.60 to 0.61, from 0.65 to 0.67 and from 0.72 to 0.74 for discount rates of 4%; 8% and 12%, respectively (Table 2).

Scenarios

The optimistic scenario represents the best case for the companies in terms of total area planted, and a sustained increase of 1% in the pulpwood price each year. In this case, the area planted by each company reaches the maximum 'feasible to plant' around the year 2010, after sustained increases of 10% each year. The feasible to plant area corresponds to the dryland and swamp areas, excluding only the areas allocated for conservation, settlements, crops and infrastructure¹². This implies that the companies would have resolved all the claims (conflict issues) in their areas—which affected over 95 000 ha in 2003 (APRIL 2004; Maturana *et al.* in press)—, and planted those areas with pulp-purpose trees. It also implies something that is seriously in doubt presently, namely that the companies are able and willing to grow trees over 100% of their swamp areas, which has proven difficult, costly and extremely prone to fires. Although under this scenario, the economic benefits increase, the country will still be losing in economic terms (Table 3). This implies that even in the best case, with all the plantation companies planting the maximum area feasible, these projects would generate a net economic loss for the country.

This scenario also demonstrates that two companies, AA and RAPP, are not capable of sustaining their own mill requirements with planted wood alone, but only 57% and 45%, respectively. Although the remaining need could be fed with planted wood from 'outside'

Table 2. Economic costs and benefits (US\$ million) for each company and aggregated, assuming that the company will harvest planted wood whenever available (stable scenario)

Disc.	TPL		AA		RAPP		WKS		MHP		Aggregated				
	EB	EC	EB	EC	EB	EC	EB	EC	EB	EC	EB	EC	EB/EC		
12%	134	226	398	507	270	495	197	319	232	109	1,230.870	429	1,656.083	301	0.74
8%	232	494	794	1,118	556	1,221	426	779	595	264	2,603.254	097	3,876.354	112	0.67
4%	486	1,305	1,936	3,071	1,336	3,546	1,106	2,254	1,790	748	6,653.918	102	10,923.962	008	0.61

¹² Except for RAPP, for which their quoted figure of 167 610 ha was used (APRIL 2004).

their concession areas (as their own statements mention), converting areas outside their concessions also has an associated economic cost, resulting in higher economic costs for the country.

The pessimistic scenario calculates the economic benefits and costs of these projects

for constant reductions in the pulpwood price (from US\$40/m³ to US\$26/m³) and yearly reductions of 1% in the planted area, using as a basis the maximum average area planted for each company. In this scenario, the benefits are reduced (Table 3).

Table 3. Economic costs and benefits (US\$ million) for each plantation company and aggregated for the three scenarios in consideration

Scenario	Disc.	TPL		AA		RAPP		WKS		MHP		Aggregated				
		EB	EC	EB	EC	EB	EC	EB	EC	EB	EC	EB	EC	EB/EC		
Stable	12%	138	264	399	534	270	495	197	319	232	112	1,235.036	861	1,725.073	984	0.72
	8%	242	557	794	1,169	556	1,222	426	780	595	272	2,613.214	717	4,000.668	752	0.65
	4%	512	1,399	1,936	3,170	1,336	3,547	1,106	2,257	1,790	770	6,679.567	076	11,143.623	738	0.60
Optimistic	12%	142	264	429	534	294	495	217	319	245	112	1,326.588	068	1,725.073	984	0.77
	8%	257	557	911	1,169	657	1,222	504	780	642	272	2,971.307	534	4,000.668	752	0.74
	4%	576	1,399	2,458	3,170	1,801	3,547	1,451	2,257	1,997	770	8,283.775	346	11,143.623	738	0.74
Pessimistic	12%	135	264	385	534	262	495	189	319	219	112	1,190.583	662	1,725.073	984	0.69
	8%	230	557	743	1,169	525	1,222	395	780	548	272	2,440.170	123	4,000.668	752	0.61
	4%	462	1,399	1,701	3,170	1,189	3,547	959	2,257	1,582	770	5,893.782	108	11,143.623	738	0.53

CONCLUSIONS

This study used specific information and data related to each of the plantation companies in the analysis and the areas in concession to demonstrate that the allocation of the 1.4 million ha of forest land, for the development of industrial tree plantations in Indonesia, represents an economic loss for the country. The economic benefits generated by the increases in the production of pulpwood, calculated using an efficiency price of US\$40/m³ of wood, are well below the economic costs incurred in the conversion of this land.

Measuring only the 'observable' financial benefits can lead to wrong perceptions and decisions. The allocation of logged-over forest lands for the development of industrial tree plantations may appear to be very beneficial¹³ for the country, if financial benefits and costs alone are accounted. While the allocated forest land was perceived to be producing no direct 'observable' benefits for the Government, these projects would create direct benefits, including the payments for concession and conversion, the capture of foreign investment in the development of the related pulp industry, and increases in the production and exports of pulp and paper. In fact, however, and when economic costs and benefits are calculated, we can see that these projects are generating costs that are 1.67 times over the generated benefits.

Four of the five plantation projects analysed generate economic costs above their economic benefits. Of those, AA has the highest benefit-cost ratio (0.61), followed by WKS (0.49) and RAPP (0.38); TPL has the lowest (0.37). MHP in South Sumatra is the only company (in this study) with a positive benefit-cost ratio (2.32).

The Government of Indonesia is 'selling' its forest resources to the plantation companies for a price below its value. The current payments for the use and conversion of logged-over areas (PSDH, SPK and DR) are far from representing the actual economic costs of using such resources. The estimated economic costs represent over 30 times the actual financial payments that the Indonesian Government receives from each company (current economic costs in Annexes I.1-I.5). The plantation

company IIR should pay over US\$92 million per year on average, instead of the approximately US\$2 million corresponding to the actual financial costs that this company is asked to pay. AA and RAPP should pay near US\$200 million and US\$290 million per year compared to the approximately US\$6 million and US\$8 million dollars (on average) they are asked to pay; WKS should pay nearly US\$180 million per year and not the near US\$6 million dollars it does pay; and MHP should pay nearly US\$67 million per year and not the US\$2 million dollars it actually spends.

The only plantation company producing benefits large enough to cover its incurred costs is MHP in South Sumatra. This company would be able to pay for the economic costs and still produce over US\$98 million per year in net economic benefits. The allocation of the nearly 300 000 ha of highly degraded forests and grasslands for conversion to industrial tree plantations in South Sumatra is the only one of the five plantation projects studied that is beneficial for the country. The allocation of the other over 1 million ha for the same purpose is detrimental to the country.

Allocating the logged-over areas of Riau, Jambi and North Sumatra for conversion into tree plantations was a mistake, and the people of Indonesia will lose over US\$3 billion (for a 4% discount rate) from 1984 to 2038. Because the economic costs are higher than the related economic benefits, the plantation companies in economic deficit cannot afford to pay for their actual costs. The best present option for the country is to allow these companies to operate, avoiding higher net economic costs (because the economic costs would remain the same while the benefits would become zero).

Despite the fact that there is not much that can be done to achieve a positive economic performance for these companies with concessions already granted, this assessment becomes critical when considering future policies and decisions related to the allocation of new areas for HTI development. This analysis clearly demonstrates that the Government of Indonesia should not allocate any more logged-over land for conversion into HTI plantations,

¹³ For an analysis of the financial aspects of these projects and the related mills see Barr (2001).

if it wants to benefit the country and its people.

This research can provide evidence for interested parties, NGOs and civil society to help avoid further sales of resources at prices below costs. It can help the Indonesian people to ensure that their Government takes the right decisions when investing their assets (money,

natural resources, environmental quality, etc.) and that new policy related to natural resources results in positive economic returns for the country. The development of HTI plantations on logged-over forests should either pay the related economic costs for the country or not be allowed to happen.

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Annex I: Detailed time-series data for the estimation of economic costs and benefits

1.1. Inti Indo Rayon

Plantation Company: Inti Indo Rayon

Related Mill Company: Toba Pulp Lestari/Indorayon

Kabupatens: SIMALUNGUN

(Districts) TAPUT

TOBASA

TAPSEL

DAIRI

Planted species		Natural coverage	
Species 1	<i>Eucalyptus</i> sp.	Species 1	MTHW
Species 2		Species 2	Pines
Species 3		Species 3	

EB (1984)12% = US\$138,027,774

EB (1984)8% = US\$241,626,464

EB (1984)4% = US\$511,588,592

EEC (1984)12% = US\$263,921,323

EEC (1984)8% = US\$557,121,027

EEC (1984)4% = US\$1,398,888,431

BCR

0.52

0.43

0.37

Current EC

Total = US\$93,727,296

Current EC

Total = US\$4,442,146,638

EB total = US\$1,441,227,324

DF	DEMAND FITNESS			VOLUME OF PRODUCTION			HARVESTABLE VOLUME					MILL REQUIREMENT			ANF (tonnes of pulp)	AVAILABLE NATURAL FOREST VOLUME								ECONOMIC BENEFITS			ECONOMIC COSTS										
	Year	Vol. Produced (tonnes of pulp)	Mill requirement (tonnes of pulp)	Harv. Vol. (tonnes pulp)	Logged Vol. (tonnes of pulp)	Other Sources (tonnes of pulp)	Harvestable (tonnes of pulp, cumm.)	Species 1: <i>Eucalyptus</i> sp.				Prod. Cap. (tonnes of pulp)	Quota (%)	Running (%)		Restricted	Species 1: MTHW				Species 2: Pines				EB (US\$)	Price (US\$/m ³)	Vol. of Prod. (m ³ of wood)	Current EC (US\$)	Species 1: <i>Eucalyptus</i> sp.		Species 1: MTHW		Species 2: Pines		EEC (US\$)	Area Logged (ha)	TEV (US\$/ha)
								Planted area (ha)	MI (m ² /ha)	Survival F. (%)	Conv. Rate (m ² wood/t pulp)						Concession Area (ha)	Feasible (%)	Mean Wood Prod. (m ³ /ha)	Conv. Rate (m ² /t pulp)	Con. Area (ha)	Feasible (%)	Mean Wood Prod. (m ³ /ha)	Conv. Rate (m ² /t pulp)					Cost Harvest (US\$/m ²)	Total Harvest (m ²)	Cost Log. (US\$/m ²)	Total Log. (m ²)	Cost Log. (US\$/m ²)	Total Log. (m ²)			
0.00	1984	0	0	0	0	0	0	126	0.85	4	0	0	0	1,247,000			91.5	4.5	86,000	0.29	200	4	\$0	40	0	\$0	\$0.46	0.00	\$11.22	0.00	\$3.56	0.00	\$0	0	\$1,283		
0.00	1985	0	0	0	0	0	0	126	0.85	4	0	0	0	1,247,000			91.5	4.5	86,000	0.29	200	4	\$0	40	0	\$0	\$0.46	0.00	\$11.22	0.00	\$3.56	0.00	\$0	0	\$1,283		
0.00	1986	0	0	0	0	0	0	126	0.85	4	0	0	0	1,247,000			91.5	4.5	86,000	0.29	200	4	\$0	40	0	\$0	\$0.46	0.00	\$11.22	0.00	\$3.56	0.00	\$0	0	\$1,283		
0.00	1987	0	0	0	0	0	182	126	0.85	4	0	0	0	1,247,000			91.5	4.5	86,000	0.29	200	4	\$0	40	0	\$0	\$0.46	0.00	\$11.22	0.00	\$3.56	0.00	\$0	0	\$1,283		
1.00	1988	21,600	21,600	0	21,600	0	2,941	126	0.85	4	180,000	1	0.12	1,225,400			91.5	4.5	86,000	0.29	200	4	\$3,456,000	40	86,400	\$307,469	\$0.46	0.00	\$11.22	0.00	\$3.56	86,400.00	\$554,256	432	\$1,283		
1.00	1989	176,400	176,400	0	176,400	0	6,089	126	0.85	4	180,000	1	0.98	1,049,000			91.5	4.5	86,000	0.29	200	4	\$28,224,000	40	705,600	\$2,510,995	\$0.46	0.00	\$11.22	0.00	\$3.56	705,600.00	\$5,080,680	3,528	\$1,283		
1.00	1990	176,400	176,400	0	176,400	0	6,246	126	0.85	4	180,000	1	0.98	872,600			91.5	4.5	86,000	0.29	200	4	\$28,224,000	40	705,600	\$2,510,995	\$0.46	0.00	\$11.22	0.00	\$3.56	705,600.00	\$9,607,104	3,528	\$1,283		
1.00	1991	176,400	176,400	0	176,400	0	0.00	4,832	126	0.85	180,000	1	0.98	696,200			91.5	4.5	86,000	0.29	200	4	\$28,224,000	40	705,600	\$2,510,995	\$0.46	0.00	\$11.22	0.00	\$3.56	705,600.00	\$14,133,528	3,528	\$1,283		
1.00	1992	176,400	176,400	0	176,400	0	0.00	3,002	126	0.85	180,000	1	0.98	1,652,314	192,060	0.29	91.5	4.5	86,000	0.29	200	4	\$9,988,000	40	749,700	\$6,967,919	\$0.46	0.00	\$11.22	553,474.67	\$3.56	213,622.52	\$23,264,660	7,117	\$1,283		
1.00	1993	235,200	235,200	0	235,200	0	0.00	3,123	126	0.85	240,000	1	0.98	1,417,114	192,060	0.29	91.5	4.5	86,000	0.29	200	4	\$9,984,000	40	999,600	\$9,290,559	\$0.46	0.00	\$11.22	737,966.22	\$3.56	284,830.02	\$35,439,502	9,489	\$1,283		
1.00	1994	235,200	235,200	0	235,200	0	4,873.05	4,696	126	0.85	240,000	1	0.98	1,217,294	6,000	0.29	91.5	4.5	86,000	0.29	200	4	\$9,984,000	40	999,600	\$9,290,559	\$0.46	0.00	\$11.22	737,966.22	\$3.56	284,830.02	\$47,614,344	9,489	\$1,283		
1.00	1995	235,200	235,200	0	235,200	0	83,618.33	5,117	126	0.85	240,000	1	0.98	982,094	6,000	0.29	91.5	4.5	86,000	0.29	200	4	\$9,984,000	40	999,600	\$9,290,559	\$0.46	0.00	\$11.22	737,966.22	\$3.56	284,830.02	\$59,789,186	9,489	\$1,283		
1.00	1996	235,200	235,200	0	235,200	0	246,659.33	5,008	126	0.85	240,000	1	0.98	746,894	6,000	0.29	91.5	4.5	86,000	0.29	200	4	\$9,984,000	40	999,600	\$9,290,559	\$0.46	0.00	\$11.22	737,966.22	\$3.56	284,830.02	\$71,964,028	9,489	\$1,283		
1.00	1997	235,200	235,200	0	235,200	0	413,895.98	5,389	126	0.85	240,000	1	0.98	511,694	6,000	0.29	91.5	4.5	86,000	0.29	200	4	\$9,984,000	40	999,600	\$9,290,559	\$0.46	0.00	\$11.22	737,966.22	\$3.56	284,830.02	\$84,138,870	9,489	\$1,283		
1.00	1998	84,000	84,000	0	84,000	0	543,272.78	4,686	126	0.85	240,000	1	0.35	427,694	6,000	0.29	91.5	4.5	86,000	0.29	200	4	\$14,280,000	40	357,000	\$3,318,057	\$0.46	0.00	\$11.22	263,559.37	\$3.56	101,725.01	\$88,487,028	3,389	\$1,283		
0.00	1999	0	0	0	0	0	623,651.33	724	126	0.85	240,000	1	0	427,694	6,000	0.29	91.5	4.5	86,000	0.29	200	4	\$0	40	0	\$0	\$0.46	0.00	\$11.22	0.00	\$3.56	0.00	\$88,487,028	0	\$1,283		
0.00	2000	0	0	0	0	0	707,269.66	0	126	0.85	240,000	1	0	427,694	6,000	0.29	91.5	4.5	86,000	0.29	200	4	\$0	40	0	\$0	\$0.46	0.00	\$11.22	0.00	\$3.56	0.00	\$88,487,028	0	\$1,283		
0.00	2001	0	0	0	0	0	833,005.06	355	126	0.85	240,000	1	0	427,694	6,000	0.29	91.5	4.5	86,000	0.29	200	4	\$0	40	0	\$0	\$0.46	0.00	\$11.22	0.00	\$3.56	0.00	\$88,487,028	0	\$1,283		
0.00	2002	0	0	0	0	0	970,012.73	603	126	0.85	240,000	1	0	427,694	6,000	0.29	91.5	4.5	86,000	0.29	200	4	\$0	40	0	\$0	\$0.46	0.00	\$11.22	0.00	\$3.56	0.00	\$88,487,028	0	\$1,283		
1.00	2003	153,600	153,600	0	153,600	0	1,104,096.58	500	168	0.85	240,000	1	0.64	274,094	6,000	0.29	91.5	4.5	86,000	0.29	200	4	\$26,112,000	40	652,800	\$6,067,304	\$0.46	0.00	\$11.22	481,937.13	\$3.56	186,011.44	\$96,437,946	6,197	\$1,283		
1.00	2004	235,200	235,200	0	235,200	0	1,248,387.05	3,000	168	0.85	240,000	1	0.98	38,894	6,000	0.29	91.5	4.5	86,000	0.29	200	4	\$9,984,000	40	999,600	\$9,290,559	\$0.46	0.00	\$11.22	737,966.22	\$3.56	284,830.02	\$108,612,788	9,489	\$1,283		
1.00	2005	235,200	235,200	196,306	38,894	0	1,373,860.06	5,000	168	0.85	240,000	1	0.98	0	6,000	0.29	91.5	4.5	0	0.29	200	4	\$38,409,876	40	960,247	\$2,321,663	\$0.46	785,224.80	\$11.22	175,022.10	\$3.56	0.00	\$11,066,923	1,913	\$1,283		
1.00	2006	235,200	235,200	235,200	0	0	1,196,930.93	5,000	168	0.85	240,000	1	0.98	0	6,000	0.29	91.5	4.5	0	0.29	200	4	\$37,632,000	40	940,800	\$429,691	\$0.46	940,800.00	\$11.22	0.00	\$3.56	0.00	\$11,066,923	0	\$1,283		
1.00	2007	235,200	235,200	235,200	0	0	961,730.93	5,000	168	0.85	240,000	1	0.98	0	6,000	0.29	91.5	4.5	0	0.29	200	4	\$37,632,000	40	940,800	\$429,691	\$0.46	940,800.00	\$11.22	0.00	\$3.56	0.00	\$11,066,923	0	\$1,283		
1.00	2008	235,200	235,200	235,200	0	0	736,033.37	5,000	168	0.85	240,000	1	0.98	0	6,000	0.29	91.5	4.5	0	0.29	200	4	\$37,632,000	40	940,800	\$429,691	\$0.46	940,800.00	\$11.22	0.00	\$3.56	0.00	\$11,066,923	0	\$1,283		
1.00	2009	235,200	235,200	235,200	0	0	516,984.05	5,000	168	0.85	240,000	1	0.98	0	6,000	0.29	91.5	4.5	0	0.29	200	4	\$37,632,000	40	940,800	\$429,691	\$0.46	940,800.00	\$11.22	0.00	\$3.56	0.00	\$11,066,923	0	\$1,283		
1.00	2010	235,200	235,200	235,200	0	0	299,634.05	5,000	200	0.85	240,000	1	0.98	0	6,000	0.29	91.5	4.5	0	0.29	200	4	\$37,632,000	40	940,800	\$429,691	\$0.46	940,800.00	\$11.22	0.00							

I.2. Arara Abadi

Related Mill Company: Indah Kiat
 Kabupaten: KAMPAR
 (Districts) PELALAWAN
 SIAK
 BENGKALIS
 ROKAN HILIR
 DUMAI
 PEKANBARU

Plantation Company: Arara Abadi

Planted species		Natural coverage	
Species 1	Acacia sp.	Species 1	MTHW
Species 2		Species 2	
Species 3		Species 3	

EB (1984)12% = US\$398,513,520
 EB (1984)8% = US\$793,918,705
 EB (1984)4% = US\$1,935,837,869

EC (1984)12% = US\$533,947,366 0.75
 EC (1984)8% = US\$1,169,452,455 0.68
 EC (1984)4% = US\$3,169,867,526 0.61

EB total = US\$6,187,130,263

Current EC
 EC total = US\$358,214,408

Estimated EC
 EC total = US\$11,164,245,409

DF	DEMAND FITNESS			VOLUME OF PRODUCTION			HARVESTED VOLUME					MILL REQUIREMENT			ANF Restricted (tonnes of pulp)	AVAILABLE NATURAL FOREST VOLUME				ECONOMIC BENEFITS			ECONOMIC COSTS						
	Year	Volume Prod. (tonnes of pulp)	Mill requirement (tonnes of pulp)	Harv. Vol. (tonnes pulp)	Logged Vol. (tonnes of pulp)	Other Sources (tonnes of pulp)	Species 1: Acacia sp.				Prod. Cap. (t pulp)	Quota (%)	Running (%)	Species 1: MTHW				(US\$)	Price (US\$/m ²)	Vol. of Prod. (m ² of wood)	Species 1: Acacia sp.			Species 1: MTHW					
							Harvestable (tonnes of pulp, cumm.)	Planted area (ha)	MI (m ³ /ha)	Survival F. (%)				Conv. Rate (m ³ wood/t pulp)		Concession Area (ha)	Feasible (%)				Mean Wood Prod. (m ³ /Ha)	Conv. Rate (m ³ /t pulp)	Current EC (US\$)	Cost Harv. (US\$/m ²)	Total Harvest (m ²)	Cost Log. (US\$/m ²)	Total Log. (m ²)	Estimated EC (US\$)	Area Logged (ha)
1.00	1984	117,600	117,600	0	117,600	0	415	131.6	0.73	4.40	120,000	1	0.98	674,400	40,000	0.72	123.75	4.50	\$21,168,000.00	40	529,200	\$5,935,446	\$0.46	0.00	\$11.22	529,200.00	\$5,486,575	4,276	\$1,283
1.00	1985	117,600	117,600	0	117,600	0	351	131.6	0.73	4.40	120,000	1	0.98	556,800	40,000	0.72	123.75	4.50	\$21,168,000.00	40	529,200	\$5,935,446	\$0.46	0.00	\$11.22	529,200.00	\$10,973,149	4,276	\$1,283
1.00	1986	117,600	117,600	0	117,600	0	1,350	145.6	0.73	4.40	120,000	1	0.98	439,200	40,000	0.72	123.75	4.50	\$21,168,000.00	40	529,200	\$5,935,446	\$0.46	0.00	\$11.22	529,200.00	\$16,459,724	4,276	\$1,283
1.00	1987	117,600	117,600	0	117,600	0	1,848	145.6	0.73	4.40	120,000	1	0.98	321,600	40,000	0.72	123.75	4.50	\$21,168,000.00	40	529,200	\$5,935,446	\$0.46	0.00	\$11.22	529,200.00	\$21,946,298	4,276	\$1,283
1.00	1988	117,600	117,600	0	117,600	0	2,125	166.6	0.73	4.40	120,000	1	0.98	204,000	40,000	0.72	123.75	4.50	\$21,168,000.00	40	529,200	\$5,935,446	\$0.46	0.00	\$11.22	529,200.00	\$27,432,873	4,276	\$1,283
1.00	1989	117,600	117,600	0	117,600	0	7,847	166.6	0.73	4.40	120,000	1	0.98	86,400	40,000	0.72	123.75	4.50	\$21,168,000.00	40	529,200	\$5,935,446	\$0.46	0.00	\$11.22	529,200.00	\$32,919,447	4,276	\$1,283
0.73	1990	86,400	117,600	0	86,400	0	15,622	180.6	0.73	4.40	120,000	1	0.98	0	40,000	0.72	123.75	4.50	\$15,552,000.00	40	388,800	\$4,360,736	\$0.46	0.00	\$11.22	388,800.00	\$36,950,400	3,142	\$1,283
0.08	1991	9,086	117,600	0	9,086	0	9,086.78	11,099	187.6	0.73	120,000	1	0.98	\$1,599,097.92	40	0.72	123.75	4.50	\$18,259	\$0.46	39,977.45	\$11.22	0.00	\$36,950,400	0	\$1,283			
0.07	1992	7,685	117,600	0	7,685	0	7,684.60	9,134	187.6	0.73	120,000	1	0.98	0	40,000	0.72	123.75	4.50	\$1,352,490.05	40	33,812	\$15,443	\$0.46	33,812.25	\$11.22	0.00	\$36,950,400	0	\$1,283
0.28	1993	32,700	117,600	0	32,700	0	32,700.44	8,962	187.6	0.73	120,000	1	0.98	0	40,000	0.72	123.75	4.50	\$5,755,276.80	40	143,882	\$65,715	\$0.46	143,881.92	\$11.22	0.00	\$36,950,400	0	\$1,283
0.12	1994	44,756	372,400	0	44,756	0	44,756.00	11,662	187.6	0.73	380,000	1	0.98	0	40,000	0.72	123.75	4.50	\$7,877,055.51	40	196,926	\$89,942	\$0.46	196,926.39	\$11.22	0.00	\$36,950,400	0	\$1,283
0.16	1995	58,897	372,400	0	58,897	0	58,896.89	13,484	187.6	0.73	380,000	1	0.98	0	40,000	0.72	123.75	4.50	\$10,365,852.00	40	259,146	\$118,360	\$0.46	259,146.30	\$11.22	0.00	\$36,950,400	0	\$1,283
0.54	1996	217,495	401,800	0	217,495	0	217,495.25	15,328	201.6	0.73	410,000	1	0.98	0	40,000	0.72	123.75	4.50	\$38,279,164.61	40	956,979	\$437,081	\$0.46	956,979.12	\$11.22	0.00	\$36,950,400	0	\$1,283
0.75	1997	469,353	622,300	0	469,353	0	469,352.53	19,184	201.6	0.73	635,000	1	0.98	5,147,505	259,975	0.72	123.75	4.50	\$82,606,044.99	40	2,065,151	\$943,216	\$0.46	2,065,151.12	\$11.22	0.00	\$36,950,400	0	\$1,283
1.00	1998	622,300	622,300	0	622,300	0	346,388.72	12,959	201.6	0.73	635,000	1	0.98	4,525,205	259,975	0.72	123.75	4.50	\$112,014,000.00	40	2,800,350	\$31,408,404	\$0.46	0.00	\$11.22	2,800,350.00	\$65,983,524	22,629	\$1,283
1.00	1999	622,300	622,300	0	622,300	0	631,466.38	19,087	201.6	0.73	635,000	1	0.98	3,902,905	259,975	0.72	123.75	4.50	\$112,014,000.00	40	2,800,350	\$31,408,404	\$0.46	0.00	\$11.22	2,800,350.00	\$95,016,647	22,629	\$1,283
1.00	2000	622,300	622,300	0	622,300	0	911,156.60	14,697	201.6	0.73	635,000	1	0.98	3,280,605	259,975	0.72	123.75	4.50	\$112,014,000.00	40	2,800,350	\$31,408,404	\$0.46	0.00	\$11.22	2,800,350.00	\$124,049,771	22,629	\$1,283
1.00	2001	1,960,000	1,960,000	0	1,960,000	0	1,275,118.94	22,836	201.6	0.73	2,000,000	1	0.98	1,320,605	259,975	0.72	123.75	4.50	\$352,800,000.00	40	8,820,000	\$98,924,108	\$0.46	0.00	\$11.22	8,820,000.00	\$215,492,680	71,273	\$1,283
1.00	2002	1,960,000	1,960,000	0	1,960,000	0	1,695,964.62	21,591	215.6	0.73	2,000,000	1	0.98	0	259,975	0.72	123.75	4.50	\$350,242,420.00	40	8,756,061	\$67,937,828	\$0.46	2,813,338.00	\$11.22	5,942,722.50	\$277,104,906	48,022	\$1,283
0.80	2003	1,570,637	1,960,000	0	1,570,637	0	1,570,637.24	18,000	215.6	0.73	2,000,000	1	0.98	0	259,975	0.72	123.75	4.50	\$276,432,155.01	40	6,910,804	\$3,156,369	\$0.46	6,910,803.88	\$11.22	0.00	\$277,104,906	0	\$1,283
0.33	2004	643,407	1,960,000	0	643,407	0	643,407.08	18,000	229.6	0.73	2,000,000	1	0.98	0	259,975	0.72	123.75	4.50	\$113,239,645.75	40	2,830,991	\$1,292,998	\$0.46	2,830,991.14	\$11.22	0.00	\$277,104,906	0	\$1,283
0.22	2005	434,637	1,960,000	0	434,637	0	434,637.10	18,000	229.6	0.73	2,000,000	1	0.98	0	259,975	0.72	123.75	4.50	\$76,496,128.77	40	1,912,403	\$873,451	\$0.46	1,912,403.22	\$11.22	0.00	\$277,104,906	0	\$1,283
0.33	2006	640,144	1,960,000	0	640,144	0	640,144.41	18,000	243.6	0.73	2,000,000	1	0.98	0	259,975	0.72	123.75	4.50	\$112,665,416.69	40	2,816,635	\$1,286,441	\$0.46	2,816,635.42	\$11.22	0.00	\$277,104,906	0	\$1,283
0.25	2007	492,917	1,960,000	0	492,917	0	492,916.99	18,000	243.6	0.73	2,000,000	1	0.98	0	259,975	0.72	123.75	4.50	\$86,753,389.69	40	2,168,835	\$990,571	\$0.46	2,168,834.74	\$11.22	0.00	\$277,104,906	0	\$1,283
0.39	2008	765,896	1,960,000	0	765,896	0	765,895.87	18,000	243.6	0.73	2,000,000	1	0.98	0	259,975	0.72	123.75	4.50	\$134,797,673.04	40	3,369,942	\$1,539,152	\$0.46	3,369,941.83	\$11.22	0.00	\$277,104,906	0	\$1,283
0.40	2009	774,430	1,960,000	0	774,430	0	774,429.93	18,000	243.6	0.73	2,000,000	1	0.98	0	259,975	0.72	123.75	4.50	\$136,299,668.29	40	3,407,492	\$1,556,302	\$0.46	3,407,491.71	\$11.22	0.00	\$277,104,906	0	\$1,283
0.33	2010	645,624	1,960,000	0	645,624	0	645,624.00	18,000	263.2	0.73	2,000,000	1	0.98	0	259,975	0.72	123.75	4.50	\$113,629,824.00	40	2,840,746	\$1,297,453	\$0.46	2,840,745.60	\$11.22	0.00	\$277,104,906	0	\$1,283
0.35	2011	687,548	1,960,000	0	687,548	0	687,547.64	18,000	263.2	0.73	2,000,000	1	0.98	0	259,975	0.72	123.75	4.50	\$121,008,384.00	40	3,025,210	\$1,381,703	\$0.46	3,025,209.60	\$11.22	0.00	\$277,104,906	0	\$1,283
0.35	2012	687,548	1,960,000	0	687,548	0	687,547.64	18,000	263.2	0.73	2,000,000	1	0.98	0	259,975	0.72	123.75	4.50	\$121,008,384.00	40	3,025,210	\$1,381,703	\$0.46	3,025,209.60	\$11.22	0.00	\$277,104,906	0	\$1,283
0.37	2013	729,471	1,960,000	0	729,471	0	729,471.27	18,000	263.2	0.73	2,000,000	1	0.98	0	259,975	0.72	123.75	4.50	\$128,386,944.00	40	3,209,674	\$1,465,953	\$0.46	3,209,673.60	\$11.22	0.00	\$277,104,906	0	\$1,283
0.37	2014	729,471	1,960,000	0	729,471	0	729,471.27	18,000	263.2	0.73	2,000,000	1	0.98	0	259,975	0.72	123.75	4.50	\$128,386,944.00	40	3,209,674	\$1,465,953	\$0.46	3,209,673.60	\$				

The allocation of large areas of State owned forest land for the development of Industrial Timber Plantations (HTI) in Indonesia has been very important in supporting the economically-important pulp and paper industry. This allocation resulted in totally clearing vast areas of forests already logged for their prime timber and the elimination of the many environmental and social benefits these areas provide. This CIFOR working paper analyzes the economic costs and benefits of the allocation of nearly 1.4 million hectares of logged-over forests to five large pulp-plantation companies in Sumatra. The results and conclusions may be particularly relevant for future forestry policy in Indonesia.