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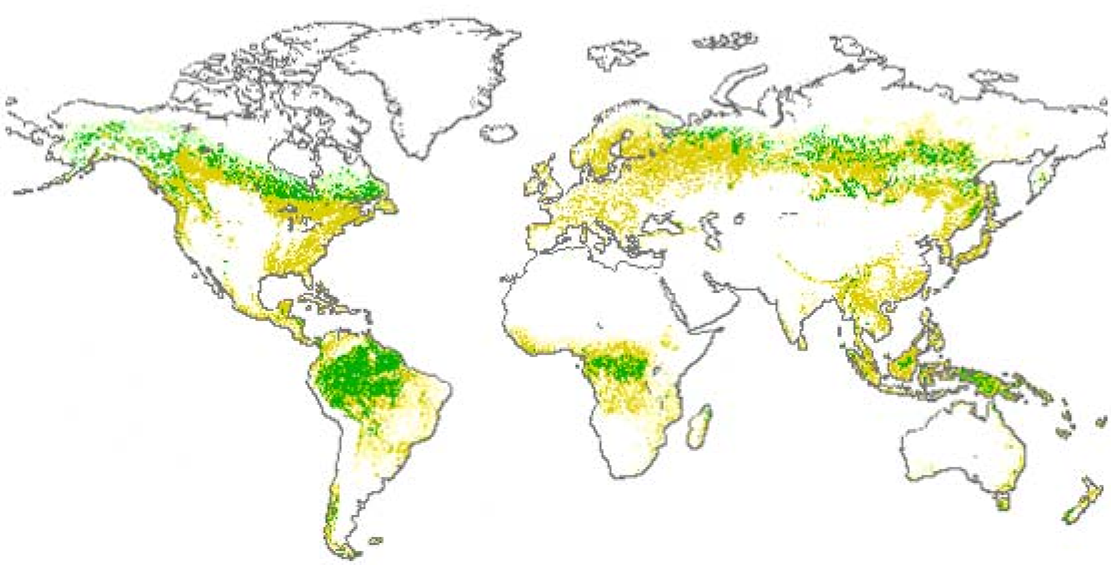
The Dutch economic contribution to worldwide deforestation and forest degradation



Prepared for Greenpeace Netherlands

International Institute for Environment and Development

AidEnvironment

September 2007

Acknowledgements
This report was prepared for Greenpeace Netherlands by the International Institute for Environment and Development (IIED) and AidEnvironment. The authors of the report in alphabetical order were Maryanne Grieg-Gran, Myrthe Haase, Jan Joost Kessler, Sonja Vermeulen and Eric Wakker. The authors would like to acknowledge the contribution of Wolfgang Richert, formerly of Greenpeace Netherlands and now at Greenpeace International, who had the idea to commission the study and who provided valuable guidance and advice. We would also like to thank Hilde Stroot and Suzanne Kröger at Greenpeace Netherlands for their comments on a draft of this report, the organisation Profundo which provided the Dutch import data, and colleagues at IIED (Bill Vorley, Annie Dufey and Steve Bass) and at AidEnvironment (Jan Maarten Dros) who offered advice and facilitated access to key information.

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Overview

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Background and objectives

Through its *Regeringsstandpunt Tropisch Regenwoud* policy (1991), and subsequent policy decisions, the Dutch government is committed to contributing to the protection of tropical and temperate intact forests. These policy decisions include a variety of initiatives aimed at reducing deforestation, such as encouraging certification, afforestation and forest management projects, regional agreements to combat illegal logging (FLEGT and others), conventions to protect biodiversity, and development aid to strengthen institutional capacity in timber producing countries. On the other hand, there is increasing evidence that Dutch imports and consumption of commodities results in deforestation and forest degradation in the countries where those commodities are produced.

The aim of this research is to quantify the contribution of relevant Dutch economic activities to impacts on natural forests worldwide, based on an objective, independently verifiable assessment of the best available data for the past decade. The research project focuses on the adverse impacts of Dutch economic activities on global forests, and does not look at the positive impacts of Dutch policy initiatives such as those elaborated above. However, good practices like FSC certification have been taken into account.

The findings of the research are presented as a series of country studies, with the aggregate global and regional results presented in this overview.

Definitions

Impacts on natural forests ('*aantasting van bossen*') include both deforestation and forest degradation. Deforestation is defined here as the conversion of natural forest to another type of land use or the long-term (more than approximately 100 years) reduction of the tree canopy cover below 10%, which is the internationally accepted (FAO) threshold for forest. Forest degradation is defined as loss of trees and woody biomass that does not amount to conversion of forest to non-forest, but does involve change in structure, species composition and productivity. Degraded forests may or may not be able to recover to their former condition. Forest degradation may be a precursor to deforestation, especially in a forest frontier zone.

The emphasis of this research is on natural forests, since these harbour the greatest biodiversity and ecosystem functions. Natural forests are characterised using the best available knowledge for each country study. The presence of intact forest landscapes, defined broadly as territories of at least 500 km^2 of forests minimally disturbed by human economic activity[1], was the first criterion for selection of the country studies in this research. The quantification of forest impacts, however, refers to natural forest as a whole rather than to intact forest landscapes specifically.

[1] Roadmap to Recovery: The world's last intact forest landscapes, Greenpeace Jan 2007, ver. 1.1 www.intactforest.org

Methods

To provide a representative global overview, countries were selected for case studies according to the following process:

1. Selection of the five regions that collectively hold 90% of the world's intact forest landscapes: Canada, Russia, South-East Asia, the Congo Basin (extended to include West Africa) and the Amazon Basin (extended to include the savannah forests and Atlantic forests of South America).

2. Identification within each of these regions of (a) commodities associated with impacts on forests and for which Dutch imports represent a relatively great share of global trade and (b) countries that represent a large share of Dutch imports or a large share of country exports. These criteria resulted in a matrix of country-commodity combinations (Table 1).

Table 1. Selected country commodity studies

Region / country		Soy	Palm oil	Beef	Timber	Pulp and paper
Russia					X	X
Canada					X	X
South-east Asia	Indonesia		X		X	X
	Malaysia		X		X	
Congo region	Cameroon				X	
	Congo DRC				X	
	Gabon				X	
West Africa	Côte d'Ivoire				X	
South America	Argentina	X		X		
	Brazil	X		X	X	
	Paraguay	X			X	

Some commodities or countries were initially selected but then excluded from the study for reasons of insufficient impact on intact or natural forests or insufficient exports. Commodities excluded due to insufficient direct impacts on intact forest landscapes include minerals, oil and prawns. Pulp and paper was excluded for Brazil, because although this country exports higher quantities to the Netherlands than Indonesia, Russia or Canada, the pulp is sourced from long-term plantations rather than from natural forest. Countries excluded due to insufficient exports of any of the selected commodities include Papua New Guinea, Thailand, Liberia, Congo (Brazzaville), Bolivia and Surinam. Cameroon, Congo DRC and Gabon were combined into one country study due to the similar forest dynamics in the three countries.

For each selected country study, the research followed the following steps, considering the trends from 1995 to 2005 throughout:

1. Collation and assessment of quantitative data on deforestation and forest degradation.

2. Determination of the drivers of deforestation and forest degradation, including historical changes in the major drivers, the links between proximate and

underlying drivers, indirect drivers, and the pathways from forest degradation to deforestation.

3. Determination of the contribution of the selected commodities to deforestation and forest degradation, including corrections for sustainable forest management.

4. Calculation of Dutch contribution to forest impacts, based on trade statistics and on the previously determined contribution of that commodity to deforestation and forest degradation, for two periods: 1996-2000 and 2001-2005.

Assumptions and interpretation

The quantitative results of this research must be interpreted in terms of the major understandings and assumptions used in the country studies.

Deforestation and forest degradation

For rates of deforestation and forest degradation, the starting point was the data presented in the FAO Forest Resource Assessment of 2005. Where possible, these figures were verified or modified on the basis of national or regional empirical studies, particularly for rates of forest degradation.

The FAO data on deforestation were used as this is the only institution publishing worldwide deforestation data. However, the FAO data are likely to underestimate deforestation rates since the FAO statistics include plantation forests and degraded forests as forest landscapes and have been criticized because of this (Rainforest Foundation, 2005). In this study, we verified the FAO data with other available statistics and made adjustments where possible. Also, we took into account indirect impacts (see below). Thus, the study team is confident that deforestation data in this study are relatively reliable.

Deforestation and forest degradation can have both direct and indirect drivers. The focus of the study has been on the direct impacts, but Indirect and multiplier impacts on deforestation were also calculated. The latter may be associated with displacement of economic activities into other areas, (e.g. soy and cattle rearing in South America). This was done through analysis of production trends, in particular the expansion in cattle numbers, and by taking into account the socioeconomic dynamics in different areas within the countries concerned.

Since deforestation is defined as long-term canopy loss or land use change, most logging for timber, whether selective or clear cutting, does not constitute deforestation but can result in forest degradation.

Forest degradation can range from minor impacts (e.g. selective logging with low-impact techniques) to major disturbance comparable in the short-term to complete deforestation (e.g. clear cutting. Changes in tree canopy cover may not always be the best measure of forest degradation (e.g. in the Congo Basin losses to wildlife may be far more severe than losses to vegetation). For this reason we do not use such data to quantify degradation but instead work on the basis that any logging from natural forest that is not FSC certified will lead to loss of forest quality. Thus, forest degradation refers to natural forests being logged without evidence of sustainable practices. Logging of forests that are already degraded (secondary forests) do not contribute to forest degradation.

Contributions by specific commodities

Commodities that require complete deforestation for production are palm oil, soy, fibre for pulp and paper (in Indonesia) and beef from cattle reared on intensive pasture. For these, care was taken to distinguish the proportion of expansion due to forest conversion relative to the proportion replacing other agricultural use. This was done through analysis of production trends and expansion in areas of pasture and crops and comparison with deforestation trends, taking into account any evidence from previous research in these countries. Timber and fibre for pulp and paper can come from multiple sources: natural primary forest, natural secondary forest, timber plantations, or clearance of land for agriculture. Waste paper and residues from sawmilling can also be used as inputs in paper manufacture. Care was taken to distinguish these different sources of wood and fibre and avoid double counting. This involved analysis of the characteristics of the logging and pulp and paper sectors in the countries concerned.

Correction for good practices

Most commodity initiatives that tend to work towards sustainabililty (e.g. for soy or palm oil) are not yet operational at a significant scale.

In the absence of other reliable information on sustainable forest management, it was assumed that only FSC-certified forests were sustainably managed and that all other logging could be regarded as leading to forest degradation.

Illegal logging makes up a proportion of logging in all countries, but does not affect conclusions about the extent of forest degradation.

Dutch contribution

The proportion of Dutch impact on forests was calculated only in terms of the commodity imports mentioned above and did not include other economic activities such as provision of credit by Dutch financial institutions.

Exports of processed products derived from activities or sectors contributing to forest impacts, such as chicken meat from Brazil fed on soy, were not included.
Products that pass through intermediary countries were only calculated separately where good data are available (e.g. plywood from Morocco and China sourced from the Congo Basin).

The basis for the analysis were the import data (and not consumption data) derived from FAOstat and Eurostat, this means that re-export of products after processing in the Netherlands was not deducted.

Results

A global estimate for impacts on natural forests (aantasting van bossen) due to Dutch commodity imports over the decade 1996 - 2005 is in the order of 1.6 million ha (Table 2), which is on average 160,000 ha per year. This estimate is based on the sum of estimated areas deforested or degraded in eleven countries in five regions where impacts of exported commodities on natural forests were assessed. Deforestation and forest degradation refer to natural forest, which includes, but which is not limited to, intact forest landscapes. The quantitative estimates need to be understood in relation to the methodological approach and assumptions made in the research, discussed in the previous section.

Table 2. Dutch impacts on forests 1996-2005 (ha)

Region / country		**Deforestation**	**Forest degradation**	**Total impact**
Russia (timber, pulp and paper)		-	53,000	53,000
Canada (timber, pulp and paper)*		-	13,000	13,000
South-east Asia	Indonesia (palm oil, timber, pulp and paper)	130,000	33,000	163,000
	Malaysia (palm oil, timber)	29,000	25,000	54,000
Congo region	Cameroon (timber)	-	234,000	235,000
	Congo DRC (timber)	-	5,000	5,000
	Gabon (timber)	-	88,000	89,000
	Côte d'Ivoire (timber)	-	3,000	3,000
	Argentina (soy, beef)	35,000	-	35,000
	Brazil (soy, beef, timber)	780,000	62,000	842,000
	Paraguay (soy, timber)	70,000	-	70,000
Indicative global totals		**1,045,000**	**516,000**	**1,561,000**

*2000-2004 only. All numbers rounded to nearest thousand **-** = Less than 1,000 ha

The impacts on deforestation and on forest degradation are separate processes, and the intensity of impacts (loss of forest quality) is of course greatest for deforestation dynamics. However, both deforestation and forest degradation fall under the heading of '*aantasting van bossen',* which is the basis and aim of the Dutch forest policies that are being evaluated. This is an important argument to add both categories. Also, forest degradation can be a precursor of deforestation, particularly in countries with a forest frontier.

Theoretically it is possible that there is overlap between forest degradation (through logging for timber) and forest conversion: first an area is degraded and within a timeframe of several years it is converted for example to oil palm. However, the chance that through *Dutch* imports of timber a particular forest area is degraded and within the period of ten years also is degraded through the *Dutch* imports of palm oil is fairly slim. It is possible that there is some overlap in the case of Brazil as wood processing companies often source a proportion of their timber from forest clearance, but this proportion is likely to be smaller for export-oriented companies.

When comparing the Dutch impacts between the two periods of 1996-2000 and 2001-2005, in most cases we observe an increase of impacts by at least 20%. The most significant increase of impacts is found in Brazil (for soy). Significant declines (over 10%) were only observed for Cameroon and Côte d'Ivoire (both in relation to timber) and for Indonesia (in relation to palm oil)

Another interesting observation is that about 2/3 of the deforestation and forest degradation is associated with the selected agro-commodities (palm oil, soy and beef) and only 1/3 with timber and pulp and paper. This underlines the fact that currently the major threats to tropical forests come from beyond the forestry sector. The current demand for biofuels is already putting an extra pressure on many tropical forests worldwide, as we found in several country studies, and is expected to increase rapidly.

As stated in the methodology, the calculation of impacts was corrected for sustainable forest management, as indicated by FSC certification in the case of wood products. For the other commodities, initiatives that set criteria for sustainable production are not yet operational at a significant scale, although for recent years we can observe that quantities are slowly increasing.

Canada and Russia

In the countries with boreal forests, Canada and Russia, production of timber, pulp and paper comes almost entirely from natural forests rather than from plantations. For 2001-2005 Dutch imports accounted for about 0.4% of virgin-fibre based production in Canada and just under 1% of production in Russia, for timber, pulp and paper combined. Logging is by clearcutting, but does not result in permanent deforestation because there is no land use conversion and the forest cover regenerates naturally. However, the regenerating secondary forest is poorer in terms of biodiversity, ecological functions and commercial value than the primary forest. Recovery to mature forest may take a couple of hundred years. Therefore all clear cutting for timber and fibre for the pulp and paper industry can be regarded as forest degradation unless the operation is sustainably managed and certified. Areas of forest degraded annually are small relative to the total extent of forests in these countries, but there are nonetheless concerns around protection of truly intact forest landscapes.

South-East Asia

Expansion of the palm oil sector is the major driver of deforestation in both Malaysia and Indonesia. Conversion of forest to plantations for pulp and paper is responsible for a small proportion of total deforestation only. The Netherlands is a major importer of palm oil from Malaysia and Indonesia, taking 5% of total production in the period 2001-2005. Timber production comes from selective logging of natural forests and from clearance of natural forests for plantations. Some areas are cleared but not planted with oil palms; this is an indirect impact of the palm oil sector.

Selective logging causes forest degradation and is much more destructive in South-East Asia than in the Congo Basin: higher extraction rates per hectare (30-75 m^3 Round Wood Equivalent per hectare compared to 5-15 m^3 RWE in the Congo) and higher levels of destruction to the surrounding vegetation. Forest degradation and deforestation are tightly linked in South-East Asia, as selective logging in most cases leads to gradual land conversion as the forest frontier moves ahead. Dutch imports account for up to 2% of timber, pulp and paper in Malaysia and Indonesia.

Congo region and West Africa

In Cameroon, DRC and Gabon industrial logging is associated with forest degradation but the primary drivers of deforestation are small-scale agriculture and settlements. Timber is produced via selective logging. The associated forest degradation is, in terms of tree cover, less severe than in South-East Asia, but effects on other qualities such as animal biodiversity are pronounced. Forest degradation does not begin a pathway towards forest conversion as in the Amazon and South-East Asia, because economic drivers for agricultural development are lacking at the present time. timber production from Cameroon and DRC, but closer to 1% for Gabon and Côte d'Ivoire.

The situation in Côte d'Ivoire is different and may indicate future trends in the Congo Basin. Côte d'Ivoire's agricultural plantation sector developed rapidly in the 1960s-1980s, associated with extensive deforestation, but is currently static. Selective logging for timber does cause degradation, but largely in already degraded secondary forest. From 2001 to 2005 Dutch imports accounted for almost 5% of timber production from Cameroon and DRC, but closer to 1% for Gabon and Côte d'Ivoire.

South America

This region includes the tropical rainforests of the Amazon Basin and the Yunga, but also Atlantic forests and *Cerrado* and *Chaco* wooded savannas. Historically the main drivers of deforestation have been cattle ranching and plantation crops such as sugar cane, but soy production is now the major driver in Brazil and Paraguay, with soy and beef equally important in Argentina. The soy sector is growing fast, with an increase in area of almost 100% in the period of 1995-2004. The Netherlands imports a high proportion of national soy production: 11% of Brazilian, 10% Paraguayan and 3% Argentinian total soy production between 2001 and 2005.

Soy expansion in Brazil has largely been at the expense of primary forest in the *Cerrado*, additionally causing a multiplier effect as soy farming displaces cattle farmers into the Amazon, where they buy and transform large forest areas for grazing. In Argentina, 50-75% of soy expansion has been at the expense of natural forest, compared to an estimated 80-100% in Paraguay. Cattle farming has had an impact on deforestation that is about 10% of that of soy for Brazil and Argentina, while it is not the major driver of deforestation in Paraguay. Forest degradation is due both to selective logging (in Brazil and Paraguay) and to extensive grazing by cattle (in Paraguay only). A key observation is that Dutch imports from Brazil account for about half of the Netherlands' global impacts on natural forests (Table 2).

Country study 1 – Russia

Summary

National forest cover has remained stable in Russia over the last ten years. However, there is considerable variation among the different regions of the country, with specific areas of rapid forest loss associated with large-scale industrial logging (clear felling) and high incidence of fire. Natural regeneration follows logging or fire and there are no drivers of long-term land use conversion away from forestry. Hence logging for timber and for fibre for the pulp and paper industry does not result in irreversible deforestation. Logging does however cause degradation of forest, since the secondary regeneration does not have the commercial value or ecological integrity of the original forest.

The Netherlands is an import country for wood products, pulp and paper from Russia, importing about 0.8% of annual production between 2001 and 2005. These imports have resulted in forest degradation amounting over the past ten years to 53,000 ha. This is less than .001% of the total forest area. Nonetheless, there is cause for concern over loss of old growth and high conservation value forests. The Russian industry is highly export-driven and the area under FSC-certification is expanding rapidly.

Dutch contribution to forest degradation in Russia (ha)		
Period	Total degradation associated with timber logging	Annual degradation associated with timber logging
1996-2000	23,190	4,640
2001-2005	29,950	5,990
1996-2005	**53,140**	5,314

1. Trends in deforestation

Trends in deforestation

Russia has 22% of the world's forested area, with 809 million ha of forest – 255 million ha primary forest, 536 million ha modified natural forest, 12 million ha productive plantations and 5 million ha protective plantations established for soil, water or habitat conservation – and a further 74 million ha of other wooded land (FAO 2005). Most of the forest is boreal (taiga), dominated by pine (*Pinus*), spruce (*Picea*), fir (*Abies*) and larch (*Larix*). Boreal forests have slow rates of regeneration but are considered a highly resilient ecosystem relative to temperate and tropical forests (Hagner 1999).

There has been no appreciable change in the overall forest cover in Russia over the last decade (Table 1) although there has been some change in its quality as discussed below.) The total growing stock has increased since the 1960s, due to natural re-growth on abandoned agricultural lands and also the dip in industrial logging at the start of the economic transition in the 1990s (World Bank 2004). The different regions of Russia have very different histories of deforestation: the north-west, which supplies most of the wood exports to the EU, was deforested at a rate of 3% per year in the 1970s and 1980s, followed by a recovery of 2.3% per year in the 1990s, while in the far east, which supplies mainly Asian markets, there was consistent deforestation of 0.7% from the 1970s to the 1990s (Woods Hole 1998).

The rate of deforestation in eastern Russia today is estimated at 0.8% per annum (Kondrashov 2004).

Rapid changes in forest cover have been clustered in particular locations, with high intensity logging mostly taking place in western Russia (e.g. the Karelian Isthmus) and along the southern boundary of the boreal forests. Rates of deforestation range from 0.26% for diffuse logging activities to around 0.65% for areas affected by intense clear-cutting activities, up to 2.3% for areas affected by fires or a combination of fires and logging (Achard et al. 2006).

Table 1: Annual rates of deforestation and afforestation 1990 – 2005 (FAO 2005)

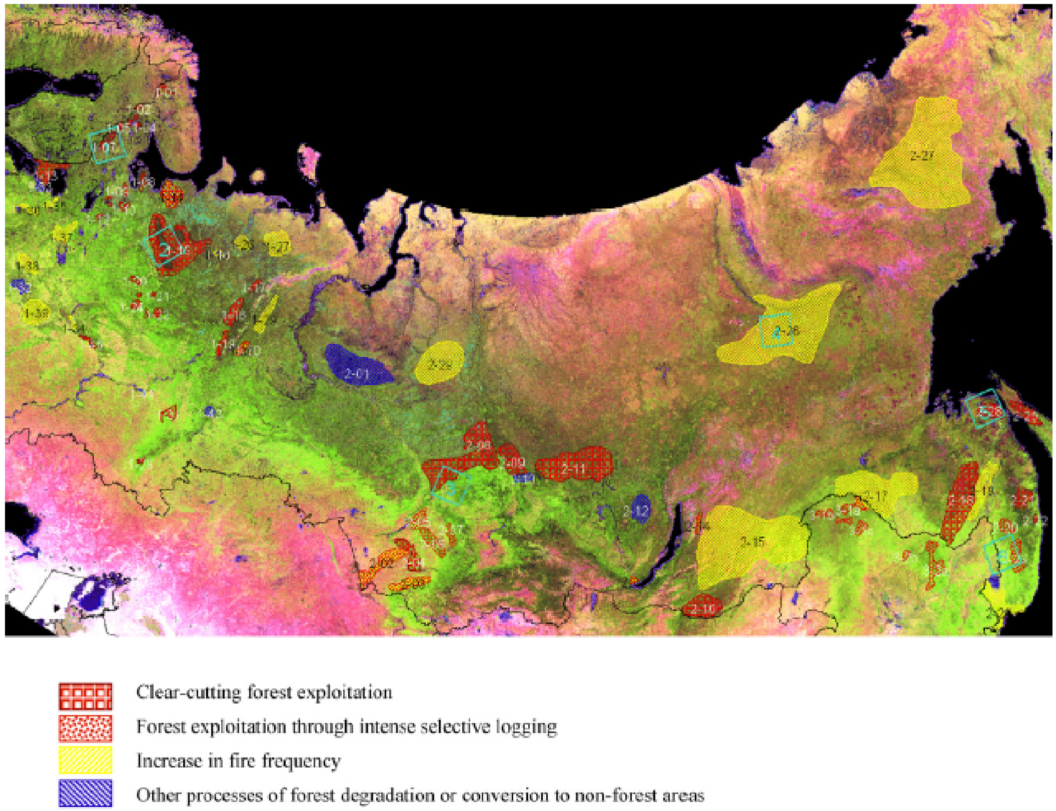
Forest cover 1990 (000 ha)	Annual rate 1990-2000 (ha)	Annual rate 1990-2000 (%)	Forest cover 2000 (000 ha)	Annual rate 2000-2005 (ha)	Annual rate 2000-2005 (%)	Forest cover 2005 (000 ha)
808,950	32,000	Negative but not significant	808,268	96,000	Positive but not significant	808,790

Trends in forest degradation

Boreal forests regenerate naturally following logging or fire. There has, however, been a decline in the commercial quality and ecological integrity of forests in Russia, as secondary regrowth of broadleaf species replaces mature conifers. In western Russia, secondary birch and aspen forests had by the late 1990s replaced over 30 million ha of natural spruce and pine forests (Hagner 1999). The area of pine forest in southern Karelia and Vologodskaya Oblast, both western regions, fell by 50% from the 1960s to today (WWF 2004). There has similarly been large-scale loss of Korean pine and other important species in the far east (Kondrashov 2004). Selective logging has also impacted on some of the forests in the south of the country (see the map in Figure 1).

The old growth forests of Russia have characteristics such as high tree mortality through old age, high levels of dead wood and high animal diversity that in Scandinavia now have to be stimulated by intensive ecological forest management (Boreal Forest 2007). While considerable tracts of high conservation value forests remain in the country, there may not be sufficient to conserve all biodiversity. For example, there is concern that not enough forest remains in the Primorsky Kray region of eastern Russia to support populations of large mammals (Aksenov et al. 2006). The likelihood of future forest degradation through logging and other human activities in forest areas – particularly mining – is high.

Figure 1. Areas of rapid change in forests in Russia (*Source: Achard et al. 2006*)



2. Drivers behind deforestation and degradation

A study based on satellite imagery shows that the main proximate drivers of deforestation in Russia over the past two decades have been logging and increase of fire frequency (Table 2; Achard et al. 2006).

Table 2: Extent of areas of rapid change in forest cover

Change process	**Extent (000 ha)**
Clear cuts	39,300
High fires frequency	67,200
Intensive logging	7,800
Other processes (e.g. forest gain on agricultural land)	5,000

Most logging in Russia is clear felling. Selective logging is confined to southeastern boreal forests, mainly to supply the Asian market (Karvinen et al. 2006). Clear felling simulates natural forest loss through fire and is considered a more appropriate silvicultural management option for boreal forests than selective logging (Hagner 1999). Natural regeneration is, however, slow, and the immediate succession is often to broadleaf species which have less commercial value. The pathway from selective logging to complete deforestation does not take place in Russia because of the lack of economically competitive land uses in remote areas with low agricultural potential.

While fire is a natural and regular phenomenon in boreal forests, the frequency of fires is increasing. Most forest fires are started by people, accidentally or deliberately

– human agency is thought to cause 80-90% of fires in Russia (TRN 2005). In the Far East, up to 93% of all ignitions arising in a 10 km zone around populated localities or a 3 km strip along regularly used roads (Kondrashov 2004). Each year across the whole country, 0.5-2.5 million ha of forest burn, in 20-35,000 wildfires (TRN 2005). In some years this is much higher: 14.5 million ha burned in 2003. The area of burn is much higher in eastern Russia where there is lower fire-fighting capacity and the natural conditions allow fires to spread over a larger area. Logging and mining increase wildfires (Achard et al. 2006).

3. Production of selected commodities and deforestation

Industrial logging is the main driver of deforestation and forest degradation in Russia. Almost 100% of forest loss can be attributed directly to logging or to wildfires exacerbated by logging. On the other hand, permanent land use change is confined to small areas. Most forest is able to regenerate naturally following logging or fire, albeit not always to the same quality as the pre-logged forest. The effective rate of deforestation is determined by the balance between harvesting and recovery. In the St Petersburg region in the north-west, for example, a reduction in the annual timber harvest from around 6 million m^3 in the 1980s to about 3 million m^3 in the 1990s resulted in an annual increase of 3% of land under forest, with the gain coming from regrowth of previously clear-felled areas (Woods Hole 1998). At the national level, harvesting tends to fall short of the annual allowable cut set by government each year (RUNA 2007) and the overall amount of forest is stable (Table 1 above).

Thus in Russia clear felling *per se* does not constitute deforestation, as it does not involve land use conversion and following felling there is a rapid increase of the canopy to above 10% cover. From an ecological point of view, clear felling is regarded as superior to selective logging for boreal forests where the natural ecosystem is fire related as it mimics natural processes of clearance through fire and subsequent regeneration (Hagner 1999). The real challenge is effective forest management at the landscape level. From an ecological point of view, boreal forest management should involve limiting the areas of clear cut within a concession, leaving patches of mature and dead trees, and refraining from clear cutting of old growth and of all-aged stands of shade-tolerant species (Boreal Forests 2007).

> Definition of deforestation: Conversion of natural forest to another type of land use or the long-term reduction of the tree canopy cover below 10%.

It is unlikely that such practices are implemented outside of certified forests. Logging companies in boreal areas attempt to recoup transport costs through efficiency based on scale, hence favouring large-scale clear cuts. Slow regeneration rates and short-term concessions encourage logging companies to view trees as a stock resource to be mined rather than a renewable resource to steward. Old growth forests are actively logged: one study estimated that 0-30% of various companies' timber supply came from "primeval forest", depending on their precise location (WWF 2004). The productive plantation sector is negligible (about 1% of the total forest). For the purposes of this study, the assumption therefore is that all non-certified logging activities result in degradation of natural forest.

Most logging activity in Russia has occurred in less remote, less mountainous areas with good infrastructure. Many natural forests remain "economically inaccessible" due to a negative balance between costs of harvesting and transport on one hand and the prices obtainable on world markets on the other hand (Kondrashov 2004).

Some analysts predict that economic conditions are unlikely ever to favour the harvesting of the most inaccessible forests (RUNA 2007).

4. Best practices

Forest certification is expanding rapidly in Russia. There are two national certification bodies, united within the international Programme for the Endorsement of Forest Certification (PEFC 2006). The area of FSC-certified forest expanded from 350,000 hectares in 2003 to 12.8 million hectares by November 2006 (Cass 2007). In August 2007 there were 43 FSC certificates covering 15.7 million ha, all of these for natural or semi-natural forest (FSC 2007). FSC Netherlands reports that 72,000 m^3 RWE per annum of FSC-certified wood products are imported from Russia to the Netherlands.

5. Production and export data and share by the Netherlands

Production of wood and wood products in Russia declined markedly in the early 1990s, then remained steady between 1995 and 1999, since which time all products have been on an upward trajectory. Overall official production and export data for Russian wood products are shown in Table 3. Total production in 2005 was 93.7 million m^3 RWE. Illegal logging which is estimated to account for 5-30% of the total harvest is generally not included in official statistics (Karvinen et al. 2006). It corresponds to an estimated 1.02 million m^3 in 2006 in the areas monitored by government remote sensing (ITAR-TASS 2007).

Table 3: Production and export of wood and wood products 2000 and 2005 (million m^3 or m^3 RWE)

	2000		2005	
	Production	**Export**	**Production**	**Export**
Export roundwood	31.3	31.3	35.8	35.8
Sawn wood	18.7	7.9	20.7	12.5
Pulp and paper	24.4	13.3	31.5	17.6
Total	78.4	57.2	93.7	71.6
Roundwood as % of exports		55%		50%
Total harvest	152		180	

Sources: FAO 2005 and 2006 supplemented by UNECE 2006 and RUNA 2007; conversion of pulp and paper to m^3 RWE uses conversion factor of 3.39 recommended by FAO 2006

Table 4 shows the rapid growth of the pulp and paper sector. Russia both exports and imports pulp and paper products, but the manufacturing sector is strongly driven by the export market, especially for pulp. Increases in production in recent years, both for pulp and paper and for the sawnwood and wood products industries, have been due to new operations rather than to increases in efficiency (RUNA 2007). In the absence of market incentives to improve efficiency, forest harvesting and wood processing technology in Russia is generally out of date, with little capital available for upgrading (Korppoo 2007).

Table 4: Production and export of pulp and paper 1996-2005						
Year	**Market pulp**			**Paper and board**		
	Output (million t)	Exports (million t)	Share of exports (%)	Output (million t)	Exports (million t)	Share of exports (%)
1996	1.3	1.1	86	3.2	1.4	43
1997	1.2	1.0	83	3.3	1.5	45
1998	1.3	1.1	76	3.5	1.8	50
1999	1.7	1.4	78	4.5	2.0	45
2000	2.0	1.6	82	5.2	2.4	45
2001	2.1	1.8	86	5.6	2.4	42
2002	2.2	1.9	86	5.9	2.5	41
2003	2.3	1.9	83	6.2	2.6	41
2004	2.4	1.9	79	6.7	2.6	39
2005	2.4	1.9	79	6.9	2.7	39

Source: UNECE 2006

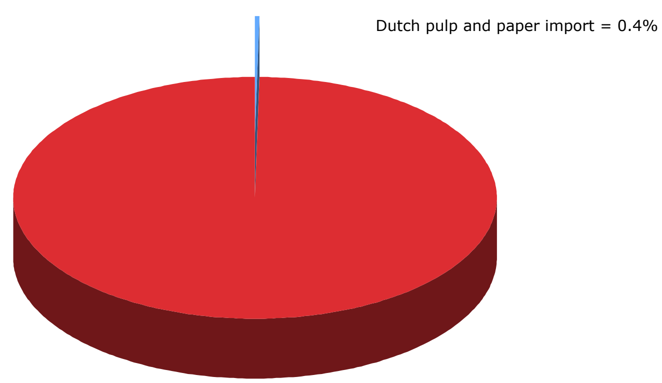
Table 5 shows Dutch imports of wood products and pulp and paper from Russia.

Table 5: Dutch timber imports (thousand m^3 RWE including logs sawn wood plywood and veneer) and pulp and paper imports (thousand m^3 RWE) as a percentage of production from Russia						
	1996-2000 total	**1996-2000 annual average**	**% 1996 -2000 production exported to Netherlands**	**2001-2005 total**	**2001-2005 annual average**	**% 2001-2005 production exported to Netherlands**
Russian timber production	250,000	50,000		280,000	56,000	
Dutch timber imports	2,000	400	0.8	2,900	580	1.0
Russian pulp and paper production	92,200	18,400		144,800	29,000	
Dutch pulp and paper imports	416	83.2	0.5	557	111.4	0.4

Sources: production data from Tables 3 and 4; Dutch import data from Eurostat; conversion to m3 RWE using the FAO figure for industrial sawnwood volume-mass (1.25 m3/t) and the specific FAO conversion factors for Russia of 1.5 for sawnwood to roundwood, 2 for veneer and manufactures to roundwood; pulp and paper already converted to m3 RWE

Figure 2: Dutch timber imports as percentage of total Russian production 2001-2005

Figure 3: Dutch pulp and paper imports as percentage of total Russian production 2001-2005



Yields from mature boreal forests in Russia are reported to be between 50 m^3/ha of wood in the north to 200–250 m^3/ha in the south of the zone (Kondrashov 2004). Thinning of younger stands has traditionally been regarded as too labour-intensive (Paivenen 1999) but is now becoming more important in the western forests, which are more intensively managed. Pre-final fellings provide about 4 million m^3 yield per year in total, at an average yield of 22 m^3 per ha, while final fellings yield on average 100 m^3 per ha (calculated from data in Karvinen et al. 2006). Selective logging, which occurs in the southeastern forests of the Primorsky Kray region (Pye-Smith 2006), results in much lower levels of extraction. The exact figures are not relevant to this study since this timber is destined for export to for export to China, Japan and Korea rather than to European countries. Given that the total production of wood products in Russia of 84 million m^3 in 2005 was harvested from 2 million ha gives an average yield of 42 m^3 per ha.

The Russian forest industry is highly export-driven. There is a clear differentiation between the forest sector in the west of the country, from which exports go largely to Europe, and the east of the country, which supplies Asian markets. The northwestern forests account for about 60% of national production (Karvinen et al. 2006). One of the main routes into Europe is via the Finnish pulp and paper industry: Finland procures 80% of its timber imports from Russia, mainly in the form of pulpwood (not processed pulp), about 14 million m^3 in 2004 (Greenpeace 2006). One of the main end uses is packaging e.g. Tetrapak. From the eastern forests, exports to China increased 30-fold from 500,000 m^3 in 1996 to 17 million m^3 in 2004. There has been a major decline in the processing industry in eastern Russia and today 95% of exports to China are as raw logs (Pye-Smith 2006).

In terms of industry structure, the Russian pulp and paper industry is dominated by a small number of large companies, increasingly involving joint ventures with foreign investors. For example, International Paper and the Ilim Group have recently announced what will be largest domestic-foreign joint venture in Russia, operating the largest of the pulp and paper mills located in the European and Siberian regions of Russia (PR Newswire 2007). The sawnwood industry, on the other hand, is characterised by a large number of small, domestically owned companies, with rapid turnover as individual companies develop or become obsolete (WWF 2004). There is little integration between the sawnwood industry and the pulp and paper industry. Vertical integration is also little developed, though low profitability is now forcing many of the smaller logging operations in the north-west to amalgamate with larger corporations that both harvest and process timber (Karvinen et al. 2006). Current government policy supports vertical integration (RUNA 2007).

6. Results and conclusions

The data and evidence above can now be used to estimate the contribution made by Dutch imports of timber products and pulp and paper from Russia to deforestation and forest degradation. For the reasons set out in Section 3, the contributions to deforestation are negligible and will not be calculated (see the examples from Cote d'Ivoire and the Congo Basin for calculations of the very small contribution of forest industry infrastructure to deforestation). The contribution to forest degradation is calculated by assuming that 100% of timber is obtained by logging in natural forests (ignoring the small level of extraction from plantations and the selective logging in the Primorsky Kray, which is not for export to Europe). Since there is little or no integration between the wood products industry and the pulp and paper industry, there is a further assumption that the wood entering into the pulp and paper industry is sourced from harvesting of trees rather than from by-products of the wood manufacturing. Thus the harvests for pulp and paper and for wood products are additional rather than overlapping.

Of the total timber production, 4% (4 million out of 94 million m^3 production) comes from pre-final fellings (thinning of non-mature stands) at a yield conversion rate of 22 m^3 per ha, which does not contribute to forest degradation. The remaining 96% comes from clear felling of natural forest, at a yield conversion rate of 100 m^3 per hectare (see Section 5). After subtracting the 72,000 m^3 RWE that is FSC-certified, all of this directly causes forest degradation, at a yield conversion rate of 100 m^3 per ha. Calculations give the figures shown in Table 6.

Table 6: Dutch contribution to forest degradation in Russia (ha)		
Period	Annual degradation associated with timber logging	Total degradation associated with timber logging
1996-2000	4,640	23,190
2001-2005	5,990	29,950
Total over 10 years		**53,140**

The current contribution to forest degradation in Russia of 53,140 ha as a result of Dutch imports of wood products, including pulp and paper, is very small when compared with the extent of forest cover in Russia (it is less than 0.001 percent per year). However, there is a clear need to pay attention to protection of high conservation value forests, which are now well mapped for most parts of the country, and to practise ecological forest management of production forests.

References

Achard, F., Mollicone, D., Stibig, H-J., Aksenov, D., Laestadius, L., Li, Z., Popatov, P. and Yaroshenko, A. 2006. Areas of rapid forest-cover change in boreal Eurasia. *Forest Ecology and Management* 237: 322-334.

Aksenov, D. E., Dubinin, M.Y., Karpachevskiy, M. L., Liksakova, N. S., Skvortsov, V. E., Smirnov, D. Y. and Yanitskaya, T.O. 2006. Mapping High Conservation Value Forests of Primorsky Kray, Russian Far East. Global Forest Watch. Moscow/Vladivostok, Russia.

Boreal Forest 2007. Forest management in Russia. http://www.borealforest.org/world/rus_mgmt.htm accessed August 2007.

Cass, J. 2007. Russia's sustainable forestry revolution. World Wide Fund for Nature.

FAO 2000. Forest Resources Assessment 2000. Food and Agriculture Organisation of the United Nations.

FAO 2005. Forest Resources Assessment 2005. Food and Agriculture Organisation of the United Nations.

FAO 2006. Russia country report. 47th Session of the Advisory Committee on Paper and Wood Products. Food and Agriculture Organisation of the United Nations.

Greenpeace 2006. Partners in crime: a Greenpeace investigation into Finland's illegal forest trade with Russia.

Hagner, S. 1999. Forest management in temperate and boreal forests: current practices and the scope for implementing sustainable forest management. Working Paper prepared for the World Bank Forest Policy Implementation Review and Strategy. Food and Agriculture Organisation of the United Nations.

Karvinen, S., Välkky, E., Torniainen, T. and Gerasimov, Y. 2006. Northwest Russian forestry in a nutshell. Working Paper 30. Finnish Forest Research Institute.

ITAR-TASS 2007. One million cubic metres of timber produced in Russia illegally last year. Information Telegraph Agency of Russia, 5 April 2007.

Killmann, W. 2006. The Russian forestry sector in the global forest products market: trends, outlook and opportunities for development. Presentation to the 7th International Forestry Forum, St. Petersburg, 10-13 October 2006.

Kondrashov, L.G. 2004. Russian Far East forest disturbances and socio-economic problems of restoration. *Forest Ecology and Management* 201: 65-74.

Korppoo, A. 2007. Modernisation of the Russian pulp and paper industry: lessons from Finland. Imperial College, University of London, UK.

Kulikova, E. 2007. Update on Russian Forest Sector and Russian-Chinese Relations: WWF View. Presentation given in Beijing, China, 26 April 2007. World Wide Fund for Nature.

Paivinen, R., Nabuurs, G-J., Lioubimov, A. and Kuusela, K. 1999. The state, utilisation and possible future developments of Leningrad Region Forests. EFI Discussion Paper 18. European Forestry Institute, Finland.

PEFC 2006. Russian forest certification initiatives sign historic agreement. Programme for the Endorsement of Forest Certification. http://www.pefc.org/internet/html/news/4_1154_65/5_1105_1400.htm accessed August 2007.

PR Newswire 2007. International Paper, Ilim Group agree to form 50:50 joint venture. PR Newswire 17 August, 2007.

Pye-Smith, C. 2006. Logging in the Wild East: China and the forest crisis in the Russian Far East. Forest Trends, Washington DC, USA.

RUNA 2007. Russian timber industry review 2005-2006. Russian Business Support Bureau.

Russian Federal Agency for Forestry 2007. Russian activity in combating against illegal logging in the framework of ENA FLEG process. http://www.illegal-logging.info/item_single.php?item=presentation&item_id=176&approach_id=23 accessed August 2007.

TRN 2005. Forest fires in the Russian taiga: natural disaster or poor management? Taiga Rescue Network Factsheet.

TRN 2007. Comments on the new Russian Forest Code. Taiga Rescue Network Policy Brief. http://www.taigarescue.org/_v3/files/pdf/201.pdf

UNECE 2006. UNECE/FAO forest products annual market review 2005-2006. United Nations Economic Commission for Europe.

Woods Hole 1998. Rates of forest cover change in Russia based on satellite imagery 1975-1995. Woods Hole Research Centre, USA.

World Bank 2004. Key challenges of the Russian forest policy reform. World Bank Discussion Paper.

WWF 2004. Illegal logging in Northwestern Russia and export of timber products

to Germany. WWF-Russia.

Country study 2 – Canada

Summary

Permanent deforestation involving conversion of forestland to another land use is very small in Canada compared to total forest area and economically accessible forest area. FAO statistics report zero deforestation over the period 1995-2005. However, since regeneration takes many years, the disturbance to forests from logging in Canada implies the loss of forest quality and ecosystem services over several generations. This study therefore focuses on forest degradation.

Production of wood products and pulp and paper is highly interdependent as considerable use is made of wood processing residues in pulp and paper manufacture. The study therefore makes combined estimates of the contribution to forest degradation of Dutch timber imports and Dutch pulp and paper imports. The use of recovered paper in paper and board manufacture is also taken into account in the calculations.

The Netherlands is an import country for wood products and pulp and paper from Canada, importing on average about 0.4% of Canadian annual production (in RWE terms) over the period 2000-2004. Adjusting for recovered paper use and use of wood residues, these imports are estimated to have required logging of nearly 13,000 ha over the period 2000-2004, on average about 2,500 ha per year.

Certification of forest management is well established in Canada. FSC certification covers about 20 million ha but production from these forest areas are not well represented in Dutch imports. Only 1000 m3 of FSC certified timber was imported to the Netherlands in 2005.

Dutch contribution to forest degradation in Canada 2000-2004* (ha)		
Period	**Forest degradation associated with timber**	**Annual Average Forest Degradation**
2000-2004	12,740	2,548

* Based on UNECE trade flow data which is only available from 2000

1. Trends in deforestation and degradation

The FAO Forest Resource Assessment for 2005 reports 0% deforestation over the preceding 15 years, with the area of primary forest remaining at 165,424,000 ha since 1990. The Canadian government vigorously defends the position that net deforestation in Canada stands at 0% (NRC 2005). However, these figures equate replanted or regenerating forest land with primary forest.

While very little of the area harvested is changed to another land use as in the strict definition of deforestation, recently logged land cannot be regarded in any way as an intact landscape. The Canadian Council of Forest Ministers makes a distinction between "*temporary disturbance"* from forest harvesting which averages 900,000 ha per year and "more permanent deforestation "involving conversion, estimated at 54,700 too 80,500 ha annually (CCFM 2006). It also notes that afforestation has only been at the rate of 6,000 to 10,000 ha per year.

A number of estimates of deforestation in Canada have been made as shown in Table 1 below. While there is some variation between them, even the highest one is still only a tiny fraction of forest cover in Canada.

Table 1: Estimates of deforestation in Canada

Deforestation rate per year	Years	Locality	Notes	Source
0%	1990-2005	Canada		FAO
92,500 ha per year	Not specified	Canada	Equates to 0.0002% using NRC figure for total forest cover of 402,597,000 ha (or 0.0005% using FAO figure for primary forest)	NRC 2005 (unreferenced study)
54,700-80,500 ha per year	Not specified	Canada	Permanent conversion: urbanisation, agriculture, forest road construction	CCFM 2006
0.82%	1977-1998	Southern boreal		Young et al. 2006
0.89%	1966-1994	Boreal transition zone of Saskatchewan		Hobson et al. 2002
0.19% 0.43%	1963-1990 1957-1990	Waskesiu Hills Red Deer River (Saskatchewan)	Notes differences for parks, forests, agricultural	Fitzsimmons 2002
969,569 ha per year	2002 only	Canada	Deforestation through logging only. Equates to 0.002% using NRC figure for total forest cover of 402,597,000 ha	Canadian Boreal Initiative 2005

In Canada, therefore it is temporary forest disturbance that is the main concern rather than deforestation. Harvesting takes the form of clear-cutting, often in large blocks, rather than selective felling. While it is clear that Canadian forests (being species-poor) compared to tropical forests are able to regenerate successfully (McLachlan and Bazely 2003), reaching the pre-harvest state can take as long as 250-300 years (Cumming et al 2000). Although the disturbance is temporary, it implies the loss of forest quality and ecosystem services over several generations. In this sense it can be equated with forest degradation.

As logging without disturbance is not possible, the way in which regeneration takes place is key. According to CCFM (2006) “companies that harvest trees from crown land must by law, ensure sufficient forest regeneration to re-establish thriving forest ecosystems on harvested sites”. Forest management certification schemes aim to set out the conditions required for minimising disturbance and ensuring regeneration. However the existence of three different schemes in Canada, Forest Stewardship Council (FSC), Canadian Standards Association and Sustainable Forestry Initiative (SFI), indicates that there are differences in opinion over what constitutes sustainable forest management and acceptable disturbance and sufficient forest regeneration. In this study, we assume that timber harvesting on forested land that is not FSC certified is likely to be associated with an unacceptable level of disturbance and hence forest degradation.

2. Drivers of deforestation and degradation

The main drivers of deforestation are logging (in northern and southern forests) and conversion to agriculture (southern forests). Long-term conversion is associated with private land ownership, agricultural potential, and proximity of roads and settlements – and overall is more likely in southern than northern areas (Hobson et al. 2002).

The main human driver of forest disturbance/degradation as defined above is logging. Natural disturbances such as wildfire or insect defoliation also affect several million hectares of forest each year (CCFM 2006).

3. Production of selected commodities and degradation

Production volumes of the main wood and pulp and paper products in Canada are shown in Table 2.

Table 2: Wood, pulp and paper production in Canada

Product category	2000	2001	2002	2003	2004
Sawnwood (000m3)	50,465	47,696	58,481	56,892	60,952
Wood-based panels (000m3)	14,533	14,985	16,093	16,491	16,919
Market pulp (000 t)	11,133	9,582	9,985	10,395	10,536
Paper and board (000 t)	20,762	19,632	20,073	19,964	20,463

Source: Compiled from UNECE data (sawnwood and panels) and PPPC 2006 (market pulp and paper and board)[2]

Timber
The key wood products are coniferous sawnwood, structural panels and engineered wood products but value added wood products such as doors and windows are also important (NRC 2006). Production has expanded over the last ten years, with sawnwood increasing by 26% and structural panels by 60% between 1997 and 2006[3].

Pulp and Paper
The chief pulp and paper products are newsprint, printing and writing papers and market pulp. Overall the sector is tending to contract rather than expand. Production of newsprint declined by 23% between 1995 and 2006[4] reflecting the reduction in consumption in the North American market (NRC 2006). Printing and writing papers has seen some expansion with an average annual increase of production of 3.3% from 1995 to 2005 to reach 6.7 million tonnes (PPPC 2006). Production of market pulp has fluctuated over the period 1995-2000 ranging between 9.6 million to 11 million tonnes per year (PPPC 2006).

[2] UNECE figures on wood pulp are considerably higher than PPPC's but appear to include the pulp used in integrated operations. For this study to avoid double counting we need production of pulp additional to that used in domestic paper industries. For this reason we use PPPC data.
[3] Calculated from data in PPPC (2006)
[4] Calculated from data in PPPC (2006)

Wood input requirements for the timber and pulp and paper sectors

In order to estimate the impact of timber and pulp and paper production on forests we need to calculate the production volume in terms of roundwood equivalents (RWE), that is, the volume of wood that needs to be harvested to produce the final product. Table 3 presents these calculations.

Table 3: Wood, pulp and paper production in Canada as roundwood equivalent (000 m3 RWE)

Product category	2000	2001	2002	2003	2004
Sawnwood	100,930	95,392	116,962	113,784	121,904
Wood-based panels	26,159	26,973	28,967	29,684	30,454
Market pulp	39,522	34,016	35,447	36,902	37,403
Paper and board	74,743	70,675	72,263	71,870	73,667
Total RWE 000m3	241,355	227,056	253,639	252,240	263,428

Source: Calculated from UNECE data using conversion factors for Finland in UNECE (2005) RWE to produce 1m3 of product as follows: sawnwood: 2, wood-based panels: 1.8 (particle board), market pulp 3.55(average of mechanical and chemical pulp), 3.6 paper and board

Adjustment for waste paper use

However, roundwood is not the only source of fibre for the industry. There is also some use of waste paper and it is necessary to exclude this, as it does not directly lead to harvesting of timber and impact on forests. The waste paper utilisation rate[5] in paper and board manufacturing has been around 24% since 1995, up from 8%-10% in the 1980s and early 1990s (PPPC 2006). We calculate the amount of virgin fibre in m3 RWE required to produce paper and board in Canada given the recovered paper utilisation rates that prevailed over the period, and assuming yield losses in the use of recovered paper of 15%. The results of the calculations made are shown in Table 4.

Table 4: Calculation of virgin fibre inputs for paper production in Canada

	2000	2001	2002	2003	2004
Production (000 t)	20,762	19,632	20,073	19,964	20,463
Recovered paper used in production (000 t)	5,018	4,891	5,043	4,946	4,863
Input of recovered paper after yield losses (000 t)	4,363	4,253	4,385	4,301	4,229
Virgin fibre-based production (000 t)	16,399	15,379	15,688	15,663	16,234
Virgin fibre inputs for paper production (000 m3 RWE)	59,035	55,364	56,476	56,387	58,443

Source: Calculated from data in PPPC (2006) using a yield loss factor of 15% and a tonne to m3 roundwood equivalent conversion factor of 3.6

Table 5 shows the total production in RWE adjusted for recovered paper use over the period 2000-2004, the annual average and the share of each product category. It

[5] Defined as the volume of waste paper used in production divided by the volume of production

can be seen that market pulp and paper and board manufacture combined account for over 40% of RWE.

Table 5: Production in RWE (000 m3) adjusted for recovered paper use and share of each product category			
	Total (000 m3 RWE)	Annual average (000 m3 RWE)	Share of total
Sawnwood	548,972	109,7944	47%
Wood-based panels	142,238	28,448	12%
Market pulp	183,290	36,658	16%
Paper and board	285,706	57,141	25%
Total RWE 000m3	**1,160,206**	**23,204**	**100%**

Source: Calculated from UNECE and PPPC data

Adjusting for wood residue use

Production of wood products and pulp and paper are highly interdependent. The pulp and paper industry makes extensive use of wood residues from sawmilling as a fibre source and energy source.

Between 2002 and 2006 pulpwood accounted for only 14%-15% of industrial roundwood removals as shown in Table 6. But the production of market pulp and paper and board when expressed as roundwood equivalent (RWE) using standard conversion factors corresponds to about 40% of total RWE from wood products and pulp and paper combined, taking into account the extent of waste paper utilisation in the pulp and paper sector. This means that the roundwood required to produce this volume of pulp and paper considerably exceeds the volume of pulpwood harvested. This implies that over half of the virgin fibre inputs of pulp and paper are derived from wood residues from wood processing.

For this reason, the calculations that follow do not attempt to split the contribution to forest degradation of wood products and pulp and paper products.

Table 6: Timber harvesting and the share of pulpwood			
Year	**Removals of industrial roundwood 1000 m3**	**Removals of pulpwood 1000 m3**	**Pulpwood as % of roundwood removals**
2000	176,572	22,944	13.0
2001	175,592	21,392	12.2
2002	195,211	27,526	14.1
2003	176,799	26,635	15.1
2004	205,617	29,286	14.2
2005	208,712	31,501	15.1
2006	203,104	31,081	15.3

4. Best practices

There are three forest certification programmes in operation in Canada: Forest Stewardship Council (FSC), Canadian Standards Association (CSA) and the Sustainable Forestry Initiative (SFI). As of June 2007, there were 134,060,558 hectares certified under one or more of these three schemes (CSFCC 2007). This represents 93% of the forests subject to forest management in Canada as shown in Table 7. FSC certification covered 20.5 million hectares or 14.2% of the forest subject to forest management. However, in 2005, Dutch imports of FSC certified timber amounted to no more than 1,000 m3 (FSC Netherlands).

Table 7: Forest Area Certified in Canada under FSC and CSA, SFI schemes				
Year	**Total area certified under FSC, CSA, SFI (mn ha)**	**Certified area as % of total area subject to forest management**	**Total area certified under FSC (mn ha)**	**FSC certified area as % of total area subject to forest management**
2000	5	3	0.03	0.02
2001	17	12	0.05	0.04
2002	28.1	19	0.48	0.33
2003	58.3	40	3.7	2.5
2004	87.3	60	4.3	3.0
2005	119.8	83	15.4	10.7
2006	123.7	86	20.5	14.2
2007 (June)	134.1	93	20.5	14.2

Source: Compiled from data in CSFCC (2007). Area subject to forest management 144.6 mn ha from FPAC (2007)

5. Export data and share of the Netherlands

Timber

Canada is the largest exporter worldwide of softwood lumber but a large proportion goes to the US and only a small proportion to European countries including the Netherlands (NRC2006). Wood-based panels (oriented strand board mainly), printing and writing paper and newsprint are also mostly exported to the US (*ibid*). For wood pulp, the export markets are more diversified and this is reflected in the relatively high exports to the Netherlands (*ibid*).

Trade flow data from UNECE have been used for exports of wood and pulp and paper to the Netherlands rather than Eurostat as it appears to be more consistent with the product categories and volumes reported in Canadian production and trade statistics. Eurostat reports large volumes of export of chips and particles to the Netherlands but there is no mention of this in UNECE data, FAOstat data. UNECE trade flow data is available only for 2000-2004 so the calculations made refer to this period only.

Table 8 shows Dutch imports[6] from Canada for the main product categories over the period 2000 to 2004. Table 9 shows that these imports were a very small proportion (less than 0.5%) of total Canadian production for each main product category, except for market pulp.

[6] UNECE trade flow shows separate figures for exports from exporting countries to importing countries and imports made by importing countries from exporting countries. There are often discrepancies between these two sets of figures as the sources are different exporting country governments and importing country governments respectively. We opt here to use the export figures to maintain consistency with other figures on production and roundwood removals that come from Canadian government or Canadian industry sources.

Table 8: Dutch Imports of wood, pulp and paper 2000-2004					
Product category	**2000**	**2001**	**2002**	**2003**	**2004**
Sawnwood (000 m3)	63	44	71	27	44
Wood-based panels (000m3)	20	3	7	22	17
Market pulp (000t)	109	88	226	257	258
Newsprint (000t	34	58	60	59	37
Paper and board ex newsprint (000t	17	18	6	3	4

Source: compiled from UNECE trade flow data.

Table 9: Dutch Imports of wood, pulp and paper and share of Canadian Production			
Product category	**Total 2000-2004**	**Annual average**	**Share of Canadian Production**
Sawnwood (000 m3)	249	49.8	0.09%
Wood-based panels (000m3)	69	13.8	0.09%
Market pulp (000t)	938	187.6	1.82%
Newsprint (000t	248	49.6	0.29%*
Paper and board ex newsprint (000t	48	9.6	

Source: Calculated from UNECE trade flow data
*Figure for newsprint and paper and board combined

6. Results and conclusions

In order to relate these import figures to harvesting requirements and hectares of forest affected, it is necessary to make some adjustments to the Dutch import figures:

- Conversion to roundwood equivalent using standard conversion factors so that the different products can be added together
- Deduction of the recovered paper content of paper and board imports. It is assumed that the average utilisation rate prevailing each year applied to Dutch imports.

The data in Table 10 is used to calculate the number of hectares needed to supply the virgin fibre inputs for Dutch imports. In 2004, the harvest area was 840,888 ha (NRC 2005). Combining this with the harvest volume or industrial roundwoods removal figure for the same year (205.6 million m3) gives an average yield per ha of 245 m3/ha. It is assumed that this figure is representative of other years. In 2004, our estimate of the virgin fibre requirement for the wood and pulp and paper production combined is 248 million m3 in RWE. This exceeds the harvest volume because of the use of wood residues. We calculate the ratio between the estimated requirement and the actual roundwoods removal and apply this factor (1.2) to the average yield per ha. This increases the effective yield per ha to 295 m3/ha. This takes into account that each hectare will yield more than the amount indicated by roundwood removals because of the use of residues by-products in production

.Table 10 presents the results of these adjustments**.**

Table 10: Dutch imports in RWE (000 m3) adjusted for recovered paper use[1]		
Product	**Total (000 m3 RWE 2000-2004**	**Annual average**
Sawnwood	498	100
Wood-based panels	124	25
Market Pulp	3330	666
Newsprint	623	125
Other paper	128	26
Total	4704	941

Source: Calculated from UNECE data using conversion factors for Finland in UNECE (ref) RWE to produce 1m3 of product as follows: sawnwood: 2, wood-based panels: 1.8, market pulp 3.55(average of mechanical and chemical pulp), 3.2 newsprint, 3.4 other paper and board. Recovered paper utilisation rates from PPPC 2006.
1 See explanation for Table 5

The number of hectares affected by Dutch imports is calculated by dividing the total RWE of Dutch imports by the adjusted yield per ha. The results are shown in Table 11 and Table 12 As Dutch imports of FSC timber appear to be rather small, no correction is made for the impact of FSC certification on forest degradation area..

Table 11: Dutch Contribution to Forest Degradation in Canada 2000-2004					
	2000	**2001**	**2002**	**2003**	**2004**
Dutch imports as % of Canadian production (virgin fibre based)	0.30%	0.28%	0.47%	0.49%	0.46%
Dutch contribution to roundwood removals (000m3)	532.5	496.9	921.6	867.8	943.7
Area of forest affected by Dutch imports (ha)	2,177	2,031	3,767	3,547	3,858

Table 12: Dutch contribution to forest degradation in Canada 2000-2004 (ha)		
Period	**Forest degradation associated with timber**	**Annual Average Forest Degradation**
2000-2004	12,740	2,548

References

Arseneault, D. and S. Payette 1997 Landscape Change Following Deforestation at the Arctic Tree Line in Quebec, Canada *Ecology* 78: 693-706

Canadian Boreal Initiative 2005. Counting Canada's Natural Capital: Assessing the Real Value of Canada's Boreal Ecosystems. Pembina Institute, Alberta, Canada

CCFM 2006 Criteria and indicators of sustainable forest management in Canada: national status 2005. Canadian Council of Forest Ministers.

Chapman, R. 2006. Trends in land cover change and isolation of protected areas at the interface of the southern boreal mixedwood and aspen parkland in Alberta, Canada. Forest Ecology and Management 230: 151-161

CSFCC 2007 Certification Status Report Canada-wide SFM June 21 2007 Canadian Sustainable Forestry Certification Coalition www.CertificationCanada.org Prepared by Abusow International Ltd.

Cumming, S.G., Schmiegelow, F.K.A. and Burton, P.J. 2000. Gap dynamics in boreal aspen stands: is the forest older than we think? Ecological Applications 10: 744-759

FAO 2005 Forest Resources Assessment 2005. Food and Agriculture Organization.

Fitzsimmons, M. 2002. Estimated rates of deforestation in two boreal landscapes in central Saskatchewan, Canada. Can. J. For. Res. 32(5): 843–851.

FPAC 2007 The Canadian Forest . Forest Products Association of Canada www.fpac.ca/en/sustainability/forest/ viewed on 23/082007.

HOBSON Keith A. ; BAYNE Erin M.; VAN WILGENBURG Steve L.; Large-scale conversion of forest to agriculture in the boreal plains of Saskatchewan

McLachlan, S.M. and D. R. Bazely 2003 Outcomes of longterm deciduous forest restoration in southwestern Ontario, Canada Biological Conservation 113: 159-169

NRC 2005. Is Canada's Boreal Forest Shrinking or Expanding? Natural Resources Canada. http://cfs.nrcan.gc.ca/sof/sof05/for_the_record_e.html

NRC 2006. The State of Canada’s Forests 2005-2006.

PPPC 2006 Canadian Pulp and Paper Industry Key Statistics Pulp and Paper Products Council

The State of Canada’s Forests 2005-2006 Forestry Statistics and Trends

UNECE 2007 Forest Products Statistics 2002-2006 Timber Bulletin ECE/TIM/BULL/60/2 –provisional As of July 2007 United Nations Commission for Europe

UNECE 2005 Forest Products Trade Flow Data 2002-2003 Timber Bulletin Vol. LVIII No. 5 United Nations Commission for Europe Food and Agriculture Organization

UNECE Forest Products Statistics 1997-2001 Timber Bulletin, Volume 55, No. 2 United Nations Commission for Europe Food and Agriculture Organization

UNECE 2005 European Forest Sector Outlook Study Annex 1 Conversion Factors http://www.unece.org/trade/timber/efsos/data/conversion-factors.pdf

UNECE 2006 Forest Products Trade Flow Data 2003-2004 Timber Bulletin Vol. LIX (2006) No. 5 United Nations Commission for Europe Food and Agriculture Organization

UNECE Forest Products Trade Flow Data 2001-2002 http://www.unece.org/trade/timber/mis/tb-5/57-5.pdf

UNECE Forest Products Trade Flow Data 2000-2001 http://www.unece.org/trade/timber/mis/tb-5/56-5.pdf

Country study 3 – Indonesia

Summary

Total deforestation in Indonesia over the period of 1995 to 2005 has been estimated at more than 20 million ha, with an annual average in the period of 2000-2005 of 1.9 million ha. Scientific data on the degradation of primary forest are not available, but estimations average at several millions of hectares per year. In the past decade, the main large-scale economic drivers behind deforestation in Indonesia are land required for palm oil plantations, production of pulp for paper and timber. Other minor drivers behind deforestation and forest degradation are mining, infrastructure and the production of other agricultural commodities.

The Netherlands is an important import country for Indonesian palm oil: over the period of 1995 to 2005 of Indonesian palm oil production 5% was annually exported to the Netherlands. Dutch average timber imports are less important, increasing from 0.23% of Indonesian timber production in 1995–2000 to 0.74% in the next period. The Dutch import of Indonesian pulp is also limited, decreasing from 0.61% of the total Indonesian production in the period 1996–2000 to 0.29% during 200–2005.

The Dutch contribution to deforestation and forest degradation in Indonesia through its imports of palm oil, pulp and timber, is summarised in the table below. The total Dutch contribution to deforestation through palm oil imports equalled 129,970 ha over the 10-year period. The total forest degradation due to Dutch pulp and timber imports was 32,662 ha. Although the import of Indonesian FSC timber increased over the years, the area degraded as a result of Dutch demand increased in the second period (2001–2005).

Dutch contribution to deforestation and forest degradation in Indonesia 1996 – 2005 (ha)

Period	Deforestation associated with Dutch imports of palm oil	Deforestation associated with Dutch imports of pulp	Total deforestation due to Dutch imports	Annual average	Total forest degradation due to Dutch imports of timber and pulp
1996-2000	70,400	153	70,553	14,110	14,768
2001-2005	59,570	73	59,643	11,929	17,894
Total	**129,970**	**223**	**130,196**	**13,020**	**32,662**

1. Trends in deforestation

Deforestation

The data on deforestation according to FAO Forest Resource Assessment are presented in table 1 and figure 1. The data have been corrected for an increase in forest plantations (approximately 400,000 ha in all three periods).

Table 1: Deforestation in Indonesia 1991 – 2005 (x 1,000 ha)

Period	Total deforestation	Deforestation annually
1991-1995	7,176	1,435
1996-2000	12,339	2,468
2001-2005	9,757	1,951
Total	**29,272**	**1,951**

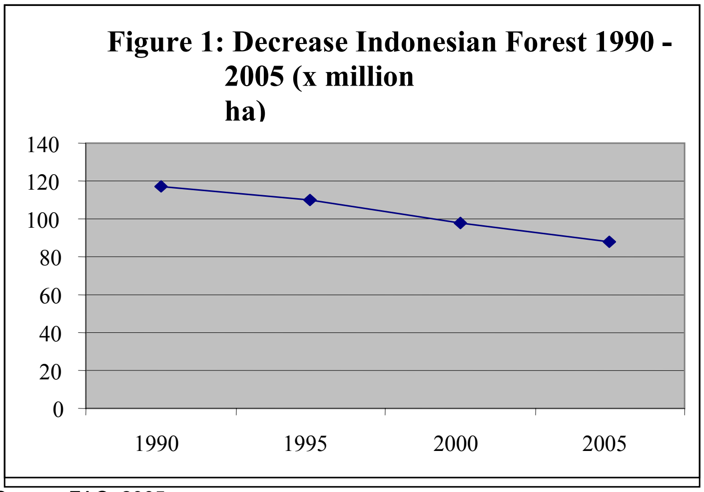
Source: FAO, 2005

The FAO data are in line with other studies on deforestation in Indonesia like those of Holmes (2002) and Forest Watch Indonesia /Global Forest Watch (FWI/GFW, 2002). Other sources like FERN et al (2005) indicate a higher deforestation rates (see table 2). Of the 44 countries which collectively account for 90% of the world's forests, Indonesia pursues the world's highest annual rate of deforestation with 1.9 million ha per year between 2000-2005, which corresponds to a rate of 2% annually (accepted as a record in the Indonesia Guinness book of records, 2008).

Within Indonesia there are considerable differences in deforestation rates between regions. Between 1985 and 1997 deforestation in West Papua was 1.8 million ha, compared to 10 million ha in Kalimantan and 6.5 million ha in Sumatra in the same period (DTE, 2002). Indonesia's lowland tropical forest has already been cleared in Sulawesi and is nearly cleared in Sumatra. With deforestation rates accelerating in Kalimantan, the frontier is expected to move to West Papua, which has been relatively untouched until recently (FWI/GFW, 2002; World Bank, 2006).

Table 2: Deforestation rates in Indonesia according to various sources

Source	Period	Total deforestation	Annual deforestation	Main drivers
Holmes (2002)	1985 - 1997	20 million ha	2 million ha	Timber plantations (11%) estate crops (14%), forest fires (10%) small investors (10%) pioneer farmers (7%). Only amounts to 9,7 mln ha
FWI/GFW (2002)	1950 - 2000	64 million ha	1.7 million ha 1990-1995 2 million ha 1995-2000	
Rautner et al. (2005)	1985 - 2005	17 million ha in Borneo (including Sabah and Sarawak)	Borneo: 850.000 ha in 1985–2005; Kalimantan: 1.2 million ha 2000–2002	(illegal) logging, palm oil development
FERN, Greenpeace, WWF (2005)	1985 - 2000		1.6 million ha 1985–1997; 3.8 million ha 1997-2000	



Source: FAO, 2005

Forest degradation

Data on Indonesian forest degradation vary, which is partly because of different scope and definitions used (table 3). Forest Watch Indonesia refers to degraded *logging concessions* and not to degraded forest land in total. Some sources, like Purnomo and Guizol (2006), include deforested areas in the total degraded area, while other sources do not. Accurate data on forest degradation are difficult to obtain.

Table 3: Forest degradation in Indonesia according to various sources

Source	Reference year	Total degradation
FWI/GFW (2002)	2000	13 million ha of the 44 million ha logging concessions
Indonesian Ministry of Forestry (2005)	2005	47.1 million ha
World Bank (2000)	1998	16.6 million ha due to logging operations
Purnomo and Guizol (2006)	2006	60 million ha

2. Drivers behind deforestation and degradation

In the past decade, the main large-scale economic drivers behind deforestation in Indonesia are land required for palm oil plantations, production of pulp for paper and timber. Other minor drivers behind deforestation and forest degradation are mining, infrastructure and the production of other agricultural commodities: rubber, tea and coconut. In terms of area affected, the direct contribution to deforestation by mining and infrastructure is small. The indirect contribution is difficult to quantify, but infrastructure development leads to significant forest fragmentation and subsequent forest loss. The contribution to deforestation by agricultural crops like rubber, tea and coconut is small because these are old and established crops with lower expansion rates compared to oil palm plantations (FWI/GFW, 2002).

Another specific driver behind deforestation is forest fires. In the period 1990–2000 forest fires have been a large factor in deforestation. In 1994 in total 5 million ha of forest was burned, while in 1997–1998 another 4.6 million ha of forest land was burned (FWI/GFW, 2002). An estimated 80% of the deforestation induced by forest fires can be attributed to one of the economic drivers, because both loggers and plantation owners are known to use fire for their land clearing operations. The remaining 20% can be attributed to farmers and other factors (FWI/GFW, 2002).

This country study focuses on the economic drivers of palm oil, pulp and timber. Whether the production of these commodities leads to degradation or deforestation depends on the commodity. Oil palm plantations and pulpwood plantations are typically planted in monoculture, which implies complete clearance of the original vegetation. Whether or not plantation development contributes to deforestation depends upon the land cover which is being replaced by the plantation. It has been estimated that 66% of the oil palm plantations between 1990 and 2002 were developed at the expense of forests (Wakker, 2004). For pulp plantations it is assumed that 50% have been established by replacing forests (FWI/GFW, 2002).

Tropical timber is either derived from initial forest clearings for plantation development, or from selective logging causing forest degradation. Forest degradation is often severe but when left alone, previously logged forests have regenerated quite well. During the 1998–2004 illegal logging boom, however, most of these second growth forests were logged again and many have been burnt.

The three economic drivers behind forest conversion and degradation are interlinked. In most cases selective logging is used and this leads to a mild level of forest degradation. In a second stage more intensive logging causes further forest degradation. In a final stage the degraded forest may be converted to a plantation. This process of gradual deforestation may occur illegally, but it may also follow a formal pathway: first a logging concession is issued on a forest area, then a plantation concession permit is given to the degraded forest. Although logging concessions must be managed in such a way that degradation does not occur, enforcement is poor. In 1998, the Forest Ministry revealed that 2.7 million ha of logging concessions were converted to plantation concessions (FWI/GFW, 2002).

An important link between logging and pulp and palm oil plantations is the use of plantation concessions for logging. While a logging concession can only be used for selective logging, a plantation concession allows the entrepreneur to clear the forest area. Even if the entrepreneur is only interested in the timber, it would be beneficial to apply for a plantation concession instead of a logging concession. In 2004, of 10 million ha allocated palm oil concessions only 5.4 million ha were actually planted with palm oil (Milieudefensie, 2004). For pulp and other forest plantations, of 5.7 million ha allocated concessions only 3.4 million ha were actually planted in 2005 (Indonesian Ministry of Forestry, 2007). The concession areas not being planted with palm oil or pulp plantations have probably been cleared but have not yet been planted. Of the cleared concession areas, the valuable timber species are exported as commercial timber while the less valuable species are being used as pulp.

3. Production of selected commodities and deforestation

Palm oil

Table 4 presents the deforestation which can be attributed to oil palm plantations. The deforestation is calculated as follows. First, the planted area of palm oil plantations is given in column (a). Based on literature (see above) it is assumed that for palm oil plantations 66% has been developed at the expense of forests (the remaining 33% was already cleared). Deforestation due to palm oil plantations is listed in column (c). Column (d) gives total area allocated to palm oil plantations.

Column (e) gives the difference between realised and allocated area and is assumed to have been cleared. Incomes from logging operations in these 'undeveloped' areas may have been used to finance the palm oil plantations. It is assumed that 100% of the non-realised palm oil plantation concessions have been cleared at the expense of forests.
Thus, in summary, for palm oil plantations a total of 2,852,000 ha of forest has been directly cleared, and is being planted with palm oil, while another 4,552,000 ha of forest has probably been logged and cleared but not (yet) planted.

Table 4: Area indications to compute deforestation attributed to palm oil (x 1,000 ha)

	Realised oil palm plantations (incl. immature area). Cumulative area	Increase	Realised at the expense of forests (66%)	Total allocated oil palm concessions	Difference between (a) and (d), assumed cleared at expense of forests (100%)
	(a)	(b)	(c)	(d)	(e)
1990	1,127				
1995	2,025	898	593		
2000	4,158	2,133	1,408		
2004	5,448	1,290	851	10,000	4,552
Total deforested			**Direct: 2,852**		**Indirect: 4,552**

Source: Indonesian Ministry of Forestry, 2007

Pulp and other forest products

Table 5 presents the deforestation which can be attributed to pulp plantations. The deforestation is calculated as follows. First, the planted area of pulp plantations is given in column (a). Based on literature (see above) it is assumed that for pulp plantations 50% has been developed at the expense of original forests (the remaining 50% was already cleared). Deforestation due to pulp plantations is listed in column (c). Column (d) gives total area allocated to pulp plantations. Column (e) gives the difference between realised and allocated, and is assumed to have been partially cleared. Incomes from logging operations in these 'undeveloped' areas may have been used to finance pulp plantations. It is assumed that 100% of the non-realised pulp plantation concessions have been cleared at the expense of forests (or are gradually being totally cleared in subsequent phases).

Thus, in summary, for pulp plantations a total of 805,000 ha of forest has been directly cleared, and is being planted with pulp trees, while another 2,610,000 ha of forest has probably been cleared and not (yet) planted.

Table 5: Area indications to compute deforestation attributed to pulp plantations (x 1,000 ha)					
	Realised pulp plantations. Cumulative area	**Increase**	**Realised at the expense of forests (50%)**	**Total allocated to pulp concessions**	**Difference between (a) and (d), assumed cleared at expense of forests (100%)**
	(a)	**(b)**	**(c)**	**(d)**	**(e)**
1990	66				
1995	675	609	305		
2000	1,175	500	250		
2005	1,676	501	251	4,286	2,610
Total deforested			**Direct: 805**		**Indirect: 2,610**

Source: Indonesian Ministry of Forestry, 2007

Logging and forest degradation

While palm oil can only be obtained from palm oil plantations, pulp and timber can be obtained from natural forests or forest plantations. A CIFOR study on the paper and pulp industry world-wide found that in Indonesia until 2000 only 10 % of the total timber supply for the pulp and paper sector originated from plantations. Recent data indicate that this proportion has increased to 30% from plantations. The remaining 70-90% of timber for the pulp and paper sector originates from non-sustainable forest management practices (Barr, 2001). For timber, the proportion derived from natural forests is even higher. In 2000 the total annual processing capacity of the Indonesian wood industry (pulp and timber) equalled 74 million m3 RWE[7], but the area for which a concession license had been provided equalled only 23 million m3 RWE. Thus, a gap of 51 million m3 RWE per year (almost 70%) was sourced illegally (UNEP, 2007).

To convert a certain quantity of round wood equivalents (RWE) to forest area we need a conversion factor based on yield per hectare. Many studies have been conducted during the last three decades to determine yields per hectare in Indonesia. The results of the studies vary considerably, maximum clear-cutting yield is reported to be as high as 247 m3/ha in Kalimantan (Sist et al 1998), others refer to a maximum of 150 m3/ha for Indonesia as a whole (Schoening, 1978). Selective logging yields also vary considerably, for example 20 m3/ha (Schoening) to 40 m3/ha (Kuusipalo, 1997) and 67 m3 ha (Muladi, 1996). The studies refer to different regions which makes comparison difficult: in Kalimantan commercial yields are a lot higher than in Sumatra, where most of the forest is already degraded. In addition all studies are several years old and make use of even older data, therefore the reported yields per hectare may be an over estimation of the current yields per hectare. For calculating purposes, a national average yield figure of 40 RWE m3/ha will be used, representing the range from highly selective logging through to intensive logging associated with provision for the pulp and paper industry.

Timber or pulp sourced legally or illegally is generally not exploited in a sustainable way, i.e. leading to forest degradation. Several studies on Indonesian forest operations have indicated that timber-logging operations are extremely predatory (Schroeder-Wildberg and Carius, 2003; UNEP, 2007). It is assumed that only when certified by the Forest Stewardship Council (FSC) the logging or sourcing for pulp will not lead to forest degradation.

[7] Round Wood Equivalents

In order to quantify the contribution of the timber and pulp industry to Indonesian deforestation and forest degradation we need to know the proportion of timber and pulp obtained from:

1. pulp and timber plantations, managed sustainably (FSC) or not managed sustainably;
2. clear cutting of plantation concessions: these are columns (e) in tables 4 and 5;
3. legal selective logging in forest concessions;
4. illegal logging in natural forests.

Only from category (1) reliable information is available. Based on various assumptions and the above estimate of the proportion of pulp and timber illegally sourced, a best professional judgement would be that 10% of timber and pulp is obtained from forest plantations, 30% from other plantations, and the remaining 60% from selective (legal and illegal) logging in natural forests.

4. Best practices

In 2006, 740,000 ha of Indonesian forest were certified for sustainable forest management (FSC, 2007). It is assumed that the timber which does not originate from FSC-certified forests, leads to some form of forest degradation.

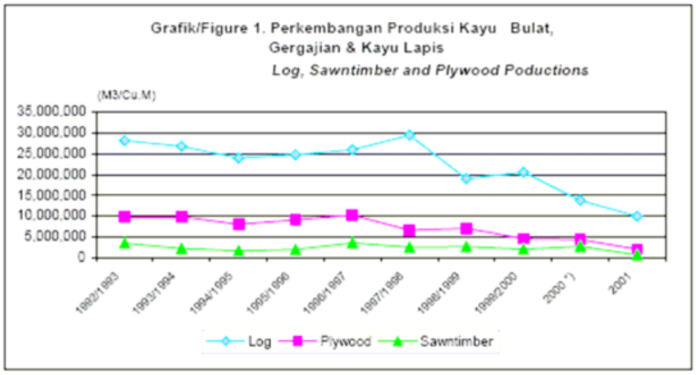
There are no records of the volume of Indonesian FSC timber imported by the Netherlands. However, it is safe to assume that before 2000, the Netherlands did not import any FSC timber from Indonesia. After 2000 the volume was still marginal. Based on information of Dutch timber traders and FSC Netherlands, the estimated volume of FSC timber imported to the Netherlands from Indonesia equalled in 2006 3,000 m3 RWE. Based on this information we assume that in the period 2001–2005 the Netherlands imported an annual average of 750 m3 RWE of Indonesian FSC timber. This quantity is expected to increase in the coming years.

5. Export data and share by the Netherlands

Timber

Available data of timber production in Indonesia show that production has shown a gradual decline over the years (figure 2). Table 6 gives a rough estimate of average annual timber production in Indonesia for two periods.

Figure 2: Trend of Indonesian timber production (logs, sawn timber and plywood) (Statistik Kehutanan Indonesia,



2001)

Table 6 lists the data on total Dutch timber imports (logs, sawn wood, plywood, veneer) from Indonesia, in m3 Round Wood Equivalent (RWE). The data for 2001 – 2005 are corrected for the average annual import of 750 m3 RWE FSC timber, as this quantity will not contribute to forest degradation or deforestation. It can be observed that the proportion of Dutch imports from total Indonesian timber production is very limited: 0.23% in the period of 1996–2000, and 0.74% in the period of 2001–2005. However, it must be stated that a considerable amount of Indonesian timber is being imported to the Netherlands through other countries, such as Belgium, Singapore, China and Malaysia and is not accounted for in this study.

Table 6: Indonesian timber production and Dutch timber imports from Indonesia (including (logs, sawn wood, plywood, veneer (x m3 RWE)

	1996 – 2000 Total	1996 – 2000 Annual average	2001 – 2005 Total	2001 – 2005 Annual average
Average annual timber production Indonesia (rough estimate)		80,000,000		30,000,000
Dutch timber imports from Indonesia	906,036	181,207	1,112,385	222,477
Proportion of Dutch imports		0.23%		0.74%

Sources: Indonesian timber production data are based on Indonesian statistics for 1998 (period 1996-2000) and for 2001 (period 2001-2005) Dutch timber data are based on Eurostat.
For conversion to m3 RWE, the round off FAO factors weigh- to-volume have been used: wood in chips (1.5 m3/t), wood in the rough (1.6 m3/t), veneers/plywood (1.4 m3/t)and an average m3 to m3 RWE conversion factor based on FAO and the Forestry Commission (UK), varying from 1 (wood in the rough) to 1.65 (veneer/plywood).

As indicated above, we will assume that of Dutch timber imports 60% is obtained by selective logging, and the remaining part is derived from forest conversion for plantation development.

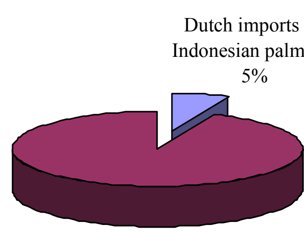
Palm oil

Table 7 lists the data on crude palm oil (CPO) production in Indonesia and Dutch CPO imports from Indonesia. It can be calculated that the proportion of Dutch imports from total Indonesian palm oil production has been about 5% in both periods of 1996 – 2000 and 2001– 2005 (figure 3). No change has taken place in spite of an absolute increase in Dutch imports, because of the strong Indonesian palm oil production increase in order to serve other producer markets (India, China).

Table 7: Average annual crude Palm oil Production in Indonesia (x 1,000 Mt) and Dutch imports from Indonesia			
	1996 – 2000	**2001 - 2005**	**Trend (%) 1991-2005**
Indonesian CPO production	5,810,519	10,765,000	85%
Dutch CPO imports from Indonesia	315,700	513,260	63%
Proportion Dutch CPO imports	5%	5%	

Source: Mielke, 2005

Figure 3: Dutch palm oil imports as a percentage of total Indonesian production



Pulp

Table 8 gives data on Dutch pulp imports from Indonesia, in metric tonnes. The proportion of Dutch imports from total Indonesian pulp production is very limited: 0.61% in the period of 1996– 2000, and 0.29% in the period of 2001–2005 (figures 4 and 5).

Table 8 – Average annual pulp production in Indonesia and Dutch pulp imports (x 1,000 Mt)		
	1996 – 2000	**2001 – 2005**
Average annual pulp production Indonesia	2,577,200	5,587,000
Average annual Dutch pulp import from Indonesia	15,691	16,102
Proportion of Dutch imports	0.61%	0.29%

Figure 4: Dutch pulp imports as a percentage of total Indonesian production 1996–2000

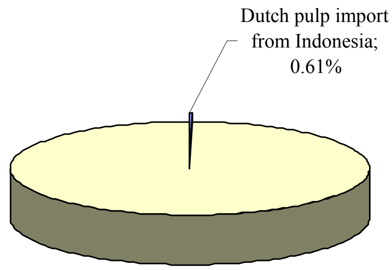
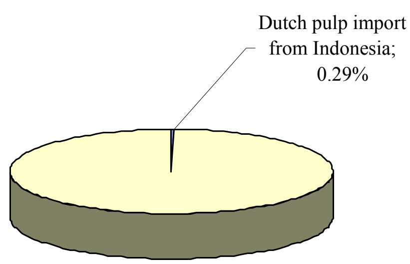


Figure 5: Dutch pulp imports as a percentage of total Indonesian production 2001–2005



6. Results and conclusions

The available data and calculations that were made can now be used to estimate the contribution by timber, pulp and palm oil to deforestation and forest degradation in Indonesia, and the proportion taken by imports in the Netherlands.

Contribution by commodities to deforestation and forest degradation
Of the 29 million ha of deforestation and an additional area of forest degradation that Indonesia has experienced between 1991 and 2005, the majority can be attributed to three main economic drivers: timber, pulp and palm oil production. Since these three economic drivers are closely interlinked in time and/or in space, it is difficult to indicate exactly the proportion of each of these drivers to deforestation. Also, the processes of forest degradation and deforestation are closely interlinked, as selectively logged forest is in most cases gradually being converted. However, it can

be safely stated that palm oil and pulp plantation development has triggered much deforestation and has allowed timber production to continue in spite of regulations to manage forest concessions.

There are indications that deforestation has been strongest in the period of 1996 – 2000 when the initial palm oil boom took place, illegal logging was rampant and also forest fires were very severe.

Dutch share in Indonesian deforestation
For *palm oil* the direct contribution to deforestation in Indonesia is presented in table 4. The Dutch contribution can be simply calculated as follows:

(proportion Dutch imports x ha deforestation as a result of palm oil production)

1996 – 2000: 5% x 1,408,000 = 70,400 ha
2001 – 2005: 5% x 851,000 = 59,570 ha

However, there are at two important indirect impacts of palm oil plantations on deforestation. One is the clearing of palm oil concessions to extract timber. As indicated in table 4, it is estimated that between 1990 and 2004 a total of 4.6 million ha has thus been cleared. This amounts to about 300,000 ha per year. Thus, the Dutch contribution, by its 5% contribution to stimulating the Indonesian palm oil sector, would be about 15,000 ha annually. Another argument to attribute this indirect deforestation to Dutch economic activities is the fact part of Dutch timber imports originate from forest clearing of plantation concessions.

Secondly, many fires have strong linkages with the palm oil sector, and in some years up to 5 million ha of forest land was destroyed by fire. We assume that these fires will not have contributed to additional deforestation as taken into account in the expansion of palm oil concessions as calculated above.

For *pulp* we assume that 10% of Dutch pulp is obtained from pulp plantations, 30% is obtained from areas which have been cleared for plantations (and thus is ignored in this calculation to avoid double-counting) and 60% of the pulp is obtained from natural forests (see section 3). For pulp, we therefore distinguish between the contribution to deforestation and to forest degradation.

Deforestation:
(proportion Dutch pulp sourced from pulp plantations x proportion Dutch imports x ha deforestation as a result of pulp production)

1996 – 2000: 10% x 0.61% x 250,000 = 153 ha
2001 – 2005: 10% x 0.29% x 251,000 = 73 ha
Forest degradation
(proportion Dutch pulp sourced from natural forests x total Dutch pulp import ÷ yield per hectare)

1996 – 2000: 60% x 78,455 ÷ 40 =1,177 ha
2001 – 2005: 60% x 80,510 ÷ 40 =1,208 ha

Similar to the palm oil sector, we can also determine indirect impacts to deforestation by clearing pulp plantations to extract timber. As indicated in table 5, between 1990 and 2004 a total of 2.6 million ha has thus been cleared. This amounts to about 170,000 ha per year. Thus, the Dutch contribution, by stimulating the Indonesian pulp sector, would be about 383 ha annually. Another argument to attribute this indirect deforestation to Dutch economic activities is the fact part of Dutch pulp imports originate from forest clearing of plantation concessions.

For *timber* the Dutch contribution to deforestation and forest degradation is determined by assuming, as explained above, that 60% of timber is obtained by selective logging of natural forests, at a yield conversion rate of 30 m3 RWE per ha (Table 9). The remaining 40% of timber is obtained from logging of areas assigned as palm oil and pulp plantations (and thus ignored in this calculation while it is included elsewhere).

(proportion Dutch timber sourced from natural forests x total Dutch timber import ÷ yield per hectare)

1996 – 2000: 60% x 906,036 ÷ 40 = 13,591 ha
2001 – 2005: 60% x 1,112,385 ÷ 40 = 16,686 ha

Conclusions
Table 10 shows that in the period 1996 – 2000 Dutch economic activities contributed annually to about 14,000 ha of deforestation in Indonesia, compared to an annual contribution of about 12,000 ha in the period 2001 – 2005. The decline took place in spite of increasing palm oil and pulp imports from Indonesia, but because the increase of palm oil and pulp plantations has been less in this second period (table 4). There is an additional indirect contribution to deforestation, by supporting the palm oil and pulp sectors in Indonesia, of more than 15,000 ha annually. One other argument to attribute this to Dutch economic activities is the fact that part of Dutch timber and pulp imports are derived from clearing palm oil and pulp plantation areas. Lastly, there is an area of about 3,000 ha annually degraded due to Dutch timber and pulp imports. Note that most degraded forest will sooner or later be deforested as the forest frontier tends to move forward and conversion of degraded forests proceeds (see section 2).

Table 10: Dutch contribution to deforestation in Indonesia 1996 – 2005 (ha)

Period	Total deforestation associated with palm oil	Total deforestation associated with pulp	Total deforestation due to Dutch imports	Annual average
1996-2000	70,400	153	70,553	14,110
2001-2005	59,570	73	59,643	11,929
Total	**129,970**	**223**	**130,196**	**13,020**

Table 11: Dutch contribution to forest degradation in Indonesia 1996 – 2005 (ha)

Period	Total forest degradation associated with timber	Total forest degradation associated with pulp	Total forest degradation due to Dutch imports	Annual average
1996-2000	13,591	1,177	14,768	2,954
2001-2005	16,686	1,208	17,894	3,579
Total	**30,277**	**2,385**	**32,662**	**3,266**

References

Barr, C. (2001). Profits on paper. The Political-Economy of Fibre and Finance in Indonesia's Pulp and Paper industries. Centre for International Forestry Research, Bogor, Indonesia.

DTE, 2002. Down to Earth Newsletter. No. 55, November 2002. Website (http:dte.gn.apc.org/55WP.htm). Viewed July 2007.

FAO, 2005. FAO, Global Forest Resources Assessment 2005, Progress Towards Sustainable Forest Management, FAO, Rome.

FERN, 2005. FERN, Greenpeace, WWF, Illegal Logging, Governance and Trade: 2005 Joint NGO Conference, 7th April 2005, EU Parliament of Brussels.

FWI/GFW, 2002. Forest Watch Indonesia, World Resources Institute, Global Forest Watch, The State of the Forest Indonesia, FWI, Bogor.

Holmes, 2002. Indonesia: Where Have all the Forests Gone? Environment and Social Development, East Asia and Pacific Region, Discussion Paper, World Bank, Washington.

Indonesian Ministry of Forestry, 2005. Presentation Indonesian Ministry of Forestry, Current Illegal Logging Situation in Indonesia, 14 November 2005.

Indonesian Ministry of Forestry, 2007. Website Ministry of Forestry Republic Indonesia, Forestry Statistics Indonesia (http://www.dephut.go.id/content.php?id=234&lev=1). Viewed July 2007.

FSC, 2007. Forest Stewardship Council, FSC Certified Forests, 08 May 2007. Website FSC (www.fsc.org). Viewed June 2007.

FSC Netherlands, 2007. Estimation of FSC Netherlands in personal communication June 2007.

Indonesia Guinness book of records, 2008. http://news.mongabay.com/2007/0504-indo.html. viewed August 2007.

Kuusipalo et al, 1997. J. Kuusipalo, J. Kangas and L. Vesa, Sustainable forest management in tropical rain forests: A planning approach and case study from Indonesian Borneo. Journal of Sustainable Forestry 5(3/4): 93-118.

Milieudefensie, 2004. Vet Fout, Palmoliebusiness Nekt het Regenwoud, Milieudefensie, Amsterdam.

Purnomo and Guizol, 2006. H. Purnomo and P. Guizol, State Forest Land Management after Deforestation. Paper presented at the Eleventh Biennial Global Conference of The International Association for the Study of Common Property (IASCP), Bali, 19–23 June, 2006.

Rautner, 2005. M. Rautner, M. Hardiono and R. J. Alfred, Borneo, Treasure Island at Risk, Status of Forest, Wildlife and related Threats on the Island of Borneo. Commissioned by WWF Germany, WWF Germany, Frankfurt am Main.

Schroeder-Wildberg and Carius, 2003. E. Schroeder-Wildberg and A. Carius, Illegal Logging, Conflict and the Business Sector in Indonesia, InWEnt, 2003.

Schoening, 1978. J.R. Schoening, Forest industry development in Southeast Asia: one company's experience and observations. In: Proceedings of Conference on Improved Utilization of Tropical Forests, May 21-26, Madison, Wisconsin. USDA, For. Serv., Forest Products Lab. p.159-164.

Sist et al, 1998. P. Sist, T. Nolan, J.-G. Bertault and D.P. Dykstra. Harvesting intensity versus sustainability in Indonesia. Forest Ecology and Management, 108: 251-260.

UNEP, 2007. UNEP and UNESCO, The Last Stand of the Orangutan, State of Emergency: Illegal Logging, Fire and Palm Oil in Indonesia's National Parks, UNEP.

Wakker, 2004. Greasy Palms, The Social and Ecological Impacts of Large-scale Oil Palm Oil Plantation Development in South East Asia. Commissioned by Friends of the Earth.

World Bank, 2000. Operations Evaluations Department, A Review of the World Bank's 1991 Forest Strategy and Its Implementation. World Bank, Washington.

World Bank, 2006. Sustaining Indonesia's Forests, Strategy for the World Bank 2006 – 2009, World Bank, Jakarta.

Country study 4 – Malaysia

Summary

Total deforestation in Malaysia over the period of 1995 to 2005 has been conservatively estimated at 1.1 million ha, with an annual average in the period of 2000-2005 of 140,000 ha and is concentrated in the regions of Sabah and Sarawak where expansion of palm oil plantations is most rapid. The degradation of primary forest is estimated at an average annual rate of about 143,000 ha over the same period. The main driver behind deforestation is the expansion of palm oil plantations while forest degradation occurs as a result of selective logging. The proportion of timber from permanent forest plantations is assumed to gradually increase.

The Netherlands is an important import country for Malaysian palm oil: the Netherlands imported annually 3% of the Malaysian palm oil production in the period 1996-2000 and 5% in the period 2000-2005. Dutch average timber imports are less important, increasing from 1.2% of Malaysian timber production in 1995-2000 to 2% in the next period. The Dutch contribution to deforestation and forest degradation in Malaysia is summarised in the following table. For both the Dutch contribution to Malaysian deforestation and forest degradation a significant increase can be observed.

Dutch contribution to deforestation and forest degradation in Malaysia 1996 – 2005 (ha)

Period	Deforestation associated with palm oil	Annual average deforestation	Forest degradation associated with timber	Annual forest degradation
1996-2000	13,200	2,640	8,220	1,644
2001-2005	16,000	3,200	16,500	3,300
Total	**29,200**	**2,920**	**24,720**	**2,472**

1. Trends in deforestation

Trends in deforestation

Malaysia's deforestation rate was 396,000 ha per year in the 1980s, or as much as 2% of the total forest area. Over the 1990-2000 period FAO reported an annual rate of deforestation in Malaysia of 238,000 ha (FRA 2000). However, in its FRA 2005, FAO reported an annual forest cover change in Malaysia of (only) 78,000 ha over the period 1995-2000 and 140,000 ha annually over the period of 2000-2005 (FRA 2000; FRA 2006; table 1). According to the FAO Forest Resource Assessment 2005 (FRA, 2006), the area of primary forest in Malaysia remained unchanged, but the extent of semi-natural forest declined and so did the area of productive plantations.

Deforestation in Malaysia results foremost from the conversion of natural forests into oil palm and tree plantations. Forest loss has been especially significant in Sabah and Sarawak where oil palm plantations, representing the primary drivers of deforestation, have been expanding particularly rapidly. The decline of forest plantations reflects the decline of rubber plantations (declining from 1.8 million ha in 1990 to 1.3 million ha in 2003) in favor of (mostly) oil palm plantations (FAO also classifies rubber plantations as forest plantations). Malaysia, however, also considers its pulpwood plantations and oil palm plantations as part of its forest cover.

Table 1: Deforestation in Malaysia 1995 – 2005		
Period	**Total deforestation**	**Annual deforestation**
1995-2000	390,000	78,000
2001-2005	700,000	140,000
1995-2005	1,090,000	109,000

Source: FRA, 2000; FRA, 2006

Trends in forest degradation

According to FAO (FRA, 2006), the area of primary forest in Malaysia remained unchanged in 1990-2005. This assessment is considered unreliable. According to FRA 1990, Malaysia's logging rates in the 1980s were as high as 455,000 ha per year, of which 84.7% took place in "newly logged forest". The proportion of timber obtained from Permanent Forest Reserves (PFR) – these are secondary forests used for logging, see below - in the early 1990's was estimated at 40% and is assumed to have gradually increased from 35% in 1995 to 45% in 2005. Thus, the proportion of timber derived from State Forests (primary forests) has declined over the same period from 65% to 55%. We estimate that in the 1995-2005 period about 2.4 million hectares of primary forest was degraded as a result of selective logging.

Table 2: Logging / forest degradation in Malaysia 1995 – 2005 (in hectares)			
Period	**Total area logged**	**Annual rate of logging**	**Annual rate of logging in primary forest (estimated at 85% logging in primary forest)**
1995-2000	1,050,990	210,198	136,629
2001-2005	1,360,000	272,000	149,600
1995-2005	2,410,990	482,198	143,146

Sources: Eighth Malaysia Plan (2001 - 2005), Malaysian Timber Council 2002; FAO 1993; Forest Resources Assessment. Tropical Forests. FAO Forestry Paper 112.

Logging intensity in Malaysia has been very high. In the 1980s, each hectare yielded on average 75 m3 (compared to 40 m3/annum for the tropics overall). In the late 1990s, the average yield per hectare, according to the 8th Malaysian National Plan was to be reduced to 55 m3 ha/yr.

2. Drivers behind deforestation

Initially the expansion of rubber and cacao plantations has been the main drivers of deforestation in Malaysia. In the past 15-20 years, oil palm plantations have been the main driver of forest conversion. Oil palm plantation expansion first took off in Peninsular Malaysia and Sabah, and at present most expansion takes place in Sarawak. Almost 2 million ha of oil palm plantation has been established between 1990 and 2005. Pulpwood plantations, which are expanding rapidly in Sarawak and Sabah since 2000, represent another significant deforestation driver although up to 2003, only 263,000 ha of plantations with merchantable timber were established. Forest conversion for oil palm takes place in the so-called State Forest land, a land use category where natural forests are to be converted into other land use.

Shifting cultivation is not a serious threat to forest cover in Malaysia, although in some areas it is still practiced (Sabah, Sarawak). Shifting cultivation in primary forests has not been a cause of forest loss for a long time now (Hong, 1987).

Forest degradation is mainly due to selective logging using damaging logging techniques, especially on sloping forest lands ("hill forests"). In Malaysia, selective felling takes place in Permanent Forest Reserves (PFR). The PFR is supposed to be managed in such a way that they produce timber on a sustained yield basis. However, there are ample reports of PFR areas still being released for conversion (Greenpeace, 2004). Secondly, there are concerns over the sustainability of logging techniques practiced, which are deemed damaging, particularly because logging techniques are not being adapted to the increasingly hilly conditions of remaining forests. Studies reported that logging damage in Sabah is as high as 60-80% of the forest area being damaged by timber extraction (Richard, 1999). According to the FAO, in 2005 a total of 11,824,000 ha of forest is under selective harvesting management (FRA, 2005).

In addition to legally endorsed logging, Malaysia's forests are also subject to illegal logging. In the period of 1996-2001 almost 700 offences were recorded in Peninsular Malaysia alone (Forestry Department, 2001). More recently, Malaysian media have been reporting on the occurrence of widespread "*gangsterism*" and criminal logging in Sarawak. In addition, Malaysia has been a major importer of illegal Indonesian timber, especially in the period 1999-2003. According to a conservative and partial estimate made by a consultant for the World Bank – WWF Alliance, Sarawak ports received 250,000-500,000 m3 of undocumented timber supplies from Kalimantan yearly. Another study for the World Bank – WWF Alliance, however, estimated that Malaysia imported about 3 million m3 of undocumented timber from Indonesia yearly.

3. Production of selected commodities and deforestation

Palm Oil and deforestation

As stated above, the expansion of oil palm plantations is at present the main driver causing deforestation in Malaysia. Table 3 provides an overview of the available data on oil palm expansion between 1980 and 2004. It can be observed that oil palm expansion has been continuous, but most intensive between 1995 and 2000 (Table 3 and 4). Oil palm plantation area has increased by more than 50% between 1995 and 2004 in terms of area planted. It can be observed that the increase has been far greatest in Sarawak (329% over this period) and Sabah (125% over this period), as compared to minor expansion in Malaysia mainland states. The largest oil palm growing states are now Sabah, Johor, Pahang and Sarawak accounting for 76% of the total planted area.

Table 3: Relative importance of oil palm production areas in oil palm producing Malaysian states In ha, sorted by size in 2004

	1980	1990	1995	2000	2004	Trend 95/04	Share 2004
Sabah	90,000	276,171	518,133	1,000,777	1,165,412	+ 125%	30%
Johor	288,883	532,866	587,686	634,716	666,368	+ 13%	17%
Pahang	276,464	439,663	498,417	514,710	578,848	+ 16%	15%
Sarawak	24,000	54,795	118,783	330,387	508,309	+ 329%	13%
Perak	122,610	236,385	265,427	303,533	302,938	+ 14%	8%
Terengganu	67,589	122,781	140,060	145,767	161,465	+ 15%	4%
Selangor	100,975	149,489	148,242	135,467	127,388	- 14%	3%
Negeri Sembilan	49,337	86,532	103,887	123,343	141,145	+ 36%	4%
Kelantan	18,238	60,490	70,834	72,065	87,644	+ 24%	2%
Kedah	11,211	29,296	37,166	57,375	72,321	+ 95%	2%
Malacca	12,184	26,856	36,278	43,859	49,586	+ 37%	1%
P. Pinang	8,116	14,149	15,174	14,665	13,868	- 9%	0%
Malaysia	**1,069,507**	**2,029,464**	**2,540,087**	**3,376,664**	**3,875,327**	**+ 53%**	**100%**

Different official sources, summarised and analysed in Kessler et al., 2007

Table 4: Oil palm area increase over different periods 1990 – 2005		
Period	**Total area increase (ha)**	**Average annual increase (ha)**
1980-1990	959,957	96,000
1990-1995	510,623	102,000
1995-2000	836,577	167,000
2000-2005 (2005 extrapolated from 2004)	623,329	125,000

Oil palm plantations have been established at the expense of natural forests, rubber plantations, other plantations (e.g. cacao, coconut) and agricultural lands. The following inputs are used to compute which share of oil palm expansion has contributed to deforestation:

- According to Malaysian Palm Oil Association (MPOA), about 2/3 of oil palm estates were converted from rubber, coconut and cacao plantations and the remaining 1/3 is assumed to have been forestlands (MPOA, 2003).
- Between 1995 and 2004 the decline of rubber plantations, considered to be part of forests, has been about 320,000 ha (FRA, 2005).
- Between 1990 and 2002 total area planted with rubber, coconut and cacao declined 842.000 ha (Casson, 2003).
- Between 1995 and 2004 the share of rubber production dropped from 39% to 29%, cacao and coconut together dropped from 13% to 4%, the share of food crops remained more or less the same (Wakker, 2003).
- The 8th Malaysian Plan 2001-2005 stipulated that in Malaysia in total 365,000 ha of new land was to be developed for agricultural development.

Based on these various inputs, we estimate that of the total oil palm area increase between 1995 and 2005 of 1.46 million ha, 350,000 was at the expense of rubber plantations, 400,000 ha was at the expense of other (cacao, coconut) plantations and agricultural lands, and the remaining 760,000 ha was at the expense of natural forest. This implies that of the total of about 1.1 million deforested between 1995 and 2005, 70% has been cleared for oil palm plantations. Of this total, deforestation in the period of 1995-2000 is set at 440,000 ha, being about 25% higher than in 2000-2005 (320,000 ha), which is in line with the data on area increase as summarised in table 4.

Logging and forest degradation

To calculate the forest area that is degraded due to logging, we need to know the proportion of timber obtained from permanent forest reserves relative to the proportion obtained from other forest lands and in particular primary forests. Based on maximum prescribed yields per hectare in Peninsular Malaysia, we assume that yield per ha of valuable timber species has been 60 m3 per ha. However, there are reasons to assume that yield per ha has declined in recent years as timber is increasingly obtained from hill forests which have a lower density of valuable tree species. Based on Malaysian timber production data (Forest Department Malaysia, various years) and above assumptions, we can calculate the proportion of timber originating from primary forest (table 5).

Table 5: Malaysian timber production, proportion from primary forest and area		
	1996 – 2000	**2001 – 2005**
Total area logged, see table 2 (x 1,000 ha)	1,050	1,360
Annual rate of logging (x 1,000 ha)	210	272
Area of primary forest affected by logging, see table 2 (x 1,000 ha)	137	150
Timber yield from primary forest (x 1,000 m3 RWE)	8,220	9,000
Average annual timber production Malaysia (x 1,000 m3 RWE)	30,000	20,000
Proportion obtained from primary forest (%)	27%	45%

4. Best practices

Palm oil

The Round Table for Sustainable Palm Oil (RSPO) was established in 2004 and with the objective to promote the production and marketing of sustainable palm oil. Most oil palm companies in Malaysia are member of RSPO and have, by becoming a member, accepted that any conversion of primary and High Conservation Value Forests after November 2005 are not certifiable as “sustainable production”. The RSPO verification mechanism is not yet operational. Therefore, no oil palm plantations in Malaysia meet the RSPO criteria.

Timber

Total export volume of MTCC certified timber increased up to 150,000 m3 in February 2007, and the total exported to the Netherlands in 2005 amounted to almost 17,000 m3 (MTCC, 2007), which is about 4% of 2000-2005 average annual imports (Table 7). MTCC timber is obtained from permanent forest reserves in a number of certified states in Peninsular Malaysia but does not guarantee sustainable production. The amount of FSC timber from Malaysia has been negligible.

5. Export data and share by the Netherlands

Palm oil

Table 6 lists the data on crude palm oil (CPO) production in Malaysia and Dutch CPO imports from Malaysia, as annual production data averaged for 5-year periods. It appears that the proportion of Dutch CPO imports from total Malaysian production increased from 3% in the period of 1996-2000 to 5% in the period of 2001-2005 (table 5, figures 2 and 3). The increase of Dutch imports significantly exceeds the increase of Malaysian palm oil production. Not all palm oil exported by Malaysia necessarily originates from Malaysian soil as Indonesia exports CPO to Malaysia which is then re-exported to third countries. This trade is not taken into account in this analysis.

Table 6: Average annual Crude Palm Oil (CPO) Production in Malaysia (x 1,000 Mt) per period of 5 years			
	1996 - 2000	**2001 - 2005**	**Trend (%) 1996-2005**
Malaysian CPO production	9.430	13.200	40%
Dutch CPO imports from Malaysia	251	631	151%
Proportion Dutch CPO imports	3%	5%	

Source: Mielke, 2000; Mielke, 2005

Figure 2: Dutch palm oil imports as a percentage of total Malaysian production 1996-2000

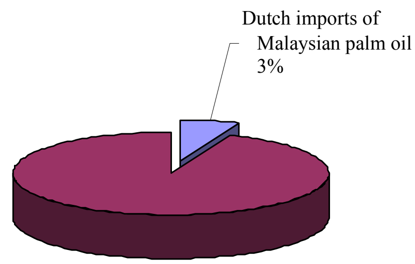
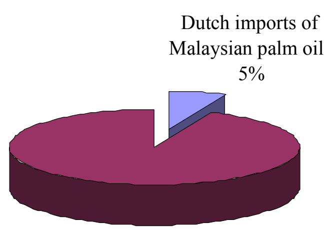


Figure 3: Dutch palm oil imports as a percentage of total Malaysian production 2001 - 2005



Timber

The Netherlands is a significant import country for tropical sawn wood from Peninsular Malaysia and to lesser extent Sabah. Sarawak is not a significant direct exporter to the Netherlands. Malaysian timber exports to the Netherlands ranged from 350,000 – 437,000 m3 annually in the period 1995-2005.

In the late 1990s and early 2000s, a major share of Malaysian timber exports were believed to be derived from (illegal) Indonesian imports. Based on estimates from various sources, as much as 69% of Malaysian red meranti exports to the Netherlands in 1999 may in fact have originated from Indonesian forests, mostly from illegal logging or trading operations (Fraanje, 2001). This trade is not taken into account in this analysis, as the data are not verified nor available for different periods.

Table 7 exhibits total Dutch timber imports (logs, sawn wood, plywood, veneer) from Malaysia between 1995-2005, converted in m3 Round Wood Equivalents (RWE).

Comparing Malaysian timber production (table 5) with Dutch timber imports from Malaysia (Table 7), we estimate that the proportion of Dutch timber imports from Malaysian timber production was 1.2% in the period of 1996-2000, and 2.2% in the period of 2001-2005.

Table 7: Dutch timber imports from Malaysia (including logs, sawn wood, plywood, veneer)		
	1996 – 2000 Annual average	**2001 – 2005 Annual average**
Dutch timber imports from Malaysia	350.000	437.000

6. Results and conclusions

The available data and calculations that were made can now be used to estimate the contribution by palm oil to deforestation and timber production to forest degradation in Malaysia, and the proportion taken by imports in the Netherlands.

Contribution by commodities to deforestation and forest degradation
Of the 1.1 million ha of deforestation that Malaysia has experienced between 1995 and 2005, an estimated 70% can be attributed to the economic driver of palm oil production. The remaining proportion may be attributed to pulp plantations, infrastructure and urban development, which will not be investigated as the Netherlands has no share in these developments.

There are indications that deforestation has been strongest in the period of 1996-2000 when the initial palm oil boom took place.

Dutch share in Malaysian deforestation
For *palm oil* the direct contribution to deforestation in Malaysia is presented in table 4. The Dutch contribution is calculated as follows:

(proportion Dutch imports x ha deforestation as a result of palm oil production)

1996 – 2000: 3% x 440,000 = 13,200 ha
2001 – 2005: 5% x 320,000 = 16,000 ha

It has been determined that of Malaysian timber production in the period of 1995-2000 about 27% was obtained from primary forest, while in the period of 2000-2005 this was 45% (tables 2 and 5). The Dutch contribution can be simply calculated as follows:

(proportion Dutch imports x ha primary forest annually degraded at average by logging)

1996 – 2000: 1.2% x 137,000 = 1,644 ha annually
2001 – 2005: 2.2% x 150,000 = 3,300 ha annually

However, for *timber* imported to the Netherlands the proportion of timber derived from primary forest may be higher because of the fact that mainly valuable timber species are imported as obtained from the primary forests.

Table 7 shows that in the period 1996 – 2005 Dutch economic activities contributed annually to about 3,000 ha of deforestation in Malaysia due to palm oil imports, with a substantial increase between 1995-2000 and 2001-2005 due to the increased import of palm oil. In the same period the Dutch contribution to forest degradation has also increased, again due to the increasing proportion of Dutch timber imports. The Dutch contribution to forest degradation through timber imports is estimated at about 23,000 ha in the 10 year period of 1996-2005. However, the area of degraded forest may be considerably higher for two main reasons. Firstly, we can take into account that valuable timber is increasingly obtained from hill forests which have lower timber yields per hectare. Secondly, we assumed that the share of timber from permanent forest plantations increased from 35% in 1996 to 45% in 2005. However, the timber imported to the Netherlands is mainly of high quality and may be obtained from primary forests mainly, which would increase the contribution by Dutch imports to forest degradation by about 60%.

Table 7: Dutch contribution to deforestation and forest degradation in Malaysia 1996 – 2005 (ha)

Period	Deforestation associated with palm oil	Annual average deforestation	Forest degradation associated with timber	Annual forest degradation
1996-2000	13,200	2,640	8,220	1,644
2001-2005	16,000	3,200	16,500	3,300
Total	**29,200**	**2,920**	**24,720**	**2,472**

References

Casson, A. 2003. Oil palm, soybeans and critical habitat loss. A review prepared for the WWF Forest Conversion Initiative. WWF, Gland, Switzerland.

FAO, 1997. State of the World's Forests 1997.

FAO 1993; Forest Resources Assessment. Tropical Forests. FAO Forestry Paper 112.

FAO, 2006. Global Forest Resources Assessment 2005, Progress towards sustainable forest management.

FAOSTAT, 2007. Website of the Statistics Institute of the FAO: http://faostat.fao.org/default.aspx. Viewed Juny 2007.

Forestry Department, 2001. Rampant forestry offences. New Straits Times 22, January 2001. Forest Department Malaysia, 2002. http://www.forestry.gov.my/index.html, viewed May 2003.

Fraanje P, 2001. Verantwoord toepassen van kozijnen uit duurzaam geproduceerd hout. TNO Bouw.

FoE, 2004. Greasy Palms. Friends of the Earth, London.

Greenpeace, 2004. Malaysian forestry: exporting destruction.

Hong, Evelyn. 1987. Natives of Sarawak: Survival in Borneo's Vanishing Forest. Pulau Pinang, Malaysia: Institut Masyarakat.

Kessler, J.J., J.M. Dros and I. de Bruin, 2007. Socio-economic impacts of agro-commodity expansion. Commissioned by The Netherlands Institute for Environmental Assessment (MNP), Bilthoven, the Netherlands.

Mielke, 2000. Oil World Annual 2000.

Mielke, 2007. Oil World Annual 2007, Vol. 1 up to 2006/07.

MPOA, 2003. Malaysia Palm Oil Association, Presentation at the Roundtable

MTCC, 2007. Newsletter April, 2007. http://www.mtcc.com.my/MTCC%20Newsletter/Issue8April2007.pdf

Richard, T (1999). Implementation of reduced impact logging in Sabah: the innoprise corporation Bhd experience. Conference on forestry and forest products research 1999. Series: 1-21.

Country study 5 – Cameroon, Democratic Republic of Congo (DRC) and Gabon

Summary

The main impact of industrial logging in this region relates to forest degradation. While total deforestation levels in Cameroon, DRC and Gabon over the period of 1995-2005 are estimated at 2.2 million ha, 4.3 million ha and 0.1 million ha respectively this is associated primarily with small-scale cultivation and small-scale local informal logging. Industrial logging is not a major direct cause of deforestation, because in this region it is selective, removing a maximum of two trees per hectare. Associated roads and other infrastructure required for industrial logging do have a direct impact on deforestation, but account for only small areas of forest loss. Indirect effects of logging on deforestation, via longer-term migration and land-use change, are difficult to predict, but will contribute to the national levels of deforestation associated with small-scale cultivation that are given above. Impacts of industrial logging on forest degradation are likely to be more pronounced. Selective logging involves damage to the vegetation beyond the logged trees, over the extended areas reached through selective logging. It can also have even greater impacts on biodiversity indicators, such as loss of species hunted for bushmeat.

The Netherlands is an import country for timber from Cameroon, DRC and Gabon: 1.0 to 4.7% of timber production in these countries was exported directly to the Netherlands between 2001 and 2005. In addition, there are major exports of wood for plywood manufacture that reach the Netherlands via intermediary processing countries. The total Netherlands imports have resulted in forest degradation amounting over the past ten years to 189,000 ha in Cameroon, 5,000 ha in DRC and 88,000 ha in Gabon.

Dutch contribution to deforestation and forest degradation from timber logging in Cameroon DRC and Gabon (ha)					
Period	Total deforestation associated with timber logging	Annual deforestation associated with timber logging	Total forest degradation associated with timber logging	Annual forest degradation associated with timber logging	Additional degradation associated with plywood
Cameroon					
1996-2000	142	28	124,684	21,238	3,699
2001-2005	122	24	109,707	18,237	3,699
1996- 2005	**264**	26	**234,363**		
DRC					
1996-2000	2	0.4	2,274	311	144
2001-2005	2	0.4	2,631	382	144
1996- 2005	**5**	0.5	**4,905**		
Gabon					
1996-2000	4	18	42,347	2,705	5,764
2001-2005	5	23	46,113	3,459	5,764
1996- 2005	4	**41**	**88,460**		

1. Trends in deforestation

Trends in deforestation

According to FAO figures, which are the most widely cited and accepted, forest cover (defined as land covering more than 0.5 ha with a canopy of at least 5m and 10%

cover) is 85% in Gabon, 59% in DRC and 46% in Cameroon. Since the plantation sector is negligible in these countries[8], these figures can be taken to mean the cover of natural forest. FAO figures indicate that the annual rates of deforestation in the three countries range from too small to measure in Gabon up to 0.9% per annum in Cameroon (Table 2). Independent remote sensing studies by the University of Bonn and the Congo Basin Forest Partnership give *lower* rates of deforestation for each of the countries (Table 2). The trend over the past 15 years is a fairly constant or slightly decelerating rate of deforestation (Table 2).

Table 1: Forest cover in 2005 in thousand ha (FAO 2005)

Country	Forest	Other wooded land	Other land	% forest cover	Most recent forest survey
Cameroon	21,245	14,758	10,537	46%	2005
DRC	133,610	83,277	9,819	59%	1989
Gabon	21,775	0	3,992	85%	1999

Table 2: Annual rates of deforestation 1990-2005 (FAO 2005)

Country	Forest cover 1990 (thousand ha)	Annual rate 1990-2000 (thousand ha)	Annual rate 1990-2000 (%)	Annual rate 1990-2000 (Uni Bonn figures)
Cameroon	24,545	220	0.9	0.21
DRC	140,531	532	0.4	0.25
Gabon	21,927	10	negligible	0.12
Country	**Forest cover 2000**	**Annual rate 2000-2005 (ha)**	**Annual rate 2000-2005 (%)**	**Annual rate (CBFP figures)**
Cameroon	22,345	220	1.0	0.19
DRC	135,207	319	0.2	0.19
Gabon	21,826	10	negligible	0.12

[8] According to the FAO 2005 data, Gabon has 36,000 ha of plantations, unchanged since 1990. There are no data on plantations in Cameroon or DRC. But according to the FAO 2000 data, Cameroon has 80,000 ha plantations and DRC 97,000 ha. WWF (2005) states that the only sizeable plantation in the Congo Basin was in Congo Brazzaville, but has been abandoned. Prospects for development of a plantation sector are low. DRC: palm oil plantations. Chinese company is planning a 3 million hectares palm oil plantation.

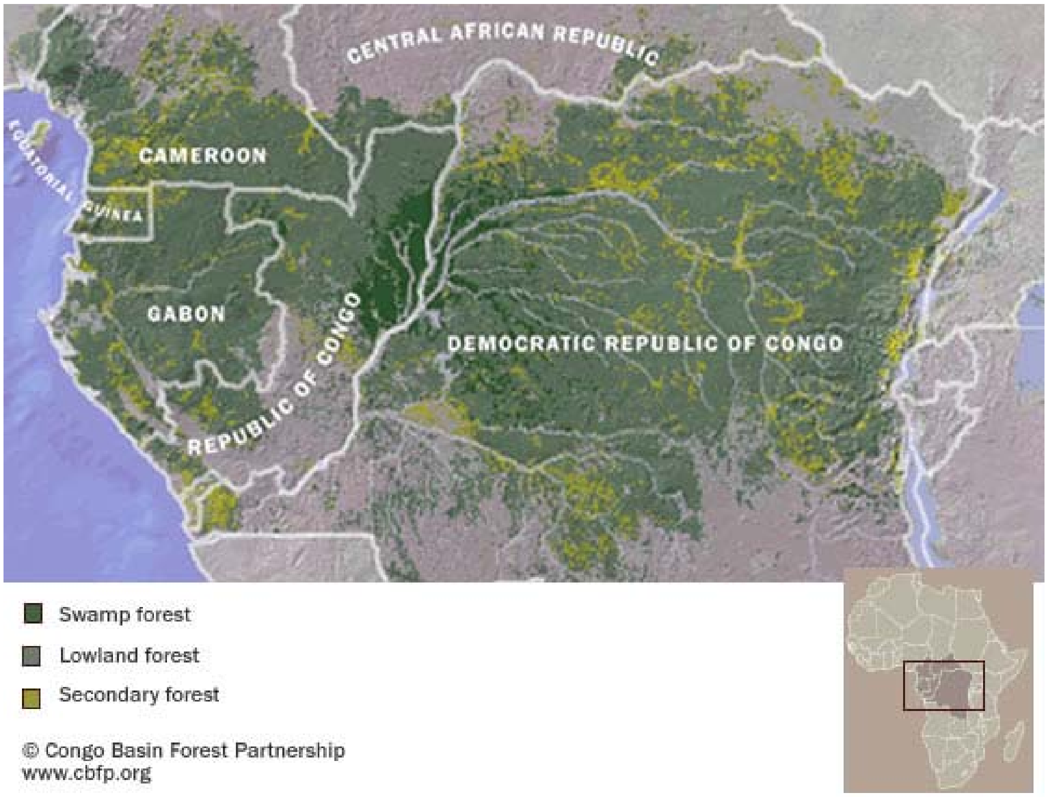


Figure 1. Forests of the Congo Basin

Trends in forest degradation

No data have been submitted to the FAO from Gabon, DRC or Cameroon on forest degradation (in FAO terminology, figures for primary and for modified natural forest). Measuring degradation of tropical forests continues to be an enormous technical challenge due to the high resolution required to detect the fine pattern of tree removal (Curran and Trigg 2006; Asner et al. 2006). The area of the Congo Basin affected by forest degradation has been estimated as 40% of total (Curran and Trigg 2006 using the data of Laporte and Lin 2003), but this figure is based simply on the area that has been allocated to concessions. Zhang et al. (2005) used remote imagery to show that an average of 0.12% (ranging from 0.01 to 0.77% among sites) of forest was degraded annually in the Congo Basin in the 1980s and 1990s. CBFP (2006) estimates current degradation rates of 0.04% to 0.13% for different forest landscapes in the region, giving composite country figures as shown in Table 3. These figures are based on remote sensing studies and provide the best current estimates.

Considering the Zhang and et al. (2005) and CBFP (2006) figures side by side, there is no clearly discernible trend in forest degradation over the past 15 years. Unfortunately there are no trend figures for specific forests or forest landscapes that could add insight on patterns of forest degradation.

It is important to note that these remote sensing studies on forest degradation are groundbreaking in their sophisticated measurements of loss of small numbers of trees from the forest canopy. However, they only measure loss of canopy trees and do not detect other aspects of forest degradation, such as changes in species composition. In particular, these studies do not measure the loss of fauna (species present, numbers of animals, population structures) in the forest.

Table 3: Annual rates of forest degradation (CBFP 2006)	
Country	**Estimated current rate**
Cameroon	0.02%
DRC	0.02%
Gabon	0.09%

2. Drivers behind deforestation and degradation

A broad consortium of researchers and practitioners (Congo Basin Forest Partnership 2006) has worked together to identify the main direct and indirect drivers of deforestation and degradation. In the absence of a developed plantation agriculture sector, cultivation and small-scale local informal logging remain the main direct drivers of deforestation (Table 4). Essentially deforestation in the Congo Basin can be said to be "poverty-driven" (associated with small-scale farming and driven by rural population size) rather than "capital-driven" (associated with large-scale land use conversion to plantation crops)[9]. Of course, this situation may change in future with changes in global economic conditions and national policies, for example if a large-scale biofuels programme is adopted.

Forest degradation is associated with a wider set of drivers than deforestation (Table 4). The most important driver of forest degradation, impacting on the faunal rather than the floristic structure of the forest, is hunting for bushmeat (CBFP 2006). Impacts on animal populations such as great apes can be severe (van Gelder et al. 2005). Bushmeat hunting can be associated with industrial logging, as explained in the next section – and industrial logging is itself a driver of forest degradation. Industrial logging is considered a medium threat to forests (CBFP 2006) but this degree of threat could change in the future as more concessions are allocated and the level of activity is stepped up.

Table 4: Direct and indirect drivers of deforestation and degradation in the Congo Basin (based on Congo Basin Forest Partnership 2006)

	Deforestation	Degradation
Direct drivers	Shifting cultivation (but low impacts) Permanent cultivation (in limited areas) Informal logging	Poaching and trade in bushmeat Ivory trade Shifting cultivation Unsustainable industrial logging (Informal logging) Mining Oil extraction Inland fishing Diseases Invasive species
Indirect drivers	Population growth, road construction, urbanisation, lack of development of national parks, climate change, pollution, marine fishing, urbanisation, displaced populations and conflicts, world energy requirements (biofuels)	

3. Production of selected commodities and forest degradation

Industrial logging is a direct driver of forest degradation but *not* a direct driver of deforestation. This is because industrial logging in the Congo Basin is based on

[9] see Geist and Lambin (2001) for a more detailed analysis

selective logging of high-value species rather than on clear-felling (Ruiz Perez et al. 2005; van Gelder et al. 2005; CBFP 2006). The only direct cause of deforestation caused by logging is through creation of infrastructure (access roads, logging yards, camps, sawmills etc). These remove up to 2% of the forest concession area, for the duration of the logging work (CBFP 2006, based on three field studies). It seems unlikely that over the study period there was a transition from selective logging through to deforestation in the Congo Basin as there is currently no "forest frontier" associated with agricultural expansion. This situation could change in the future if an agricultural plantation sector develops.

Definition of forest degradation: For the purposes of this study, we define forest degradation as loss of trees and woody biomass that does not amount to conversion of forest to non-forest (FAO definition) but does involve change in structure, species composition and productivity. Following forest degradation, recovery may be possible to a species composition and vegetation structure similar to the pre-logged state, though this could take several generations.

Impacts of selective logging on forest degradation

Rates of extraction are low, at about 0.7-2 trees per hectare (Ruiz Perez et al. 2005, based on four field studies in Gabon and Cameroon). In volume terms, field studies suggest that extraction is about 11 m^3 per ha (Brown et al. 2005). This compares with FAO figures of 7-13 m^3 per ha for Gabon and 6-8 m^3 per ha for Cameroon (FAO 2000). Averaging out extraction over the full area of a concession gives production figures of 0.24 and 0.12 m^3 per hectare for Cameroon and DRC respectively (CBFP 2006; no data for Gabon, which would be expected to have higher offtake similar to Cameroon due to more intensive forest management).

Extraction figures are not entirely accurate indicators of forest degradation, because surrounding vegetation is damaged during removal of logs. A field study in Congo Brazzaville to estimate carbon loss found that 10.20 t/ha (+/- 1 t/ha) was lost per hectare through industrial logging and that 7.24 tonnes of this was through damage to vegetation around the logging site, along skid trails and along access roads (Brown et al. 2005). As comparative data show, damage is relatively lower in the Congo Basin than in the Amazon or South-East Asia because smaller numbers of larger poles are removed. The additional damage does not add to the hectares degraded since the damage occurs within the same area.

Pathways from forest degradation to deforestation

There are two main pathways by which degradation can lead to deforestation. The first of these is that degradation can cause sufficient disturbance to prevent forest recovery. Over time, good regeneration can occur in secondary or disturbed forest (5, 10 and 40 years old), especially of high value timber trees (Makana and Thomas 2006), including okoume (van Gelder et al. 2005). But current extraction rates, though low, may impact in the long-term on species composition. A study to model recovery of two heavily logged species in the Congo Basin (*Entandrophragma cylindricum* and *Triplochiton scelroxylon*) suggests that extraction rates would need to be 22% and 53% lower respectively to achieve ecological sustainability i.e. maintenance of a constant frequency and age structure of the local population of the species (Karsenty and Gourlet-Fleury 2006). The authors argue that on the basis of economic and social sustainability, the aim should be to reach these targets at a landscape level rather than in every concession.

The second pathway is related to the indirect impacts of logging through population increase in the logging areas. The patterns here are more complex. Deforestation in the Congo Basin is known to be associated with high population densities, where land is cleared for settlement and permanent agriculture (CBFP 2006). There is a relationship between roads and forest clearance – typically a narrow ribbon of fields and residences along each side of a road. Logging operations open up previously inaccessible areas and encourage an influx of people, both the direct employees of the logging operations and secondary immigrants attracted by economic activities associated with the logging operations. A field study of logging towns in Congo Brazzaville showed an exponential relationship between the population size of the town and conversion of land from forest to agriculture and bare soil, though no tests were done for statistical significance (Lin et al. 2003). There are few economic opportunities following the end of logging operations, so under current conditions in the Congo Basin, logging towns are likely to end up as "ghost towns" rather than leading to permanent conversion of forest landscapes.

Overall, within the timeframe covered under this study, the pathways from forest degradation to deforestation are negligible for Cameroon, DRC and Gabon. However, it is important to be aware of the possible pathways when considering the set of future scenarios for the national economies and rural land use in the three countries.

4. Best practices

Best practices in timber extraction in Cameroon, DRC and Gabon are shown in Table 5. FSC Netherlands reports that 1000 m^3 of certified wood was imported from each of Cameroon and Gabon in 2005, with none from DRC.

Table 5: Good forest practice in Cameroon DRC and Gabon

Good practice	Countries	Extent	Source
Certification in natural forest	Cameroon DRC Gabon	41,965 ha under FSC (0.7% of allocated concession area) 0 ha (0 %) 0 ha (0 %) under FSC but 2 concessions totalling 868,441 ha (6.7%) under other schemes	FSC 2007 CBFP 2006
Forest concession Monitoring System in Central Africa (FORCOMS) – voluntary and independent monitoring of (a) legality and (b) sustainability, implemented 2004	Cameroon, Gabon (plus CAR and Congo Brazzaville)	Still in pilot phase	www.illegal-logging.info
Conservation areas within concessions	Cameroon DRC Gabon	245,356 ha (4.3% of allocated concession area) no data 114,836 ha (0.9%)	CBFP 2006

Examples of good practice in forest policy include:

- Independent forest monitoring (Cameroon 2000-2005: Global Witness)
- Working system for concession management plans (Cameroon, Gabon: CBFP 2006)

- Tax incentives for sustainable forest management (Cameroon, DRC, Gabon: CBFP 2006)
- Allocation of a share of timber royalties to communities (Cameroon, DRC, Gabon: CBFP 2006)
- Community forest concessions (Cameroon: Ruiz Perez et al. 2005; CBFP 2006)
- Prosecution of companies that infringe forest laws (Cameroon: Greenpeace 2005; CBFP 2006)
- Cooperation on conservation and SFM via Central Africa Forests Commission (COMIFAC) (Cameroon, DRC, Gabon, plus CAR, Congo Brazzaville, Equatorial Guinea, Chad: www.comifac.org)

5. Export data and share of the Netherlands

Timber production and export data for Cameroon, DRC and Gabon are shown in Table 6. The production data are likely to be underestimates, given the difficulties with data collection in the region. Production data pre-2000 are very unreliable and estimates are not presented here.

Table 6: Industrial logging production and exports in 2005

	Production (thousand m^3)	**Log exports**		**Exports of sawn & processed wood**	
Country		**(thousand m^3)**	**% of total production**	**(thousand m^3)**	**% of total production**
Cameroon	2,375	141	6	758	32
DRC	90	58	64	15	17
Gabon	3,700	1,517	41	515	14

Source: CBFP 2006

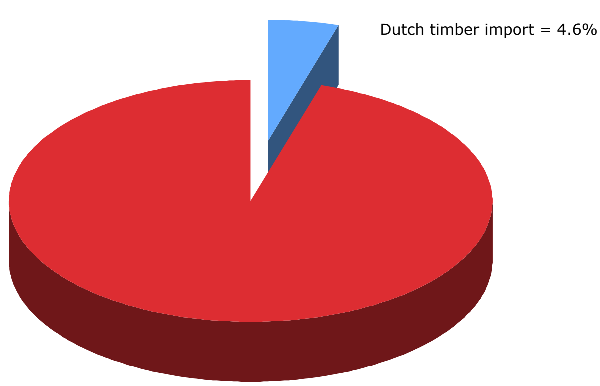
Table 7 shows the data on total Dutch timber imports (logs, sawnwood, plywood, veneer) from Cameroon, DRC and Gabon in m^3 Round Wood Equivalent (RWE). . Note that Cameroon and Gabon account for 80% of EU timber imports from the Congo Basin (WWF 2005).

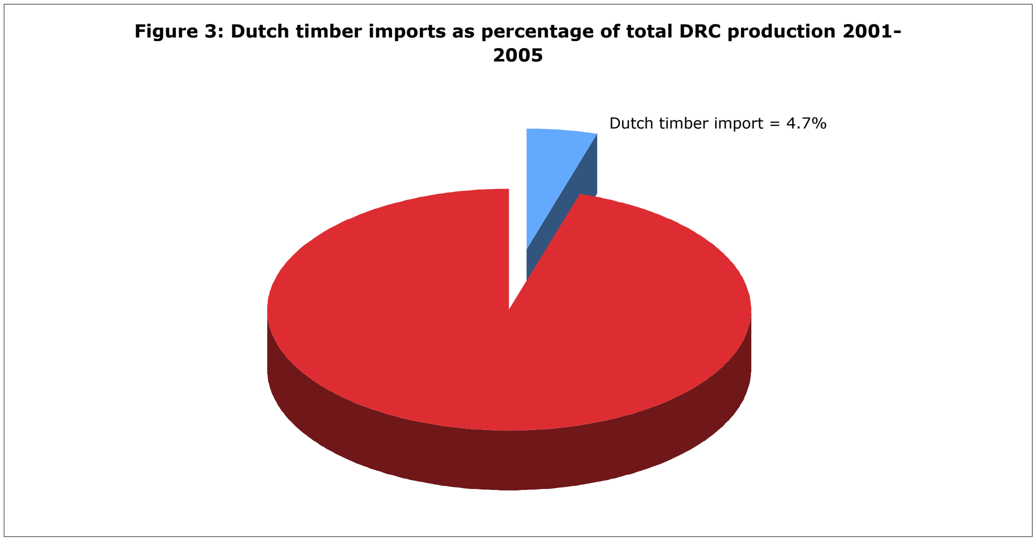
In addition to these direct imports, it is well documented that the raw materials for the 46,500 m^3 of tropical plywood (105,681 m^3 RWE using the FAO global conversion figure for veneer) that the Netherlands imported in 2003 from the intermediary processing countries China and Morocco was sourced in the Congo Basin (van Gelder et al. 2005).

Table 7: Dutch timber imports as a percentage of exports from Cameroon DRC and Gabon (m^3 RWE including logs sawn wood plywood and veneer)					
Country	**1996-2000**		**2001-2005**		**% 2001-2005 production imported to Netherlands**
	Total	**Annual average**	**Total**	**Annual average**	
Cameroon					
Timber production		Not estimated		2,375,000	
Dutch timber imports	1,168,078	223616	1,003,336	200,667	4.6
DRC					
Timber production		Not estimated		90,000	
Dutch timber imports	17,092	3,418	21,018	4,204	4.7
Gabon					
Timber production		Not estimated		3,700,000	
Dutch timber imports	148,796	29,760	190,222	37,044	1.0

Sources: 2001-2005 production data from CBFP figures for 2005; Dutch import data from Eurostat; conversion to m^3 using the FAO figure for tropical hardwoods volume-mass (1.37 m^3/t) and the global FAO conversion factor of 2 for sawnwood to roundwood (0.5) for the proportion of exports in sawn form

Figure 2: Dutch timber imports as percentage of total Cameroon production 2001-2005





6. Results and conclusions

The data and evidence above can now be used to estimate the contribution made by Dutch imports of timber and timber products from Cameroon, DRC and Gabon to deforestation and forest degradation in those countries. The contributions to degradation and to deforestation is calculated by assuming that 100% of timber is obtained by selective logging in natural forests, at a yield conversion rate of 11 m^3 per ha, with 2% deforestation due to infrastructure, spread over the 15-year timespan of a typical concession (see Section 3 for sources of data and rationale). Imports of tropical plywood from intermediary countries are also included and split proportionately according to production among Cameroon, DRC and Gabon, assuming a constant rate of import over the 10-year period. The calculations do not include the imports of FSC certified timber from Cameroon and Gabon in 2005. This would reduce the total degradation in each case by about 180 ha.

Dutch contribution to deforestation and forest degradation from timber logging in Cameroon DRC and Gabon (ha)					
Period	Total deforestation associated with timber logging	Annual deforestation associated with timber logging	Total forest degradation associated with timber logging	Annual forest degradation associated with timber logging	Additional degradation associated with plywood
Cameroon					
1996-2000	142	28	124,684	21,238	3,699
2001-2005	122	24	109,707	18,237	3,699
1996- 2005	**264**	26	**234,363**		
DRC					
1996-2000	2	0.4	2,274	311	144
2001-2005	2	0.4	2,631	382	144
1996- 2005	**5**	0.5	**4,905**		
Gabon					
1996-2000	4	18	42,347	2,705	5,764
2001-2005	5	23	46,113	3,459	5,764
1996- 2005	4	**41**	**88,460**		

The current contribution of industrial logging to deforestation and forest degradation (and how Dutch imports contribute to this) appears very low given the vast areas of forest in Cameroon, DRC and Gabon. But these results are not a justification for complacency on the status of intact forest landscapes in this region. There are two key issues to bear in mind:

1. Future trends: While population densities remain low and the governments of the region do not promote large-scale expansion of agricultural plantations, impacts will remain low. But a number of factors could precipitate a shift into rapid pushing back of the forest frontier, as seen in South-East Asia and the Amazon. Most importantly we could see a shift in economic priorities towards large-scale industrial agriculture, caused by factors such as the decline in oil reserves and escalation in global demand for biofuels.
2. Indicators of forest degradation: Low areas of forest degradation measured in terms of selective loss of trees and woody biomass mask other, potentially much more serious, losses to forest quality. In particular there are major impacts on biodiversity, including to highly valuable timber species (e.g. okoume, in DRC Wenge and Afrormosia) and to species of great apes (due to disturbance of habitat and poaching).

References

Asner, G.P., Broadbent, E.N. and Oliveira, P.J.C. 2006. Condition and fate of logged forests in the Brazilian Amazon. *Proceedings of the National Academy of Sciences* 103:12947–50.

Brown, S., Pearson, T., Moore, N., Parveen, A., Ambagis, S. and Shoch, D. 2005. Impact of selective logging on the carbon stocks of tropical forest: the Republic of Congo as a case study. Winrock USA report to USAID.

CBFP 2006. The Forests of the Congo Basin: State of the Forest 2006. Congo Basin Forestry Partnership. www.cbfp.org

FAO 2000. Forest Resources Assessment 2000. Food and Agriculture Organisation of the United Nations.

FAO 2005. Forest Resources Assessment 2005. Food and Agriculture Organisation of the United Nations.

Geist, H.J. and Lambin, E.F. 2001. What drives tropical deforestation: a meta-analysis of proximate and underlying causes of deforestation based on subnational case study evidence. LUCC Report Series No.4. LUCC International Project Office, University of Louvain, Belgium.

Greenpeace 2005. Illegal logging in Cameroon: how French government action is fuelling rainforest destruction. Greenpeace Netherlands.

Greenpeace 2007. Carving up the Congo. Greenpeace UK.

ITTO 2005. Status of tropical forest management 2005. International Tropical Timber Organisation, Japan.

Karsenty, A. and Gourlet-Fleury, S. 2006. Assessing sustainability of logging practices in the Congo Basin’s managed forests: the issue of commercial species recovery. *Ecology and Society* 11: 26.

Laporte N.T. and T.S. Lin. 2003. Monitoring logging in the tropical forest of Republic of Congo with Landsat imagery. Proceedings of the International Geoscience and Remote Sensing Symposium (IGARSS), 21-25 July 2003, Toulouse , France, Vol. IV:2565-2567.

Lin, T.S., Laporte, N.T. and Devers, D. 2003. Impacts of large-scale selective logging on ecosystem services in the northern Republic of Congo. AGU Chapman Conference on Ecosystem Interactions with Land Use Change, 14-18 June 2003, Santa Fe, New Mexico, USA.

Makana, J-R. and Thomas, S. 2006. Impacts of selective logging and agricultural clearing on forest structure, floristic composition and diversity, and timber tree regeneration in the Ituri Forest, Democratic Republic of Congo. *Biodiversity and Conservation* 15: 1375-1397.

Rainforest Foundation and Forests Monitor 2007. Concessions to poverty: the environmental, social and economic impacts of industrial logging concessions in Africa’s rainforests.

Rudel T.K., Coomes O.T., Moran E., Achard F and Angelsen, A. 2005. Forest transitions: towards a global understanding of land use change. *Global Environmental Change-Human and Policy Dimensions* 15: 23–31.

Ruiz Pérez, M. et al. 2005. Logging in the Congo Basin: a multi-country characterization of timber companies. *Forest Ecology and Management* 214: 221-236.

Van Gelder, J.W., van der Hoeven, C., Kessler, J.J., de Vries, D. and Wakker, E. 2005. Great apes in danger through okoume plywood production. Study commissioned by the International Fund for Animal Welfare (IFAW). Profundo and AIDEnvironment.

White, L. J. T. 1994. The effects of commercial mechanised selective logging on a transect in lowland rainforest in the Lope Reserve, Gabon**.** *Journal of Tropical Ecology*, Volume 10: 313-322.

WWF 2005. Failing the forests: Europe’s illegal timber trade. WWF-UK.

Zhang, Q., Devers, D., Desch, A., Justice, C. and Townshend, J. 2007. Mapping tropical deforestation in Central Africa. *Environmental Monitoring and Assessment* 101: 69-83.

Country study 6 - Timber from Côte d'Ivoire

Summary

After a prolonged period of deforestation between the 1960s and the 1990s, net afforestation has occurred since 1990 in Côte d'Ivoire, associated with the expansion of the timber plantation sector. The area of primary natural forest has remained constant over this period at 625,000 ha. Industrial logging is not a direct cause of deforestation, because in this region logging is selective, though data on extraction rates are not available and must be extrapolated from empirical studies elsewhere in the region. As in the Congo Basin, roads and other infrastructure are the only direct cause of deforestation associated with logging. They account for only small areas of forest loss. Indirect effects of logging on deforestation, via longer-term migration and land-use change, are likely to be minimal. Industrial selective logging does cause forest degradation. It is important to note however that a sizeable proportion of selective logging occurs in secondary forest that has already been degraded by earlier logging and shifting cultivation.

The Netherlands is an import country for timber from Côte d'Ivoire, importing about 1.4% of annual production between 2001 and 2005. These imports have resulted in forest degradation in primary forest amounting over the past ten years to 2,000 ha.

Dutch contribution to deforestation and forest degradation in Côte d'Ivoire (ha)				
Period	**Total deforestation associated with Dutch timber imports**	**Annual average**	**Total forest degradation associated with Dutch timber imports**	**Annual average**
1996-2000	50	10	1,881	376
2001-2005	24	5	917	183
1996-2005	**75**	7	**2,798**	**280**

1. Trends in deforestation

Trends in deforestation

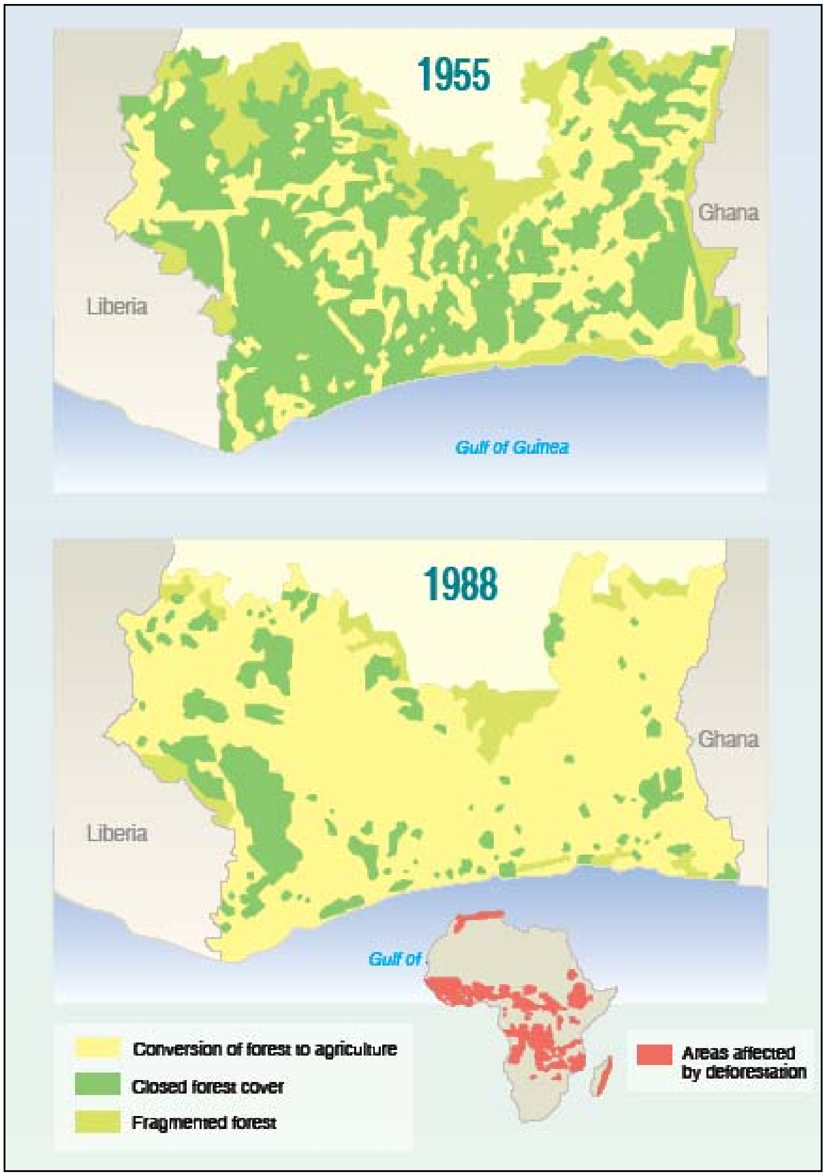
Between the 1960s and the 1990s, there was rapid deforestation in Côte d'Ivoire, with loss of as much as 83% of the 16 million hectares of tropical forests that existed in 1960 (Koudou and Vlosky 1997). The decline appears dramatic (Figure 1) – though these kinds of figures are disputed, as discussed in the next section. Since the 1990s there has been a turnaround at the national level, with net *afforestation* recorded since 1990 (Table 1). It is important to note that of the 10.5 million ha of forest remaining in Côte d'Ivoire in 2005, only 625,000 ha are primary forest (FAO 2005).

Table 1: Annual rates of afforestation 1990-2005 (FAO 2005)						
Forest cover 1990 (ha)	**Annual rate 1990-2000 (ha)**	**Annual rate 1990-2000 (%)**	**Forest cover 2000 (ha)**	**Annual rate 2000-2005 (ha)**	**Annual rate 2000-2005 (%)**	**Forest cover 2005 (ha)**
10,220,000	11,000	0.1	10,328,000	15,000	0.1	10,405,000

Trends in forest degradation

Statistics for forest degradation are not available for Côte d'Ivoire. As the next section explains, there is some debate over the true extent of intact forest landscapes over the past century, given the high densities of human population in the high forest coastal zones. As noted above, according to FAO figures, only 625,000 ha of forest (6%) in Côte d'Ivoire is primary forest. Intact forest landscapes are confined to the western border with Liberia (Greenpeace 2006). The plantation sector is growing in Côte d'Ivoire, from 150,000 ha in 1990 to 261,000 ha in 2000 and 337,000 ha in 2005 (FAO 2005). The remaining ~10 million ha of forest in the country is secondary (degraded) forest. Just over 11% of the country's forests are legally protected in a system of forest reserves (*forêts classées)*, but many of these forests are known to be degraded (Okali and Eyog-Matig 2004). Fire has been a major problem in high forest as well as savannah since the early 1980s, due to the extensive opening of the canopy (Oura 1999).

Figure 1. Deforestation in Côte d'Ivoire
(Source: UNEP)



2. Drivers behind deforestation and degradation

Côte d'Ivoire has a relatively high population density near the coast (in spite of a relatively low population density averaged over the country; CSAEHT 1993), and a complex and turbulent history. Hence there are multiple drivers behind the visible patterns of deforestation and afforestation. The simplest narrative of change in the 20th century is that forest cover declined with population expansion through the first half of the century and then there was rapid deforestation after 1960 with the post-independence expansion of the large-scale plantation sector (coca, coffee, bananas etc). More detailed analysis of drivers of deforestation and degradation have drawn attention to the greater importance of prevailing policy conditions than population growth (Verdeaux 1998) and questioned the interpretation of uninterrupted forest decline pre-1960 and post-1960 (Fairhead and Leach 1998). For the purposes of this study, it is sufficient to note that deforestation in Côte d'Ivoire has historically been both "poverty-driven" and "capital-driven" (see Geist and Lambin 2001 for a full explanation of this distinction).

In terms of forest degradation, Fairhead and Leach (1998) argue that forest landscapes in Côte d'Ivoire have a much greater history of human disturbance than acknowledged in deforestation statistics. Much of what has been reported as primary forest cover is in fact a mix of disturbed forest, secondary forest and planted tree gardens. This is illustrated by their quote from a traveller in Côte d'Ivoire in 1955: "Seen from the summit of a hill, the landscape appears as a sea of trees... but when one... travels over it following the tracks, one sees that over vast areas this actually corresponds with a corpse: the forest has been destroyed, with only a few large trees surviving, in whose shade are palm, coffee, cocoa, and cola plantains, and fields of manioc and yam. Each village is therefore at the centre of a zone not dewooded – large trees exist everywhere, and species cultivated are small trees, bushes and giant fortes, but deforested. High forest has been replaced by a mosaic of plantations, fields and bush fallows of small secondary woods."

In the 21st century, civil war has also been a driver of forest degradation. The UN noted, for example, that Côte d'Ivoire officially exported 265,000 tonnes of timber in the first half of 2004, only slightly less than the 270,660 tonnes shipped in the first six months of 2002, before the civil war erupted (UN Office for the Coordination of Humanitarian Affairs 2004). Forests in rebel-held areas were also used as a timber resource to fund activities.

3. Production of selected commodities and deforestation

Timber for export from Côte d'Ivoire is extracted from the following three sources: timber plantations, logging concessions or illegal logging in primary and secondary natural forest, and clearance of forest for large-scale agriculture. The third source is no longer important, since the large-scale plantation sector has been stagnant since 1999, with falling outputs and a hold on expansion (IMF 2007). The area of actively productive timber plantations is estimated at 167,000 ha, compared to 3,400,000 ha actively productive natural forest (ITTO 2005), a ratio of 1:20 or 5% to 95%. As for split of logging between primary and secondary forest, the assumption is 6% to 94% based on the area of the two forest types. Primary forests are likely to have more attractive species for logging, but to be less accessible and hence less economically viable for logging operations.

Impacts of selective logging on deforestation

As in the Congo Basin, the only direct cause of deforestation caused by logging is through creation of infrastructure (access roads, logging yards, camps, sawmills etc). In the absence of a figure for Côte d'Ivoire, the empirical figure of up to 2% of the forest concession area from the Congo Basin country study will be used. Concessions are granted for 10-20 years in most areas, though very short-term concessions of six months to a year may be given in *forêts classées* (Okali and Eyog-Matig 2004).

Impacts of selective logging on forest degradation

Logging of natural forest in Côte d'Ivoire is selective rather than clear-felling. Unlike the Congo Basin, for which there are recent and reliable field studies, there are neither original empirical data nor FAO figures for extraction rates via selective logging in Côte d'Ivoire. Hence a rate of 8 m^3 per ha is assumed, which falls midway in the range typical of West and Central Africa (5-14 m^3 per ha; FAO 2000). Extraction rates in Côte d'Ivoire might be expected to be *higher* than for the Congo Basin because the choice of logs is less selective given that many areas have been logged of first-choice species and sizes already, but *lower* than the Congo Basin because smaller trees are removed. Again, post-harvest recovery from selective logging is expected to be good (see country study on Congo Basin), for tree species if not for fauna, so long as land-use conversion does not follow on from logging.

Pathways from forest degradation to deforestation
The logging areas in Côte d'Ivoire do not constitute a "forest frontier" as found in the Amazon, hence there will not be the pathway of selective logging followed within a few years by forest clearance and permanent land use change (Asner et al. 2006). Instead, areas degraded by selective logging are likely to remain in the mosaic/cycle of secondary forest, tree gardens and small-scale cultivation. Logging operations will not appreciably open up new areas for settlement, nor cause indirect deforestation through other means such as displacement of populations within the logged areas.

4. Best practices

The government of Côte d'Ivoire has since 1994 been committed to a programme of sustainable forest management within forest reserves – the larger areas of forest outside reserves are considered too much under population and commercial pressure to manage sustainably (Okali and Eyog-Matig 2004). The government agency Sodefor (*Société de Développement des Forêts de Côte d'Ivoire*) was established in 1966 to oversee both management of the reserves and development of the industrial timber plantation sector. Sodefor undertakes conservation activities, for example conserving a minimum of 5% of each forest reserve from logging. Côte d'Ivoire has also undertaken projects of replanting of indigenous species in degraded natural forests (Okali and Eyog-Matig 2004; Bertault et al. 1995). Sodefor is involved in mixed management practices in protected forest areas, which allow a mosaic of biodiversity conservation, combining protection of locally valued species with protection of IUCN Red List species (Yao 2007) – through relations between communities and Sodefor may be tense (UNOCI 2007).

But despite these developments in government policy, Côte d'Ivoire does not at present have any forest management certificates from FSC. The Netherlands has not imported any FSC timber from Côte d'Ivoire (FSC Netherlands 2007). Therefore, for the purposes of this study, there is no need to adjust the estimates to take account of best practices in Côte d'Ivoire.

5. Export data and the share of the Netherlands

Timber was a major export product of Côte d'Ivoire in previous decades, but is no longer so prominent (Okali and Eyog-Matig 2004). Table 2 reports production and export data for Côte d'Ivoire. Note that the majority of timber harvested in Côte d'Ivoire is consumed domestically; also that the border between Côte d'Ivoire and Liberia is largely unrestricted (Global Witness 2005) so that timber exports from Côte d'Ivoire may well include wood originating in Liberia and vice versa.

Table 2: Industrial logging production and exports in 2005 (RWE m^3)				
Roundwood production (m^3)	**Production from plantations (5%)**	**Production from natural primary forest (5%)**	**Production from natural secondary forest (90%)**	**Export (estimated m^3)**
2,175,000	105,000	105,000	1,965,000	500,000

Sources: calculated from ITTO 2005, FAO 2005

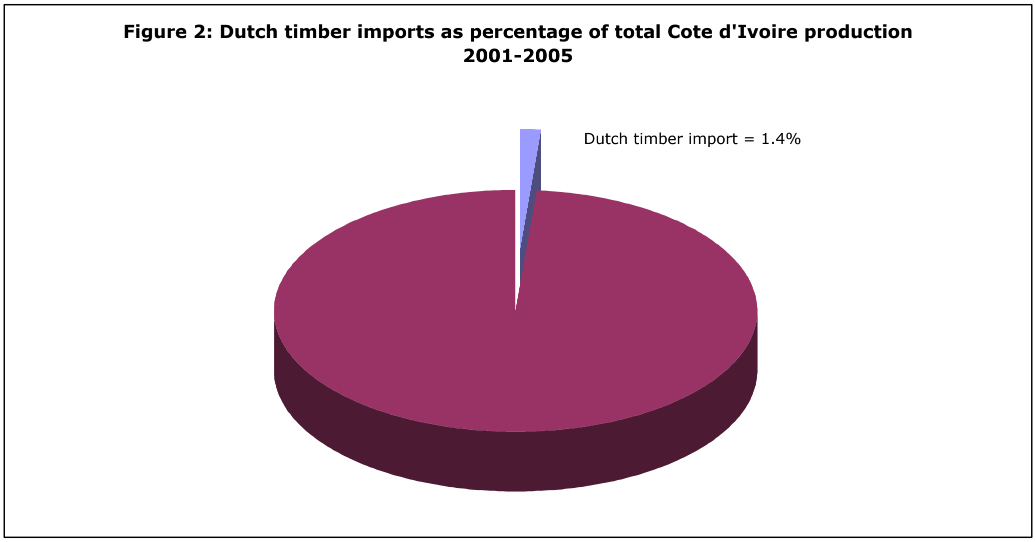


Table 3 shows Dutch imports of timber from Côte d'Ivoire in m^3 Round Wood Equivalent (RWE). The Netherlands imports about 1.4% of Côte d'Ivoire's annual production and 6.0% of estimated annual exports.

Table 3: Dutch timber imports as a percentage of sawn wood production from Côte d'Ivoire (m^3 RWE including logs plywood and veneer)					
	1996-2000 total	**1996-2000 annual average**	**2001-2005 total**	**2001-2005 annual average**	**% 2005 exported to Netherlands**
Côte d'Ivoire timber production		Not estimated		2,175,000	
Dutch timber imports	300,904	60,181	146,800	29,360	1.4

Sources: production data from FAO; Dutch import data from Eurostat; conversion to m3 RWE using the FAO figure for tropical hardwoods volume-mass (1.37 m3/t) and the global FAO conversion factor of 2 for sawnwood to roundwood

6. Results and conclusions

The data and evidence above can now be used to estimate the contribution made by Dutch imports of timber and timber products from Côte d'Ivoire to deforestation and forest degradation. These are calculated by assuming that 5% of timber is obtained by selective logging in natural primary forests, at a yield conversion rate of 8 m^3 per ha (based on FAO data for West and Central Africa, discussed in Section 3 above), with 2% deforestation (in both secondary and primary forests) due to infrastructure, spread over the 15-year timespan of a typical concession (see Section 3). There is no correction due to good practice, as there is no FSC-certified timber production in Côte d'Ivoire.

The impacts of forest degradation due to logging strongly outweigh those of deforestation. Forest degradation, as indicated, is likely to largely concern secondary forests (already having been logged and degraded before), rather than the small area of primary forest.

Table 4: Dutch contribution to deforestation and forest degradation in Côte d'Ivoire (ha)

Period	Total deforestation associated with timber logging in primary and secondary forest	Annual deforestation associated with timber logging in primary and secondary forest	Total forest degradation associated with timber logging in primary forest	Annual forest degradation associated with timber logging in primary forest
1996-2000	50	10	1,881	376
2001-2005	24	5	917	183
1996-2005	**75**	7	**2,798**	**280**

References

Asner, G.P., Broadbent, E.N. and Oliveira, P.J.C. 2006. Condition and fate of logged forests in the Brazilian Amazon. *Proceedings of the National Academy of Sciences* 103:12947–50.

Bertault, J.G., Dupuy, B. & Maître, H.F. 1995. Silviculture for sustainable management of tropical moist forest. *Unasylva* 46: 3-9.

CSAEHT 1993. Sustainable agriculture and the environment in the humid tropics: Cote d'Ivoire country profile. Committee on Sustainable Agriculture and the Environment in the Humid Tropics, Board on Agriculture and Board on Science and Technology for International Development. National Research Council, USA.

Fairhead, J. and Leach, M. 1998. Reconsidering the extent of deforestation in twentieth century West Africa. *Unasylva* 49: 38-46.

FAO 2000. Forest Resources Assessment 2000. Food and Agriculture Organisation of the United Nations.

FAO 2005. Forest Resources Assessment 2005. Food and Agriculture Organisation of the United Nations.

Geist, H.J. and Lambin, E.F. 2001. What drives tropical deforestation: a meta-analysis of proximate and underlying causes of deforestation based on subnational case study evidence. LUCC Report Series No.4. LUCC International Project Office, University of Louvain, Belgium.

Global Witness 2005. Tinker, Taylor, Soldier, Spy. Report submitted to the UN Security Council.

Greenpeace 2006. Roadmap to recovery: The world's last intact forest landscapes. Greenpeace International, Amsterdam.

IMF 2007. Public Information Notice (PIN) No. 07/101. International Monetary Fund, August 13, 2007.

ITTO 2005. Status of tropical forest management 2005. International Tropical Timber Organisation, Japan.

Koudou, A.N. and Vlosky, R.P. 1997. The forestry sector in Côte D'Ivoire: current status and policy implications. Working Paper 22, Louisiana Forest Products Laboratory, Louisiana State University, USA.

Okali, D. and Eyog-Matig, O. 2004. Rain forest management for wood production in West and Central Africa. Report prepared for the project "Lessons Learnt on Sustainable Forest Management in Africa". The African Forest Research Network (AFORNET), Nairobi, The Royal Swedish Academy of Agriculture and Forestry (KSLA), Stockholm, and The Food and Agriculture Organisation of United Nations (FAO), Rome.

Oura, B. 1999. Management and prevention of forest fires in Côte d'Ivoire. *International Forest Fire News* 20: 50-56.

UN Office for the Coordination of Humanitarian Affairs 2004. Côte d'Ivoire: Civil war allows rampant illegal logging. www.reliefweb.int

UNOCI 2007. Daily Brief on Côte d'Ivoire. United Nations Operation in Côte d'Ivoire, 17 Aug 2007.

Verdeaux, F. 1998. Paradox and rationalities of deforestation in the Ivory Coast. *Nature Sciences Sociétés* 6: 26-35.

Yao, C. Y. A. 2007. Forest management, farmers' practices and biodiversity conservation in the Monogaga Protected Coastal Forest in South-west Côte d'Ivoire *Africa: The Journal of the International African Institute* 77: 63-85.

Country study 7 – Argentina

Summary

Total deforestation in Argentina over the period of 1995 to 2005 has been conservatively estimated at 2.2 million ha, and is concentrated in the savannah Chaco eco-biome, with a small contribution from the patch of tropical forest Yunga ecozone. The main drivers of deforestation are expansion of cattle ranching and expansion of soy production. The Netherlands is an import country for Argentinean soy: of Argentinean soy production 3% was annually exported to the Netherlands. Dutch average annual meat imports from Argentina are very limited as compared to the total meat production in Argentina, increasing from 0.18% in 1996-2000 to 0.27% in 2001-2005.

The Dutch contribution to deforestation in Argentina is summarised in the following table. There has not been a major change between 1996-2000 and 2001-2005.

Table 10 Dutch contribution to deforestation in Argentina 1996 – 2005 (ha)

Period	Deforestation associated with soy	Deforestation associated with cattle	Total deforestation due to Dutch economic activities	Annual average
1996-2000	16,500	990	17,490	3,498
2001-2005	16,500	1,485	17,985	3,597
Total	**33,000**	**2,475**	**35,475**	**3,548**

1. Trends in deforestation

Trends in deforestation

In terms of forest in Argentina, a distinction can be made between two types of forest. The Yungas moist forest covers almost 5 million hectares on the Andean foothills in the Northern, subtropical part of Argentina (Figure 1). Yungas forests are found between 400 and 3.000 meters above sea level. Together with the Atlantic Rainforest it has the highest biological diversity and highest degree of endemism (occurrence of unique plants and animals) of Argentina (Brown and Grau, 1993). The Chaco consists of dry and moist savannah ecosystems covering 70 million hectares or one-fourth of Central and Northern Argentina approximately. Although biological diversity is lower than in the Yungas forests, this ecosystem has high priority for conservation, because of its limited current protection, fragile soils and hydrology (Brown and Grau, 1993).

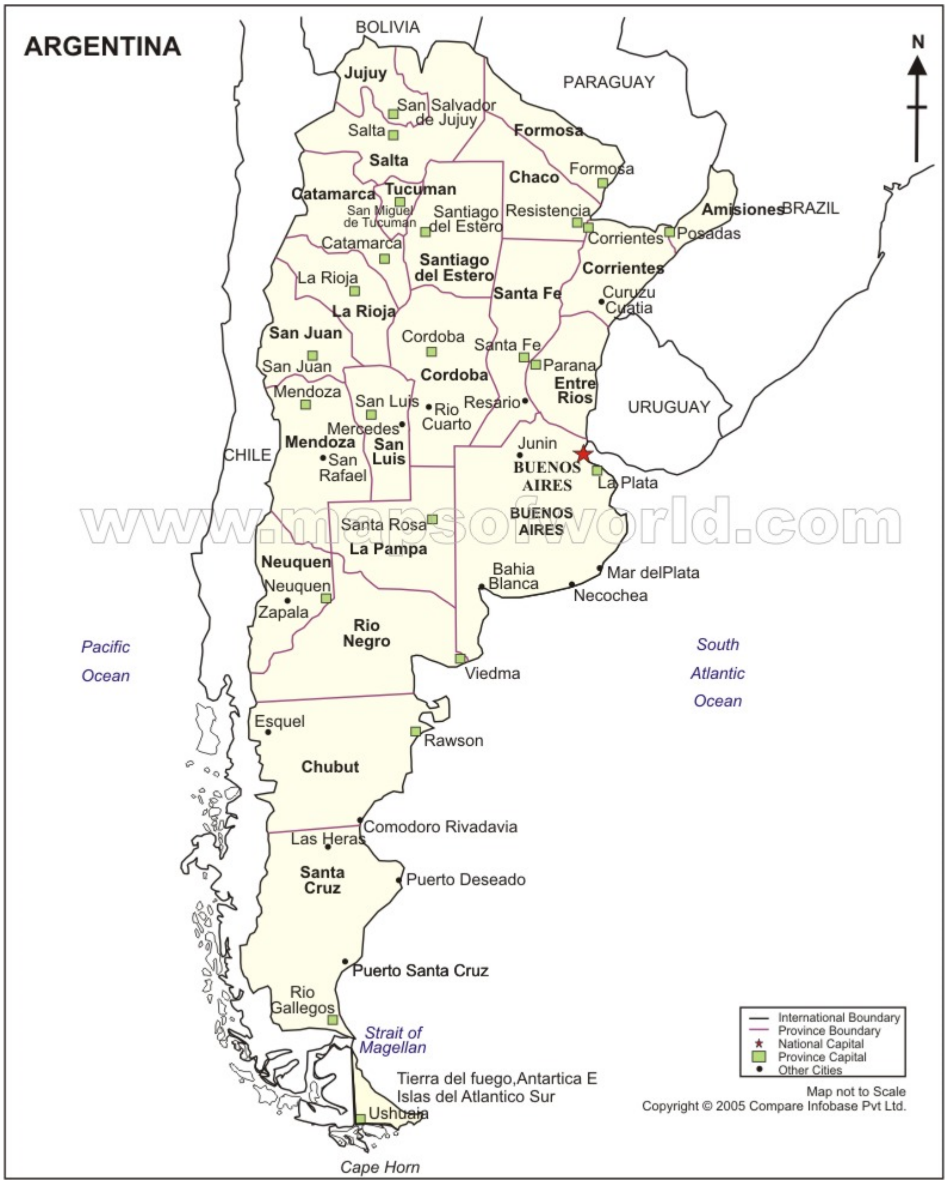


Figure 1 – Argentina Provinces

According to the FAO Global forest resources assessment in 2005, Argentina has no primary forest left but only modified natural forest (32 million ha) and productive plantations (1.2 million ha). Accordingly, FAO has not noted any deforestation of primary forest over the period of 1990 to present. However, in contradiction with the FAO statement above, Argentina has a small area of intact forest landscapes, with some primary forest, located in the Yungas forest ecosystem. The majority of forest area is basically the remaining Chaco savannah forest area .

According to WRI (2003), by 2000 Argentina had 33.8 million ha of natural forest left, while by then it had lost 46% of its original closed canopy forest. The deforestation between 1990 and 2000 was estimated at 10%, which implies a loss of about 340,000 ha of forest annually.

More recent data on deforestation in Argentina are available from the rainforests.mongabay.com website, stating that by 2005 12.1% (or about 33 million hectares) of Argentina remains forested. The decline in forest cover between 1990 and 2000 has been an average of 149,200 hectares of forest per year. This amounts to an average annual deforestation rate of 0.42%. The forest area in 2005 was 33.0 million ha, thus between 2000 and 2005 the rate of forest change had not changed much. In total, between 1990 and 2005, Argentina has thus lost 6.4% of its forest cover, or around 2.24 million hectares. Measuring the total rate of habitat conversion (defined as change in forest area plus change in woodland area minus net plantation expansion) for the 1990-2005 interval, Argentina lost 2.1% of its forest and woodland habitat.

While the WRI data are different from the rainforests data, we adopt the latter as being more recent and justified. These sources do not give any information about forest degradation.

2. Drivers behind deforestation

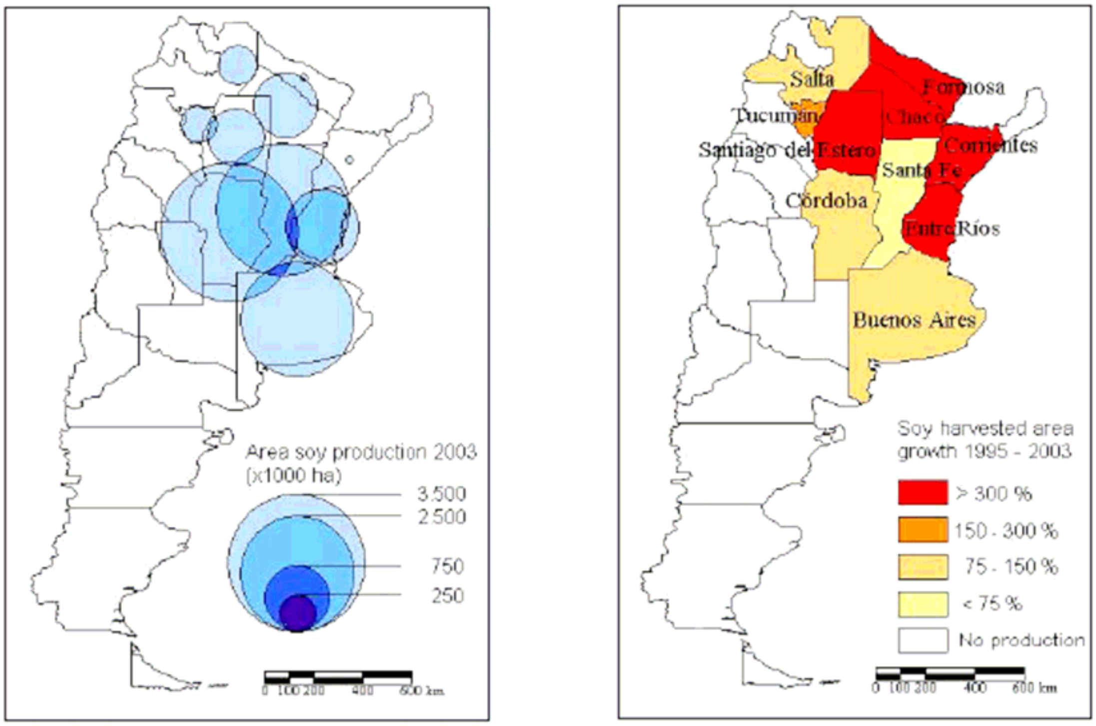
Argentina has a long tradition of cattle ranching, as the extensive central pampas grasslands are very suitable for grazing. In virtually every province beef is being produced. However, grazing area has continued to increase in recent decennia, expanding mainly into northern direction into the Chaco savannah ecosystem. The livestock industry in Argentina is differentiated, with livestock being held by smallholders for subsistence purposes mainly, as well as by large-scale enterprises. The latter are responsible for recent expansion of cattle grazing areas.

In 2000, Fundacion Vida Silvestre indicated that soy is the major threat to the forests in both the Chaco and Yungas ecosystems (Bertonatti et al., 2000). The expansion of soybean cultivation in the Chaco and Yungas biomes totalled 2.36 million ha since 1995, compared to an expansion of approximately 0.3 M ha of wheat and 0.1 M ha of corn, the two other main annual crops (Secretaria de Agricultura, 2004).

Until 2000, the Yungas pedemontana forest was predominantly cleared to give way to sugar, tobacco and tree plantations. Recently, soy has become the most important driver of deforestation in the Salta and Tucumán Yungas forest (Greenpeace, 2003). The conversion of pedemontana (or lower) Yungas habitats for soy is unlikely to be higher than 30,000 ha over the past five years, which is critical given the limited extent of this forest type. As overall arable agriculture expanded in the region, it can be concluded that 2.33 M ha of dry and humid Chaco vegetation have been cleared for soy cultivation since 1995. This area was formerly in use as extensive grazing lands with very low cattle densities (0.1 head/ha) (Garbulsky and Deregibus, 2004). Expansion of soy in the Atlantic rainforest, only present in the province of Missiones, has been negligible. The conversion in this area is mostly due to smallholder farming of high-value cash crops such as tobacco (Bertonatti et al., 2000).

Soybean cultivation in Argentina started in the 1970's and until 1998 around 90% of the planted area has been located in the three central agricultural provinces Buenos Aires, Cordoba and Santa Fé. Since the late 1990's, macro-economic developments (the Peso-crisis) have stimulated the production of export commodities. At the same time genetically modified herbicide tolerant soy has been adopted at a wide scale. As a consequence, Argentine agriculture is now dominated by mechanised production of soy. Since 1998, production expanded rapidly into the provinces of Entre Rios, Chaco, Santiago del Estero, Salta and Tucumán (Fig. 2a and 2b).

Other threats to forests are very limited as compared to cattle grazing and soy plantations. Forestry is important and Argentina does export some wood products, but much forestry is based on plantations and managed woodlands.



Figures 2a and 2b: Main soy production areas crop year 2002/2003, and growth of soy production 1995-2003 (Dros, 2004).

3. Production of selected commodities and deforestation

Cattle farming / meat production

According to the national livestock and veterinary statistics, the number of cattle amounted to 53.2 million cattle in 1994, remained relatively stable until 1997, has declined in the late 90's to about 50 million (probably due to the economic crisis), to increase again to about 58 million in 2002 (Table 1). This means an increase between 1994 and 2003 of almost 10%. More recent data are not available. Exports have also shown a large variation in the same period (Table 1).

Table 1: Cattle numbers and meat production in Argentina

	1994	1998	1999	2000	2001	2002	2003	Trend (%) 1994-2002
Numbers (x million)	53.2	50.0	50.4	--	55.9	57.9	--	10%
Production (x million tonne)	2.7	2.5	2.7	2.7	2.5	2.7	2.8	4%
Export (x 1.000 tonne)	297.0	192.6	230.8	232.5	103.3	227.0	250.7	- 16%

Source: Official SENASA statistics http://www.senasa.gov.ar/anuarios/Anuario02/an2002/estad2002.pdf)

The Pampas has about 62% of the national cattle stock. Patagonia has less than 2% of the national cattle stock but accounts for 59% of the national sheep stock. In total about 22% of cattle stock is found in the Chaco region, and the remaining 14% of cattle is in semiarid regions of the country (Garbulsky and Deregibus, 2002).

The break-down of the official cattle numbers per Province allows one to determine which proportion of the increase in cattle numbers has taken place in the northern cattle expansion zones (Chaco region). A rough estimate shows that of the 4.7 million increase between 1994 and 2003 (Table 1), about 1.5 million can be attributed to the increase in the northern frontier zones. Most of the recent increase of cattle numbers took place in the provinces of Buenos Aires and La Pampa, and will be the result of intensification as here expansion at the expense of deforestation cannot take place anymore. Thus, in the northern-most provinces the increase over the 10-year period has been at average 150,000 cattle per year.

We now need to convert the increase in cattle densities into an increase of grazing area. Statistics on grazing areas are not available. Because of the large variation in ecosystems where cattle are being held (Pampas grasslands, Chaco savannah and tropical areas), there is a concomitant major variation in productivity of cattle. In the Pampas there is a predominance of sown and managed grasslands and carrying capacity can be up to 2 cattle per ha. On natural pastures, depending upon the severity of the winter cold, the carrying capacity will vary between 0.3 and 0.7 cattle per ha (FAO, 2005), with the lower estimate in the southern-most part of Patagonia.

Based on these data, we assume that in the northern cattle expansion zone the average cattle density is 1.4 head/ha, assuming that there will be an equal proportion of unimproved natural pastures (carrying capacity 0.7 cattle per ha) as well as improved pastures (carrying capacity 2 cattle per ha). This means that annually about 105,000 ha additional grazing land should have become available for cattle grazing. A major part of this additional land should have been acquired as a result of deforestation.

Soy production

Since the late 1990's, macro-economic developments (the Peso-crisis) have stimulated the production of export commodities. At the same time genetically modified herbicide tolerant soy has been adopted at a wide scale. As a consequence, Argentine agriculture is now dominated by mechanised production of soy. Soy now occupies more land in Argentina than all other crops added together (Dros, 2004). Soy expansion has mainly taken place in the Chaco ecozone, as here soils are flat and the climate is most suitable. However, more recently soy has also expanded into the more humid Yungas tropical ecozone where we find dense forests.

Table 2 provides an overview of the available data on soy expansion between 1990 and 2005 per Province in Argentina. It can be observed that soy expansion was particularly strong between 1995 and 2005, increasing by a factor of three over this period. Traditionally, soy in Argentina is produced in the provinces of Buenos Aires, Córdoba and Santa Fé. In 2005, these three provinces together produce 82% of overall soy production in Argentina (76% in terms of planted area). Since the 1990s, soy expanded rapidly northward to Entre Rios, Santiago del Estero, Chaco and Salta (Dros, 2004), so that now their share in terms of soy production is 14% (21% in terms of planted area). Table 2 clearly shows that between 1995 and 2005 expansion by area has been most important in these and other northern provinces. The fact that the northern provinces have a much greater share in national soy production in terms of area than in terms of production volume, shows that here soy production increase mainly takes place by area increase. The area increase due to soy expansion in forested *Provinces*

Table 2: Soy production planted area by province In ha, sorted by size in 2004/05						
	1990/01	**1995/96**	**2000/01**	**2004/05**	**Increase 1995-2005**	**Share planted area 2004/05**
Córdoba	1,250,000	1,711,500	3,151,500	3,981,146	133%	28%
Santa Fé	1,987,000	2,441,300	3,117,150	3,531,100	45%	25%
Buenos Aires	1,313,000	1,308,055	2,413,010	3,324,129	154%	23%
Entre Rios	54,800	149,000	579,500	1,242,811	734%	9%
Chaco	50,000	70,500	410,000	664,475	843%	5%
Santiago del Estero	72,500	94,500	323,000	630,713	567%	4%
Salta	95,500	120,000	300,000	466,546	289%	3%
Tucumán	83,000	85,000	180,000	259,630	205%	2%
La Pampa	30,000	4,500	148,500	187,628	4,070%	1%
Catamarca	15,000	12,000	23,000	40,394	237%	0%
San Luis	200	-	10,000	25,246	0%	0%
Corrientes	7,000	2,300	3,750	24,468	964%	0%
Formosa	1,200	1,000	1,100	13,734	1,273%	0%
Jujuy	4,400	1,000		5,049	405%	0%
Misiones	3,000	1,500	4,000	2,929	95%	0%
Argentina	**4,966,600**	**6,002,155**	**10,664,510**	**14,399,998**	**140%**	**100%**

Source: Dirección de Coordinación de Delegaciones, SAGPYA.

The area increase due to soy expansion in forested *Northern Provinces* (see Figure 1) has been summarised in the following table 3.

Table 3: Soy production planted area in northern forested provinces (based on Table 2)							
	1990/01	**1995/96**	**2000/01**	**2004/05**	**Increase 1990-1995**	**Increase 1995-2000**	**Increase 2000-2005**
Northern forested Provinces	380,100	536,800	1,824,400	2,930,900	156,700	1,287,600	1,106,500

Expansion of labour-extensive mechanised soy farming may take place at the expense of virgin forest or at the expense of land that has already been cleared, and where agricultural (cropping or livestock keeping) land-use takes place. It is important to make this distinction because the latter would not contribute to deforestation. Another important dynamics is smallholder family farmers and livestock keepers being displaced moving either to cities or to virgin forest areas.

We now estimated the proportion of soy expansion in these provinces that took place at the expense of virgin forest or that took place at the expense of land that had already been cleared, and where agricultural (cropping or livestock keeping) land-use takes place. It is important to make this distinction because the latter would not contribute to deforestation. We made estimates of the proportion of soy expansion at the expense of virgin forest and other land-use on the basis of best professional judgments by people who very well know the area, and available documents (e.g. Dros, 2004). The results are indicated in Table 4.

Table 4: Forest conversion effects of soy cultivation 1995-2005				
	Total area increase for soy	**Proportion at the expense of intact forest ecosystems**	**Proportion at the expense of land already cleared**	**Total area forest converted due to soy expansion**
Entre Rios	1,093,800	50%	50%	546,900
Chaco	594,200	50%	50%	297,100
Santiago del Estero	536,200	75%	25%	402,150
Salta	346,500	75%	25%	259,875
Tucumán	174,600	75%	25%	130,950
Catamarca	28,000	75%	25%	21,000
Corrientes	22,000	50%	50%	11,000
Formosa	12,500	75%	25%	9,400
Jujuy	4,000	75%	25%	3,000
Misiones	1,500	75%	25%	1,100
Total				**1,135,575**

4. Best practices

Soy
Several initiatives are being taken to produce sustainable or responsible soy. In cooperation with WWF, the Swiss Coop has developed the so-called Basel Criteria for sustainable soy. However, so far no initiatives have been taken in Argentina.

Similarly, the Netherlands has imported biological soy in 2007, about 25,000 tons (Dros, 2007). However this volume is likely to have been very small or even non-existent in 2005. Therefore no correction for biological soy is made in this study. It should be noted that the volume of soy certified according to a set of social and environmental criteria, is expected to increase in coming years partly as a result of initiatives like the Round Table Responsible Soy.

Meat
Meat being produced without any deforestation is not yet an available option.

5. Export data and share by the Netherlands

Soy
Soy is an important export product for Argentina: soybeans, soy meal and soy oil represent a considerable share of the Argentinean export of agricultural products. Especially the export of soybeans has grown during the last decade (table 5). With an 18% share in the global production of soy in 2004, Argentina is the world's third largest soy producer, after the United States and Brazil. Argentina exports 98% (36.5 million tons) of its produced soy (Mielke, 2005). Consequently, soy in Argentina does not contribute to the national food production.

The Netherlands is an import country for Argentinean soy products: in both periods of 1996-2000 and 2001-2006, of Argentinean soy production, 3% is annually exported to the Netherlands (table 6, figure 3).

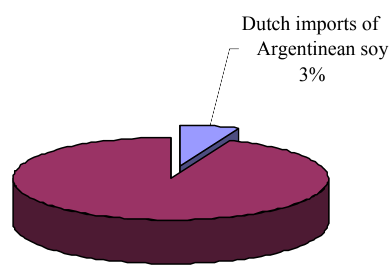
Table 5: Average annual soy production in Argentina (x 1,000 Mt)			
	1996-2000	**2001-2005**	**Trend (%) 1996-2005**
Total Argentinean production of soybeans, meal and oil	31,843	58,005	82%

Source: Mielke, 2000 and Mielke, 2007

Table 6: Average annual soy imports into the Netherlands (x 1,000 Mt)			
	1996-2000	**2001-2005**	**Trend (%) 1996-2005**
Total Dutch imports of soybeans	4,758	4,743	0%
Imports of Argentinean soybeans	256	85	- 67%
Total Dutch imports of soy meal	1,681	3,822	127%
Imports of Argentinean soy meal	682	1,840	170%
Total Dutch imports of soybean oil	102	67	- 34%
Imports of Argentinean soybean oil		1	
Total Dutch imports of Argentinean soy	937	1,926	106%

Source: Mielke, 2000 and Mielke, 2007

Figure 3 - Dutch soy imports as percentage of total Argentinean production 1996–2000 and 2001-2005



Meat

Another Argentinean export product for the Dutch market is cattle meat. Again both the Argentinean production as well as the Argentinean export to the Netherlands has increased (tables 7 and 8). Of the total Argentinean cattle meat production (of around 2.7 million tonne) only 10% is exported, while of total Dutch meat imports, only about 3% is obtained from Argentina. As a result, the average proportion of Dutch meat imports from Argentina meat production is only very small: 0.18% in 1996-2000 to 0.27% in 2001-2005 (figures 4 and 5).

Table 7: Average annual cattle meat production in Argentina (tonnes)			
	1996-2000	2001-2005	Trend (%) (1996 – 2005)
Total Argentinean production of cattle meat	2,662,591	2,723,224	2%

Source: FAOstat, 2007

Table 8 Average annual cattle meat imports into the Netherlands (tonnes) (including cattle meat carcasses, fresh, chilled, and frozen; boneless fresh, chilled, and frozen and offal fresh, chilled, and frozen)			
	1996-2000	2001-2005	Trend (%) (1996 – 2005)
Total Dutch imports of cattle meat	127,379	208,446	64%
Dutch imports of Argentinean cattle meat	4,544	7,424	63%

Source: FAOstat, 2007

Figure 4 - Dutch cattle meat imports as a percentage of Argentine production 1996 - 2000

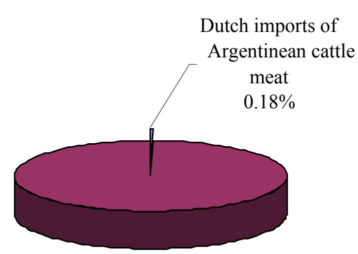
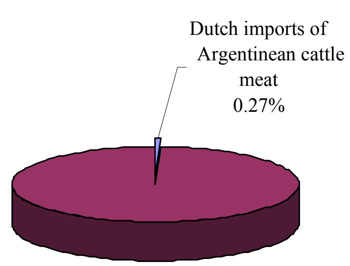


Figure 5 - Dutch cattle meat imports as a percentage of Argentine production 2001 - 2005



6. Results and conclusions

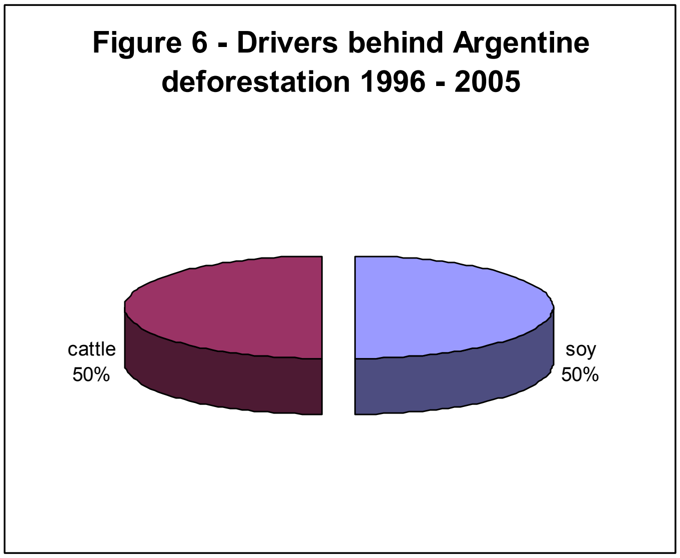
The available data and calculations that were made can now be used to estimate the contribution by soy and meat to deforestation in Argentina, and the proportion taken by imports in the Netherlands.

Contribution by commodities to deforestation
In Argentina deforestation between 1990 and 2005 has been around 2.24 million hectares, based on an average rate of deforestation of about 0.42% annually. Within this period, we have seen that cattle ranching has expanded to some extent, while soy expansion has boomed in particular from 1995 onwards.

We roughly estimated the contribution to deforestation by expansion of cattle grazing at 105,000 ha annually, thus amounting to 1.05 million ha over the 1995-2005 period, probably with a greater share in the period of 2000-2005 due to more rapid increase of cattle numbers in this period. We calculated the contribution by soy to deforestation over this period at 1,135,575 ha, with an equal share between the two periods of 1995-2000 and 2000-2005. Thus, total deforestation due to cattle grazing and soy production over the period of 1995-2005 is estimated at about 2.2 million ha. This result corresponds to the estimated deforestation rate of 2.24 million ha over the period of 1990-2005 (see above). However, it may be expected that the rate of deforestation has been higher in the period between 1995 and 2005 due to the dominant role of soy expansion. Also, considering the fact that we have adopted conservative estimates of deforestation rate (the estimates of WRI are twice higher), it is not unlikely that deforestation in the period of 1996 – 2005 has been about 2 million ha. Deforestation takes place mainly in the Chaco ecozone (savannah forest) but more recently also in the densely forested Yunga ecozone.

Thus, of the 2.2 million ha of deforestation that Argentina has experienced between 1996 and 2005, an equal share can be attributed to cattle grazing as to soy expansion (Figure 6). Other causes of deforestation are considered negligible as compared to these two causes.

Note that although the tropical forest in the Amazon area is considered to be more species rich and vulnerable, and is largely classified as an intact forest landscape, the Chaco savannah forest lands are also very biodiversity rich. Thus, we consider both the loss of tropical Amazon forest and savannah Cerrado forest of equal importance in terms of forest and associated biodiversity loss.



Dutch share in Argentinean deforestation

Based on the production and import figures presented tables 7 and 9, the share of Dutch imports to the total Argentinean production of soy and cattle meat, and thus to deforestation, can be calculated (table 10).

For soy the contribution to deforestation is calculated as follows (proportion imports Argentina production X proportion contribution to deforestation X deforestation):
1996-2000: 3% of 50% of 1.1 million ha = 16,500 ha
2001-2005: 3% of 50% of 1.1 million ha = 16,500 ha

For cattle farming:
1996-2000: 0.18% of 50% of 1.1 million ha = 990 ha
2001-2005: 0.27% of 50% of 1.1 million ha = 1,485 ha

Table 10 Dutch contribution to deforestation in Argentina 1996 – 2005 (ha)

Period	Deforestation associated with soy	Deforestation associated with cattle	Total deforestation due to Dutch economic activities	Annual average
1996-2000	16,500	990	17,490	3,498
2001-2005	16,500	1,485	17,985	3,597
Total	**33,000**	**2,475**	**35,475**	**3,548**

The table shows that Dutch economic activities contributed annually to about 3,500 ha of deforestation in Argentina in both periods. A clear trend cannot be observed. The contribution in the period of 1991-1995 can be expected to be much lower, since then soy production in Argentina and Dutch imports from Argentina were much lower.

References

Bertonatti, Claudio and Corueca, J., 2000. Situacion Ambiental Argentina 2000, Fundación Vida Silvestre Argentina, Buenos Aires.

Brown, A.D. and Grau, 1993. La Naturaleza y el Hombre en las Selvas de Montaña, Proyecto GTZ, Salta, Argentina.

Dirección de Coordinación de Delegaciones, SAGPYA Estimaciones Agrícolas – Oleaginosas. Web-site: http://www.sagpya.mecon.gov.ar. Viewed July 2007.

Dros, J.M. 2004. Managing the soy boom. Two scenarios of soy production expansion in South America. Commissioned by WWF Forest Conversion Initiative. AIDEnvironment, Amsterdam.

Garbulsky, M. and V.A. Deregibus, 2004. Argentina Country Pasture / Forage Resource Profile, FAO, Rome.

FAO, 2005. Forage Resource Profile Argentina, FAO web site, *www.fao.org/waicent/faoinfo/agricult/AGP/AGPC/doc/counprof/Argentina/argrentina.htm*, viewed may 2005.

Greenpeace Argentina, 2003. Destrucción de la Selva de Yungas, Perguntas e Respuestas, Buenos Aires.

Garbulsky M.F. and V.A. Deregibus, 2002. Country pasture / forage resource profile. Website: *http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGP/AGPC/doc/Counprof/Argentina/argrentina.htm*. Viewed July 2007.

Mielke, 2000. Oil World Annual 2000.

Mielke, 2007. Oil World Annual 2007, Vol. 1 up to 2006/07.

Rainforest, mongaby. http://rainforests.mongabay.com/deforestation/2000/Argentina.htm. Last viewed July 2007.

Secretaria de Agricultura, Ganaderia, Pesca y Alimentos, web site http://www.sagpya.mecon.gov.ar/httphsi/bases/oleagi.htm, viewed May 2005.

Country study 8 – Brazil

Summary

Annual deforestation in Brazil over the period of 1991 to 2005 gradually increased from an annual average of 2.6 to 3.1 million ha, and is concentrated in the tropical Amazon and savanna Cerrado eco-biomes. In addition, between 2001 and 2005 forest degradation was about 3 million ha annually. Cattle ranching, initially, and later soy production have been the main drivers of deforestation. Conversion of forests to agriculture started in the Cerrado savanna, and later expanded into the Amazon biome. Timber harvesting indirectly can lead to deforestation by opening up remote areas and providing a source of finance but it is not the main driver. In contrast, forest degradation is mainly due to logging (in the Amazon biome mainly), and to some extent due to cattle ranching (in the Cerrado).

The Netherlands is a significant import country for Brazilian soy: of Brazilian soy production 6% (1996-2000) to 11% (2001-2006) is annually exported to the Netherlands. Dutch average annual meat imports from Brazil are very limited, although increasing from 0.26% in 1996-2000 to 0.48% in 2001-2005. The Dutch contribution to deforestation in Brazil can be summarised in the following table. The increase between 1996-2000 and 2001-2005 has been almost 200%, largely due to increasing soy imports.

Dutch contribution to deforestation in Brazil 1996 – 2005 (ha)				
Period	**Deforestation associated with Dutch soy imports**	**Deforestation associated with Dutch beef imports**	**Total deforestation due to Dutch economic activities**	**Annual average**
1996-2000	170,100	27,000	197,100	39,420
2001-2005	532,000	50,700	582,700	116,540
Total	**702,100**	**77,700**	**779,800**	**77,980**

The Dutch contribution to forest degradation through timber imports over the ten year period 1996–2005 has been estimated at just over 60,000 ha. It increased by 65% between the first half (1996–2000) and the second half (2001–2005) of this ten-year period. Annually about 6% of degraded forest in the Amazon is being cleared, showing that degraded forest is gradually being totally lost. This means that there may be some overlap over time between the impact of Dutch imports on deforestation and on degradation. However, as timber for export is more likely to be sourced from forest management operations, this overlap will be small.

Dutch contribution to forest degradation in Brazil 1996–2005 (ha)		
Period	**Degradation associated with Dutch timber imports**	**Annual average**
1996-2000	23,460	4,692
2001-2005	38,645	7,729
Total	62,105	6,211

1. Trends in deforestation

Trends in deforestation
This study looks at deforestation and forest degradation due to timber exploitation, cattle rearing (meat) and soy production. In terms of regions with most remaining forests of Brazil, we made a distinction between the savannah forest area (the Cerrado) and the more densely forested tropical forest (Amazon) (Figure 1). The boundaries of these two ecological biomes mostly coincide with state boundaries, but not always. For instance, the large state of Mato Grosso is located in a transition area and here we find large proportions of both ecological biomes. We will use the state boundaries in subsequent paragraphs to calculate deforestation in these different ecological biomes.

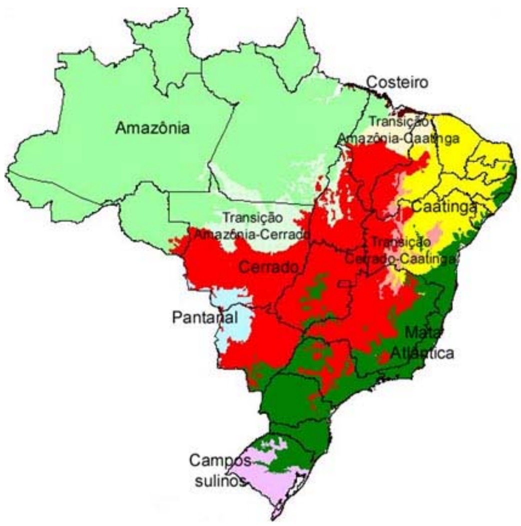


Figure 1 – Brazil Biomes (central part is Cerrado (red); upper part is Amazon (green))

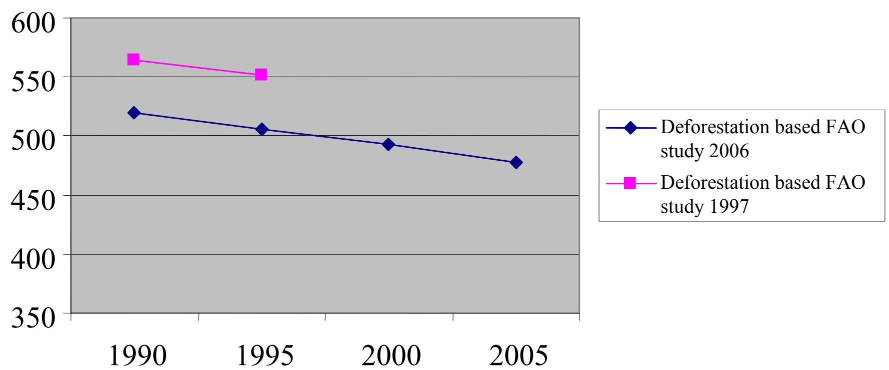
According to the FAO Global forest resources assessment in 1997, deforestation in Brazil between 1990 and 1995 equalled 12.9 million ha (corrected for 0.1 million ha increase in plantation area). According to the FAO Global forest resources assessment in 2005, deforestation in Brazil between 2001 and 2005 equalled 15.6 million ha (corrected for 0.1 million ha increase in plantation area). Deforestation between 1996 and 2005 was 29 million ha, which equals 2.9 million hectares per year. Deforestation during 1996 and 2005 is an estimation since the method has changed as compared to before and after 2000. Total deforestation between 1990 and 2005 is thus 42 million ha. The available data lead to the following estimates of deforestation (Table 1).

Table 1: Deforestation in Brazil 1990 – 2005 (x 1,000 ha)

Period	Total deforestation	Deforestation annually
1991-1995	12,900	2,580
1996-2000	13,500	2,700
2001-2005	15,600	3,120

Source: FAO, 2006a

Figure 2: Loss of Brazilian forest 1990–2005 (million ha)



Source: FAO 1997, 2006a

Data were obtained from the Brazilian INPE Institute (INPE, 2006), on deforestation rates per state, and these will be used in subsequent sections of this study. These state-level figures when aggregated to the national level give totals that are close to the FAO data.

Trends in forest degradation

Brazilian forests are also under threat of forest degradation as a result of selective logging. Recent research shows that the area of forest degraded due to selective logging was more extensive than commonly assumed: in the period 1999–2002 the annually degraded area in five Brazilian Amazon states almost matched the area which was reported to be deforested (Asner et al., 2005). Applying these findings to Brazil as a whole would suggest an annual area of forest degradation between 2001 and 2005 of almost 3 million ha.

2. Drivers behind deforestation

In the Cerrado biome, until 1960 subsistence farming of rice, beans, cassava and corn and extensive cattle farming prevailed (Aidar and and J. Klutchcouski, 2003). In the Amazon biome, until the 1960s there was little agricultural activity apart from rubber plantations.

In the 1960's, the Brazilian government made the strategic decision to 'develop' the interior, the Cerrado and the Amazon, and an expansion frontier for agricultural production emerged.

In the cerrado, colonisation started out by opening up forest areas for cattle grazing, also using fire (Klink, 2001). The cattle farms cleared the vegetation, sold the wood as fuel wood or charcoal and planted pastures with exotic, African grasses which are more easily palatable than native grasses and herbs. This allowed higher cattle densities (0.5 to 2 heads per hectare) and in the Cerrado area planted pastures increased from 12 million hectares in 1970 to 45 million hectares in 1996 Kluchoutski and Aidar, 2003; Aidar and Kluchoutski, 2003). The exotic grasses are persistent and resulted in an increase of fire frequency, causing compaction of the soil, lower infiltration capacity, runoff and erosion and reduced groundwater recharge Viela et al., 2003).

Mechanised agriculture was also introduced on the flat and stone plateaux and gently sloping areas. Over the last decade, soy has expanded rapidly and has become the main crop in the Cerrado region, and has increasingly penetrated the Amazon eco-biome. Figure 3 shows the advance of the agricultural frontier in the Cerrado biome. By 1997, nearly 80% or 160 million hectares of the Cerrado had been antropised (influenced by humans). It should be noted that there is very little quantitative data available on Cerrado conversion, and estimates vary widely: from 7% to 50% remaining. An assessment of the extent of (virgin) natural Cerrado's and priority conservation areas is badly needed.

Within the 'antropised' area, approximately 90 million hectares had been completely cleared as stated above. Only 40 million hectares or 20% were considered in natural state in 1997. As the Cerrado is being transformed into production areas with monocultures, the gateway to further encroachment into the Amazon rainforest region is also opened (Figures 4 and 5) (Bickel and Dros, 2003; Conab, 2003; Dros, 2003). As a result, expansion of soy into the Amazon region has rapidly increased in recent years.

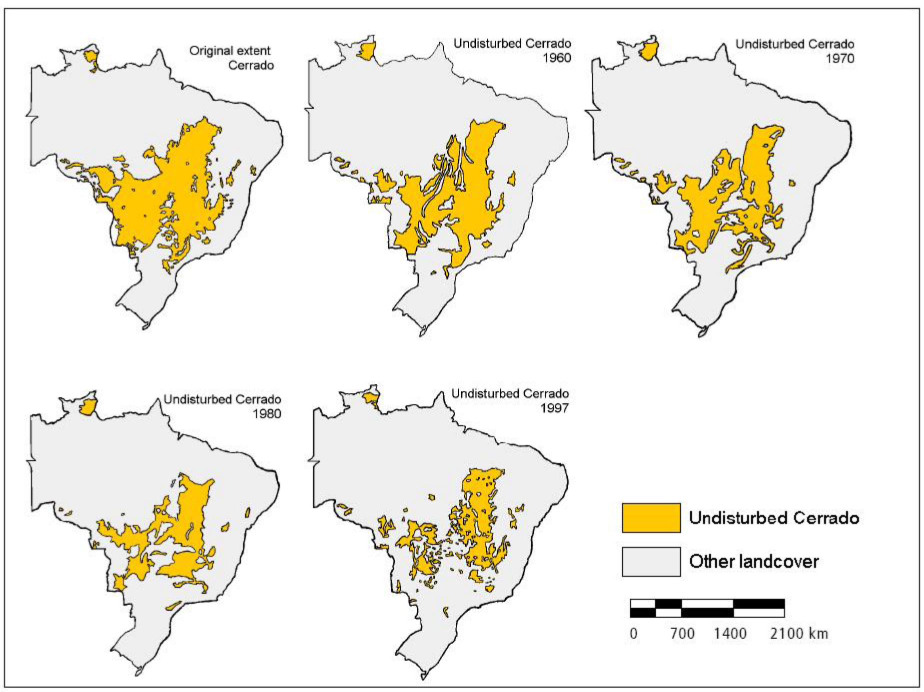
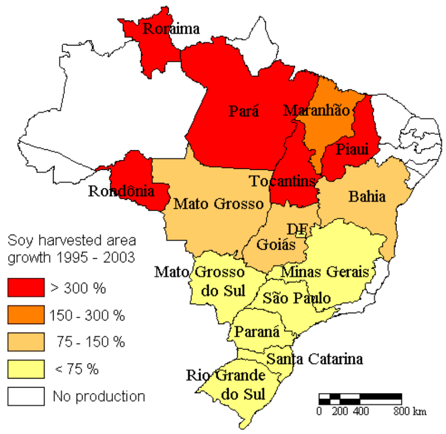


Figure 3 - Retreat of undisturbed Cerrado, 1900-1997 © AIDEnvironment, based on Atlas Nacional 2000, IBGE



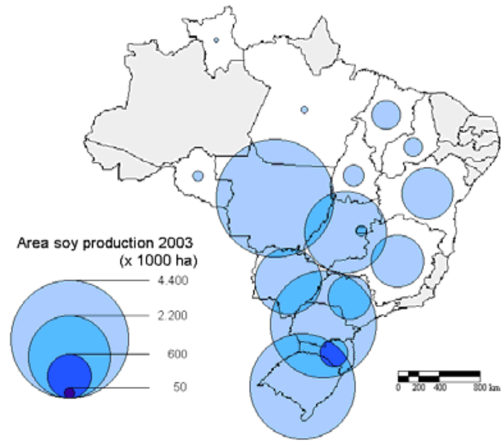


Figure 4 - Soy production growth areas

Figure 5 - Soy bean productive area

There is a considerable body of literature documenting the sequence in the Amazon biome of opening up of forest areas with logging roads, influx of settlers to the forest frontier, financing of forest conversion and pasture establishment through sale of timber (Viana et al 2002). Selective logging for timber is one of the drivers of deforestation but is closely linked with expansion of cattle ranching. Clearing of forest land for agriculture is one of two legal means for harvesting timber. By law landowners in the Amazon forest biome can clear up to 20% of their land.

While timber harvesting leads to forest degradation in the short and medium term, it is a precursor for deforestation, especially in the case of a forest frontier as in Brazil. Asner (2005) found that 19% of the area logged in any given year was subsequently deforested three years later. This implies that it could take up to 20 years for logged areas to be fully deforested. Selective logging however, by opening up the canopy and creating a large amount of waste plant material may increase susceptibility to fire and indirectly accelerate deforestation (Viana et al 2002).

3. Production of selected commodities and deforestation

Soy production

Soy expansion has mainly taken place in the Cerrado ecozone, as here soils are flat and the climate is most suitable. Only later has soy expanded to the more humid tropical zone.

Table 2 provides an overview of the available data on soy expansion between 1990 and 2005. It can be observed that soy expansion between 1990 and 1995 was limited, then increased between 1995 and 2000 by about 2 million ha, and then exploded by about 8 million ha expansion between 2000 and 2004 (data for 2005 are not yet available).

Table 2: Soy production planted area by state

In ha, sorted by size in 2004

	1990	1995	2000	2003	2004	Trend 95/04	Share 2004
Mato Grosso	1,552,910	2,338,926	2,906,648	4,414,496	5,279,928	+ 126%	24%
Paraná	2,269,615	2,206,249	2,857,968	3,649,119	4,011,021	+ 82%	19%
Rio Grande do Sul	3,519,448	3,008,550	3,030,556	3,591,970	3,984,337	+ 32%	18%
Goiás	1,001,690	1,126,511	1,491,066	2,176,720	2,591,954	+ 130%	12%
Mato Grosso do Sul	1,286,382	1,044,779	1,106,301	1,412,307	1,812,006	+ 73%	8%
Minas Gerais	558,387	603,773	600,054	885,407	1,096,423	+ 82%	5%
Bahia	360,015	470,575	628,356	850,000	821,270	+ 75%	4%
São Paulo	561,200	530,000	535,010	642,450	779,880	+ 47%	4%
Maranhão	15,035	87,690	178,716	275,252	340,403	+ 288%	2%
Santa Catarina	369,953	204,478	212,412	257,086	314,469	+ 54%	1%
Tocantins	30,120	20,237	57,919	153,048	253,466	+ 1,152%	1%
Piauí	1,560	12,784	40,004	116,613	159,281	+ 1,146%	1%
Rondônia	4,640	4,500	11,800	41,600	56,443	+ 1,154%	0%
Distrito Federal	53,500	43,831	33,582	43,210	50,383	+ 15%	0%
Other states	*9*	*36*	*3,285*	*18,266*	*50,076*	-	*0%*
Brazil	**11,584,734**	**11,702,909**	**13,693,677**	**18,527,544**	**21,601,340**	**+ 85%**	**100%**

Source: IBGE/SIDRA, 2007

Expansion of labour-extensive mechanised soy farming mainly takes place at the expense of virgin forest, and is also concentrated in the Cerrado where most suitable soils are found. Expansion may also take place at the expense of land that has already been cleared, and where agricultural (cropping or cattle rearing) land-use takes place. It is important to make this distinction because the latter would not contribute to deforestation. We made estimates of the proportion of soy expansion at the expense of virgin forest and other land-use on the basis of best professional judgments by people who very well know the area, and available documents (e.g. Bickel and Dros, 2003; Dros, 2004). The results are indicated in Table 3.

Another important dynamic is smallholder family farmers and livestock keepers being displaced moving either to cities or to virgin forest areas. Between 1999 and 2001 alone, 5.3 million people left the rural areas, according to the Brazilian Geography and Statistics Institute (IBGE). IBGE further reports the closing down of 941,000 rural establishments between 1985 and 1996, 96% of which of less than 100 hectares (Kessler et al., 2006). We estimated the proportion of displaced farmers and livestock keepers that cleared additional land in virgin forest (Amazon or Cerrado) to continue their original livelihood. These latter are mainly cattle farmers. However, when moving to other areas, the cattle farmer can occupy more land than the original land that was sold. This so-called multiplier effect is based on the following assumptions:

- the price of land in the well accessible Cerrado is about ten times higher than land in remote and less accessible Amazon areas. This implies that the cattle farmer, after selling his land in the Cerrado, can buy much more forest land and additional cattle (Dros, 2007);

- while of course the cattle owner may use the money in other ways (savings, business, …), the strong increase of the number of cattle in Brazil suggests otherwise;
- based on the increase in number of cattle and using an average cattle/land ratio, one can estimate the increase of grazing lands;
- plenty of pristine forest lands remain available in the Amazon region, at low price, and thus available for conversion to grazing land.

Based on above assumptions, we classified the multiplier effect into four categories:
- multiplier effect is 0%, where no virgin land is available or cattle herds reduced in size;
- multiplier effect of 50% where a limited area of land is being cleared by displaced farmers, e.g. where livestock herds do not increase much or little land is available;
- multiplier effect estimated at 100% where an equal amount of land is being cleared as much land is available and cattle herds seem to increase;
- multiplier effect estimated at 150% where more land is being cleared than land occupied by soy, as much land is available and cattle herds seem to increase very much.

The overview and resulting calculations are given in Table 3. The final result shows the direct loss of natural forest ecosystems by clearing for soy, and the indirect loss of natural forest ecosystems by displacement and settlement of people in areas being invaded.

Table 3: Direct and indirect conversion effects of soy cultivation 1995 – 2005

	(a)	(b)	(c)	(d)	(e)	(f)	(h)	(i)
	Total area increase for soy	Proportion at the expense of intact forest eco-systems	Proportion at the expense of land already cleared	Multiplier effect – indirect eco-system loss (% of c)	Total loss of intact forest ecosystems (direct and indirect)	Total area forest converted due to soy expansion (f x a)	Area not to be double counted in calculation cattle (f -(a x b))	Number of cattle which should be subtracted (1 head/ha)
Mato Grosso	2,940,000	50%	50%	150%	125%	3,675,000	2,205,000	2,205,000
Goiás	1,470,000	50%	50%	50%	75%	1,100,000	365,000	365,000
Mato Grosso do Sul	768,000	50%	50%	100%	100%	768,000	384,000	384,000
Minas Gerais	493,000	50%	50%	100%	100%	493,000	246,500	246,500
Tocantins	233,000	50%	50%	150%	125%	291,250	174,750	174,750
Maranhão	253,000	70%	30%	150%	115%	290,950	113,850	113,850
Piauí	143,000	80%	20%	150%	110%	157,300	42,900	42,900
Bahia	351,000	100%	0%	100%	100%	351,000	0	0
Rhondonia	52,000	100%	0%	100%	100%	52,000	0	0
Parana	1,772,000	0%	100%	0%	0%	0	0	0
Rio Grande do Sul	465,000	0%	100%	0%	0%	0	0	0
Sao Paulo	219,000	0%	100%	0%	0%	0	0	0
Total states						7,178,500		

As can be seen in the table 3, it is assumed that in the states Parana, Rio Grande do Sul and Sao Paulo, soy did not expand at the expense of forest ecosystems. Most of the forest in these three states had been cleared before 1995. It is possible that soy expansion has taken place at the expense of the little remaining Atlantic forest (Mata Atlantica), mostly in Parana. However, in terms of area, this can be ignored if compared to the forest areas cleared in other states.

Cattle farming / meat production

Soy production can displace cattle farming, as described above and is a driver behind land conversion. The Brazilian flock of cattle has increased over the last 15 years from 158 million heads in 1996 to 207 million heads in 2005. It is important to distinguish between intensive and extensive cattle farming. Intensive cattle farming requires the original forest to be converted, and can carry up to 2 heads per hectare. Extensive cattle farming can make use of the natural vegetation, so does not require conversion, but this is only possible in the Cerrado and will lead to forest degradation. Extensive cattle farming in the Cerrado can coexist with the natural forest ecosystem as long as the maximum of 0.3 cattle per hectare is respected. In the Amazon region cattle farming always requires deforestation, whether intensive or extensive, because the cattle cannot graze in the forest.

For the Amazon biome, table 4 gives an overview of the deforestation attributed to cattle farming. The data are calculated as follows:

- Cattle densities are based on data from IBGE/SIDRA (June 2007);
- Based on the net increase of cattle, the minimum required increase of grazing area is determined. This is based on 1.5 cattle per hectare, which is less than the maximum of 2 cattle per hectare carrying capacity for planted pasture because some of the converted areas within the Amazon have poor suitability for cattle farming (Kloutchuski et al., 2001).
- Of the total deforestation between 1995 and 2005 the deforestation attributed to indirect effects from soy expansion (column (i) in table 3) is subtracted. The remaining deforestation is compared with the minimum area increase. This shows that for most states all deforestation can be attributed to cattle farming.
- Deforestation data per state are based on INPE (2006), which are similar to the FAO data.

Table 4: Deforestation by cattle farming in the Amazon states, 1995 - 2005

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
State	Increase cattle between 1995 and 2005	Cattle which are already attributed to soy (see table 5)	Net increase cattle	Min area increase due to cattle (1.5 cattle/ha)	Total deforest. between 1995 and 2005 (ha)	Deforest. associated with soy	Deforest. not associated with soy	Deforestation associated with cattle (compare g with d)	Un-explained de-forestation
Acre	1,459,921	0	1,459,921	973,281	686,700	0	686,700	686,700	0
Amapá	33,000	0	33,000	22,000	16,800	0	16,800	1,680,000	0
Amazonas	463,261	0	463,261	308,841	1,084,800	0	1,084,800	308,841	775,959
Maranhão	2,513,194	113,850	2,399,344	1,599,563	1,116,400	29,100	1,087,300	1,087,300	0
Mato Grosso	11,078,406	2,205,000	8,873,406	5,915,604	8,696,200	3,675,000	5,021,200	5,021,200	0
Pará	11,312,189	0	11,312,189	7,541,459	6,957,100	0	6,957,100	6,957,100	0
Rondônia	7,412,161	0	7,412,161	4,941,441	3,243,900	52,000	3,191,900	3,191,900	0
Roraima	106,666	0	106,666	71,111	262,600	0	262,600	71,111	191,489
Tocantins	2,719,271	174,750	2,544,521	1,696,347	341,200	157,000	184,200	184,200	0
Total Legal Amazon	**37,098,069**	**2,493,600**	**34,604,469**	**23,069,646**	**22,405,700**	**3,913,100**	**18,492,600**	**17,091,464**	**967,449**
Deforestation as a result of cattle farming in the Amazon								**17,091,464**	

For the Cerrado states a different calculation is made, because here the distinction between extensive or intensive is relevant (table 5). The data are calculated as follows:

- First the ratio between extensive and intensive cattle farming is calculated per state. This calculation is based on IBGE data on of the ratio between the area of extensive and intensive cattle farming in 1995 (column e).
- Then the net cattle increase between 1995 and 2005 is attributed to intensive and extensive farming. Again, the cattle density is assumed not to be the maximum (for Cerrado 0.3 cattle/ha, for planted pasture 2 cattle/ha).
- Finally the calculated intensive farming area for 2005 is compared to the area in 1995. The increase is assumed to be the result of land conversion.

Table 5: Deforestation by cattle farming in the Cerrado states, 1995 – 2005

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
State	**Total cattle in 2005**	**Increase cattle between 1995 and 2005**	**Cattle which are already attributed to soy**	**Net cattle increase**	**Ratio between area occupied by ext. / int. cattle farming**	**Calculated ha ext. cattle farming (0.15 cattle/ha)**	**Calculated ha int. cattle farming (1.5 cattle/ha)**	**Area int. cattle farming 1995**	**Increase int. cattle farming 1995 and 2005**
Piaui	1,827,000	100,000	42,900	57,100	73% / 27%	2,591,500	958,500	459,000	499,500
Bahia	10,463,000	625,000	0	625,000	53% / 47%	7,049,000	6,251,000	6,652,955	-401,955
Minas Gerais	21,404,000	1,255,000	246,500	1,008,500	41% / 59%	9,225,000	13,275,000	11,694,188	1,580,812
Mato Grosso do sul	24,504,000	3,750,000	384,000	3,366,000	18% / 82%	3,492,000	15,908,000	15,727,930	180,070
Goias	20,727,000	11,078	365,000	-723,922	15% / 85%	2,392,500	13,557,500	14,267,411	-709,911
Sao Paulo	13,421,000	623,000	0	623,000	21% / 79%	2,310,000	8,690,000	7,055,823	1,634,177
Total	92,346,000	6,364,078	1,038,400	5,326,678		27,060,000	58,640,000		
Deforestation as a result of cattle farming in the Cerrado									**3,894,559**

It should be noted that the actual area that has been deforested as a result of cattle farming in the period 1995–2005 is probably higher then the calculated area presented above. The main reason for this is the assumed density of 1.5 cattle per ha for intensive cattle farming. Recent studies have shown that the real intensity is lower than 1.5. Possibly as low as 0.67 on average (intensive and extensive taken together) (FAO, 2006b). This would lead to a larger area needed for the total number of cattle in 2005. The total number of cattle in the Cerrado states in the table above is approximately 92 million suggesting a necessary area of (92/0.67) of 137.3 million ha. The calculated area in the states is only 85.6 million. These findings underline that the FAO statistics on deforestation are likely to be an underestimation of the actual deforestation.

Logging / timber production

It is necessary to distinguish between tropical timber from natural forests and timber from plantations (mostly pine and eucalyptus). Most of these temperate and sub-tropical plantations were established in the 1960s and 70s supported by government subsidies, sometimes on agricultural land. While some of these plantations may have involved conversion of forests, this would have been long before the time period for this study. Plantations established more recently have been on agricultural land. Exploitation of wood in cerrado forests is primarily for fuel and charcoal and for domestic use rather than export. This study therefore focuses on tropical timber from natural tropical forests in the Amazon states of Brazil which account for 90% of the country's tropical timber production (Viana et al 2002).

Lentini et al (2006) provide figures for harvesting of timber in the Amazon forest of Brazil: 24.5 million m3 in 2004, down from 28.3 million m3 in 1998. However, the processing efficiency rose over this period from 38% to 42% with the result that production of processed wood fell only slightly (from 10.8 million m3 to 10.4 million m3). There has also been geographic expansion in the sector with the number of wood hubs (polos madeireiros) increasing from 72 to 82 and a migration of the industry to new frontier areas in the extreme north west of Mato Grosso, the south of Amazonas and the east of Para (*ibid*).
Timber harvesting can be conducted legally through two main means: authorisation for forest clearance and authorisation of forest management plans. By law, landowners in Amazon forest regions are allowed to clear no more than 20% of their land. Table 6 provides figures for the amounts of timber harvested from areas authorised for forest clearance.

Table 6: Authorised timber harvesting from forest clearance

Year	Area authorised (000 ha)	Volume of timber from authorised forest clearance in Legal Amazon (million m3)
1997	255.4	5.32
1998	472.3	5.39
1999	240.9	5.89
2000	765.9	5.28
2001	263.0	5.57
2003	*138.5**	2.77
2004	*233.5**	4.67

Source: IBAMA website Lentini et al (2006)
* Estimated assuming 20m3/ha following Smeraldi (2004)

Table 7 provides figures for areas of forest and corresponding amounts of timber harvested under authorised forest management plans.

Table 7: Authorised selective timber harvesting

Year	Area with Authorised Forest Management Plan (000 ha)	Volume authorised (million m3)
2000	184.9	4.13
2001	340.4	9.37
2003	315.9	8.2
2004	342.3	9.35

Source: IMAZON 2005 (table 30 p83)

From Table 6 it can be seen that the legal clearance of forest ranges from 138,000 ha to 766,000 ha per year in the Amazon, well below the annual rate of deforestation.

However, there is also considerable illegal harvesting of timber as evidenced by the disparity between production figures and the amounts harvested under the two modalities (forest clearance and forest management). Legal extraction of timber in 2004 was 14.0 million m3 (4.67 from clearing plus 9.35 from forest management) whereas reported production was 24.5 million m3, a disparity of 10 million m3. If all of this illegal timber is assumed to come from deforestation, at a yield of 20m3/ha this would imply a further 500,000 ha of cleared forest annually. This together with the legally cleared area is still well below the annual deforestation rate. This indicates that much forest clearance for agriculture involves little commercial timber harvesting.

Forest degradation
Companies of the scale required for wood exports are more likely to be sourcing their timber from forest management plans. The major impact of wood exports is therefore on forest degradation rather than deforestation directly. They may also source from third parties engaged in deforestation but these are more likely to supply the large domestic market for timber.

An indication of the link between timber harvesting and forest degradation is given by the performance of timber companies with authorised management plans. Despite the complicated procedures required to obtain these authorisations it appears that these plans do little for forest management. A survey of forest management practices in 2005 found that with the exception of certified timber companies, timber harvesting in the Amazon was extremely "predatory". Certified companies were adopting good practices but apart from these, introduction of sustainable management was primarily limited to those practices required by law (Sabogal et al 2006). This survey also found that showing an interest in certification and/or being involved in the export market did not necessarily translate into better management practices. Better practices were only observable in companies that had already been certified.

4. Best practices

Soy
Several initiatives are being taken to produce sustainable or responsible soy. In cooperation with WWF, the Swiss Coop has developed the so-called Basel Criteria for sustainable soy. The two Brazilian soy suppliers IMCOPA and Agrenco supply sustainable soy and have a capacity of 2.2 million tons annually (WWF, 2006). Basel sustainable soy has only been available since 2006, so this best practice will not be incorporated in this research.

Similarly, the Netherlands have imported biological soy in 2007, about 25,000 tons (Dros, 2007). However this volume is likely to have been very small or even non-existent in 2005. Therefore no correction for biological soy is made in this study. It should be noted that the volume of responsible/ sustainable soy is expected to increase in coming years partly as a result of initiatives like the Round Table Responsible Soy. However, it this moment, there is no system in place yet that can guarantee the sustainability of this soy.

Meat
Currently there is no Brazilian meat available on the market for which it can be assured that did not contribute directly or indirectly to deforestation. It does not seem likely that this sustainable meat will become available any time soon.

Timber
FSC certification has been expanding in Brazil, covering 3.0 million ha in May 2005 of which 1.24 million (41%) corresponded to management of natural forest in the Legal Amazon region, 14% to plantations in the Amazon and 45% to plantations outside the Legal Amazon region (IMAZON 2005). Figures for 2004 were broadly similar, with 1.28 million ha of natural forest certified in the Legal Amazon. This represents a significant increase from 2000 when only one company (Precious Woods Amazon) with 80,751 ha was certified and from 2001 when there were 4 companies and 274,091 ha of natural forest certified (Viana et al 2002).

In 2005 the Netherlands imported an estimated 30.000 m3 of Brazilian FSC timber (FSC Netherlands, 2007). This equals approximately 15.000 tonnes. Nearly all of this timber originates from natural forests (Kreveld, 2007).

5. Export data and share by the Netherlands

Soy

Soy is an important export product for Brazil: soybeans, soy meal and soy oil represent a considerable share of the Brazilian export of agricultural products. Especially the export of soy beans has grown during the last decade (table 8). The Netherlands is a significant import country for Brazilian soy products: of Brazilian soy production 6% (1996-2000) to 11% (2001-2006) is annually exported to the Netherlands (table 8, figures 6 and 7).

Table 8: Average annual soy production in Brazil (x 1,000 Mt)

	1996-2000	**2001-2005**	**Trend (%) 1996-2005**
Total Brazilian production of soybeans, meal and oil	29,874	45,146	+ 51%

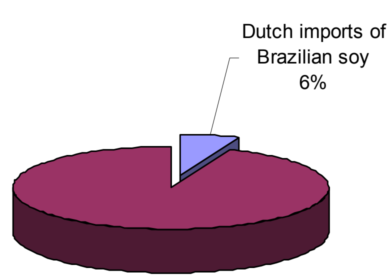
Source: Mielke, 2000 and Mielke, 2007

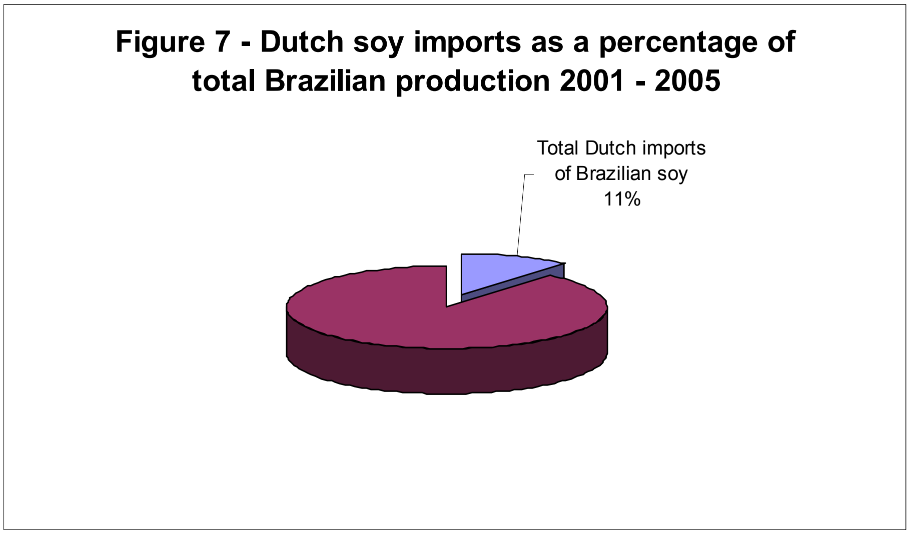
Table 9: Average annual soy imports into the Netherlands (x 1,000 Mt)

	1996-2000	**2001-2005**	**Trend (%) 1996-2005**
Total Dutch imports of soybeans	4,431	5,387	+ 22%
Imports of Brazilian soybeans	1,478	3,234	+ 119%
Total Dutch imports of soy meal	1,205	4,477	+ 272%
Imports of Brazilian soy meal	347	1,784	+ 414%
Total Dutch imports of soybean oil	114	76	- 33%
Imports of Brazilian soybean oil	0	3	
Total Dutch imports of Brazilian soy	1,825	5,021	+ 175%

Source: Mielke, 2000 and Mielke, 2007

Figure 6 - Dutch soy imports as percentage of total Brazilian production 1996 - 2000





Meat
Another important Brazilian export product for the Dutch market is cattle meat. Again both the Brazilian production as well as the Brazilian export to the Netherlands has increased (tables 10 and 11). Dutch average annual meat imports from Brazil are very limited, although increasing from 0.26% in 1996-2000 to 0.48% in 2001-2005 (figures 8 and 9). Most meat production in Brazil is consumed in-country or exported to other countries.

Table 10: Average annual cattle meat production in Brazil (Mt)

	1996-2000	2001-2006	Trend (%) (1996 – 2005)
Total Brazilian production of cattle meat	6,178,960	7,348,120	+ 19%

Source: FAOstat, 2007

Table 11: Average annual cattle meat imports into the Netherlands (Mt)

	1996-2000	2001-2006	Trend (%) (1996 – 2005)
Total Dutch imports of cattle meat	127,379	208,446	+ 64%
Dutch imports of Brazilian cattle meat	16,261	35,189	+ 116%

Source: FAOstat, 2007

Figure 8 - Dutch cattle meat imports as a percentage of total Brazilian production 1996 – 2000

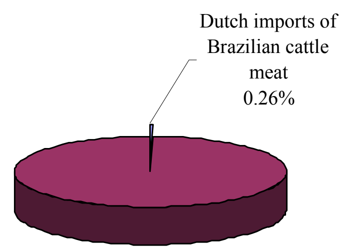
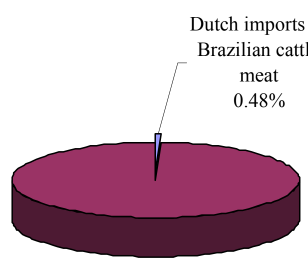


***Figure 9 - Dutch cattle meat imports as a* percentage of total Brazilian production 2001 - 2005**



Timber

In 1998 only 14% of wood produced in the Amazon region, approximately 1.5 million m3 was exported. By 2004 this proportion had increased to 36% (3.7 million m3) of processed wood production (Lentini et al., 2006). Reasons for the increase in exports include the favourable exchange rate (the Real depreciated against the dollar during this period) and increase in demand in European, North American and Asian markets (Lentini et al., 2006).

Brazil was the world's third largest tropical sawnwood exporter in 2005 with 1.3 million m3, and the fifth largest exporter of veneer (79,000 m3) and plywood (0.7 million m3). Eurostat figures for trade in wood products between Brazil and Netherlands show a steady increase between 1995 and 2006, rising from 44,242 tonnes in 1995 to 193,808 tonnes in 2006. These figures however do not distinguish between tropical and temperate timber. For this reason the ITTO figures which relate solely to tropical timber are used here. The ITTO direction of trade figures indicate the Netherlands as a significant importer over the period 1996-2005 of two main tropical timber products from Brazil, tropical plywood and tropical sawnwood. These figures converted to roundwood equivalent are shown below (Table 12) and compared with total Dutch imports of tropical timber (logs, sawnwood, plywood and veneer). Dutch imports from Brazil increased over the period in both absolute and relative terms.

Reliable production figures for tropical timber in Brazil are not available for the whole period 1996-2005. ITTO (2006) states that some countries, including Brazil have never provided it with reliable official production figures, and that the estimated production figures for these countries should be viewed with caution. As mentioned in Section 3, production figures for 1998 and 2004 are available from surveys conducted by the research institute IMAZON (Lentini et 2006). Dutch imports of tropical sawnwood and plywood (in RWE terms) in these two years corresponded to 0.17% and 1.1% respectively of Brazilian production of tropical timber.

Table 12: Dutch timber imports from Brazil (sawnwood and plywood)

	1996-2000 Annual average	**2001-2005 Annual average**
Dutch tropical timber imports from Brazil (000 m3 RWE)	95	189
Total Dutch tropical timber imports from all countries (000m3 RWE)	1,373	1,391
Share of Brazil in Dutch tropical timber imports (%)	6.9%	13.5%

Conversion factors: 1m3 RWE = 0.5 m3 sawnwood and 0.44 m3 plywood/veneer Calculated from ITTO data

These figures do not capture Dutch imports of veneer as these are not recorded separately in ITTO statistics, implying that they are very small. Brazil is also increasing its exports of secondary wood products, and after Indonesia and Malaysia is the third largest exporter amongst tropical countries. These exports include significant amounts of pine and eucalyptus as well as temperate zone hardwood species from the south part of the country (ITTO 2006). However, a furniture industry for export based on tropical hardwood is beginning to develop in the Amazon state of Para (ITTO 2006). No information is available about export of secondary wood products to the Netherlands so this is not included. The figures may therefore be an underestimate.

6. Results and conclusions

The available data and calculations that were made can now be used to estimate the contribution by soy, meat and timber to deforestation in Brazil, and the proportion taken by imports in the Netherlands.

Contribution by commodities to deforestation and forest degradation
Of the 29 million ha of deforestation that Brazil has experienced between 1996 and 2005, the majority can be attributed to cattle farming: 17 million ha of forest were lost in the Amazon due to cattle farming and almost 4 million ha were lost in the Cerrado (table 4 and 5), together this amounts to almost 21 million ha of 72% of total forest loss in that period.

The other main driver is soy production, which accounts for 7.6 million ha forest loss i.e. 26%, (table 3). This type of deforestation, by soy, predominates in the Cerrado eco-biome. Note that part of the deforestation which was actually caused by cattle farming has been attributed to soy production because clearing for cattle farming took place by farmers who had been displaced by soy expansion in the Cerrado. The remaining 2% can be attributed to other factors like logging, subsistence farming, maize production etc. (figure 10).

Timber harvesting indirectly can lead to deforestation by opening up remote areas and providing a source of finance but it is not the main driver. In contrast, forest degradation is mainly due to logging (in the Amazon biome mainly), and to some extent due to cattle ranching (in the Cerrado). While some area of deforestation can be linked to timber harvesting directly and indirectly through forest degradation this will already be accounted for in the calculations on soy and cattle.

The area of forest degradation is calculated by working back from the Dutch imports expressed as RWE to estimate the area over which selective logging needs to take place to yield this volume of logs. A merchantable volume of 20m3/ha is assumed from Smeraldi (2004). The area associated with certified timber is calculated in each year and deducted. Based on the findings of Sabogal (2006), it is assumed that any uncertified timber harvesting is resulting in forest degradation.

While information on the area certified in the Amazon is available for all years after 2001, there is less information on the amount of certified timber produced and the share of Dutch imports in certified production. We have resolved this by extrapolating from the 2005 information on certified Dutch imports. We have assumed that the ratio of Dutch imports of certified timber to certified area of tropical forest in 2005 applies to all the years from 2001. It is likely that as the certified area increased, the exports to the Netherlands increased also to reach their recorded level in 2005. Table 13 presents the calculations.

Table 13: Contribution of Dutch imports correcting for certified timber

Year	Dutch imports of Brazilian tropical timber m3 (RWE)[1]	Certified forest area (ha)	Certified exports to Netherlands m3	Certified exports to Netherlands RWE[6]	Non-certified exports to Netherlands RWE m3	Area of forest degraded[6] (ha)
1996	54,747				54,747	2,737
1997	82,091				82,091	4,105
1998	48,664				48,664	2,433
1999	133,360				133,360	6,668
2000	154,247	80,751[2]	*1,954*[5]	3,907	150,339	7,517
2001	256,800	274,091	*6,631*[5]	13,262	243,538	12,177
2002	135,914	*348,976*[3]	*8,443*[5]	16,886	119,028	5,951
2003	77,695	405,937[4]	*9,821*[5]	19,642	58,053	2,903
2004	265,825	1,281,176[4]	*30,996*[5]	61,992	203,833	10,192
2005	208,452	1,240,000[4]	30,000	60,000	148,452	7,423

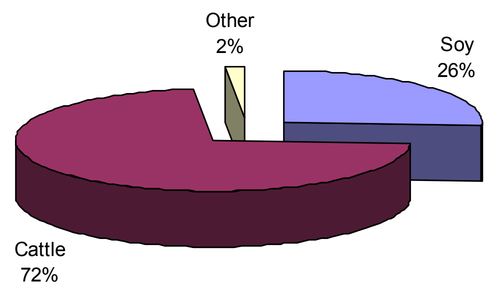
Notes 1Conversion factors: 1m3 RWE = 0.5 m3 sawnwood and 0.44 m3 plywood
2 Viana et al 2002
3 Calculated from additional area certified in 2002
4. Forest Facts, Imazon 2003 and 2005
5. Extrapolated from figures for certified area and certified export to Netherlands in 2005
6. Merchantable volume of 20m3/ha – Smeraldi, 2004

The Dutch contribution to forest degradation through timber imports over the ten year period 1996-2005 has been estimated at just over 60,000ha after correcting for FSC certification (Table 14). It increased by 65% between the first half (1996-2000) and the second half (2001-2005) of this ten-year period. Annually about 6% of degraded forest is being cleared, showing that degraded forest is gradually being totally lost.

Table 14: Dutch contribution to forest degradation in Brazil 1996-2005 (ha)		
Period	**Degradation associated with Dutch timber imports**	**Annual average**
1996-2000	23,460	4,692
2001-2005	38,645	7,729
Total	62,105	6,211

Note that although the tropical forest in the Amazon area is considered to be more species rich and vulnerable, and is largely classified as an intact forest landscape, the Cerrado savannah forest lands are also very biodiversity rich and substantial areas of intact savannah forest were cleared recently or still remain available (see Figure 3). Thus, we consider both the loss of tropical Amazon forest and savannah Cerrado forest of equal importance in terms of forest and associated biodiversity loss.

Figure 10 - Drivers behind Brazilian deforestation 1996 - 2005



We can also make specifications for the two periods of 1996-2000, and 2001-2005.

- Deforestation in the period of 2001-2005 has been about 2 million ha more than in the period 1996-2000: 13.5 and 15.6 million respectively;
- The expansion of soy in the 2nd period has been about 6 million ha more than in the 1st period;

The expansion of cattle farming is likely to have remained roughly the same within the two periods.

Thus, the contribution of soy expansion to deforestation has increased from 21% in 1996-2000 to 31% in 2001-2005 (average is 26%). Likewise the contribution by cattle farming has decreased from 77% to 67% (average is 72%).

Dutch share in Brazilian deforestation
Based on the production and import figures presented in tables 9 and 11, the share of Dutch imports to the total Brazilian production of soy, cattle meat and timber, and thus to deforestation, can be calculated (table 15).

For soy the contribution to deforestation is calculated as follows (proportion imports Brazil production X proportion contribution to deforestation X deforestation):
1996-2000: 6% of 21% of 13.5 million ha = 170,100 ha
2001-2005: 11% of 31% of 15.6 million ha = 532,000 ha

For cattle farming:
1996-2000: 0.26% of 77% of 13.5 million ha = 27,000 ha
2001-2005: 0.48% of 67% of 15.6 million ha = 50,700 ha

Table 15: Dutch contribution to deforestation in Brazil 1996 – 2005 (ha)

Period	Deforestation associated with soy	Deforestation associated with cattle	Total deforestation due to Dutch economic activities	Annual average
1996-2000	170,100	27,000	197,100	39,420
2001-2005	532,000	50,700	582,700	116,540
Total	**702,100**	**77,700**	**779,800**	**77,980**

Table 15 shows that in the period 2001 – 2005 Dutch economic activities contributed annually to over 116,000 ha of deforestation in Brazil, compared to an annual contribution of over 39,000 ha in the period 1996 – 2000. This is an increase of almost 200%. The contribution in the period of 1991–1995 can be expected to be much lower, since then soy imports from Brazil were much lower.

The contribution by soy being produced with best practices based on sustainability criteria (chapter 5) is still too meagre to play a significant role on calculations on our deforestation. However, in 2007 the proportion of sustainable soy is expected to have reached about 1% of the Dutch imports, and these quantities are expected to increase in the coming years.

References

Aidar, H. and J. Klutchcouski, 2003. Evolução das Atividades Lavoureira e Pecuária nos Cerrados, in: Integração Lavoura-Pecuária, pp 23-58, Embrapa Arroz e Feijão, Brasília.

Asner, g.p. et al., 2005. Selective Logging in the Brazilian Amazon. In: Science, Vol. 310, October 2005.

Bickel, U. and J.M. Dros, 2003. The impacts of soy bean cultivation on Brazilian Ecosystems, WWF Forest Conversion Initiative, Zurich.

CONAB, 2003. Terceiro Levantamento de Safra Agricola 2003/2004, Brasilia, February 2004; Terceiro Levantamento de Safra Agricola 2002/2003, Brasilia.

Dros, J.M., 2004. Managing the Soy Boom, Two Scenarios of Soy Production Expansion in South America, Commissioned by WWF Forest Conservative, June 2004.

Dros, J.M., 2007. Personal communication J.M Dros, July 2007.

FAO, 1997. State of the World's Forests 1997.

FAO, 2006a. *Global Forest Resources Assessment 2005, Progress towards sustainable forest management.*

FAO, 2006b. *Livestock's Long Shadow, Environmental Issues and Options.*

FAOSTAT, 2007*. Website of the Statistics Institute of the FAO: http://faostat.fao.org/default.aspx. Viewed June 2007.*

FSC Netherlands 2007. Personal communication with A van Noort, FSC Netherlands June 2007.

IBAMA Demonstrativo sobre as Areas Desmatadas Consolidado 1997-2001 Coordenação Geral de Gestão dos Recursos Florestais (CGREF) www.ibama.gov.br

IBGE/SIDRA*, 2007. Website of Statistics Institute of Brazil:* http://www.sidra.ibge.gov.br/bda/tabela/protabl.asp?z=p&o=18&i=P*, viewed June 2007.*

INPE, 2006. Website of Brazilian National Institute for Space Research: http://www.inpe.br/ingles/index.php. Viewed 2006.

ITTO 2005 Status of Tropical Forest Management Brazil, International Tropical Timber Organization, Yokohama, Japan.

ITTO 2006 Annual Review and Assessment of the World Timber Situation, International Tropical Timber Organization, Yokohama, Japan

Kessler, J.J., J.M. Dros and I. de Bruin, 2006. Ecosystem - human development dynamics in soy bean production in the Brazilian Cerrado ecosystem. Commissioned by The Netherlands Institute for Environmental Assessment (MNP), 2006.

Klink C.A., 2001. Human occupation and land-use of Brazil´s tropical savannas (the "Cerrado"), Depto. de Ecologia, Universidade de Brasilia, Brasilia (2001).

Kluthcouski et al., 2001. Integração Lavoura-Pecuária, Embrapa.

Klutchouski, J and H. Aidar, 2003 Uso da Intgração Lavoura-Pecuária na Recuperação de Pastagens Degradadas, in: Integração Lavoura-Pecuária, p 187, Embrapa Arroz e Feijão, Brasília, 2003.

Kreveld, 2007. Personal Communication with A. van Kreveld, Timber Trading Company A. van de Berg, July 2007.

Lentini, M., Veríssimo, A. and L. Sobral 2003 Forest Facts 2003 IMAZON, Belém

Lentini, M., Veríssimo, A. and L. Sobral 2003 Fatos Florestais da Amazônia 2003 IMAZON, Belém.

Lentini, M., Veríssimo, A. and L. Sobral 2003 Forest Facts 2003 IMAZON, Belém (updated English version).

Lentini, M., Veríssimo, A. and L. Sobral 2006 Fatos Florestais da Amazônia 2005 IMAZON, Belém.

Mielke, 2000. Oil World Annual 2000.

Mielke, 2007. Oil World Annual 2007, Vol. 1 up to 2006/07.

Rainforest Foundation, 2005. Irrational Numbers: Why the FAO's Forest Assessments are misleading.

Sabogal, C., Lentini, M., Pokory, J., Silva, N., Zweede, J., Verissimo, A. and M. Boscolo 2006. Manejo Florestal Empresarial na Amazônia Brasileira Restrições e Oportunidades CIFOR IMAZON, Embrapa, Fundação Florest Tropical. Belem.

Smeraldi, R. 2004 Legalidade Predatória – o novo contexto da exploração madeireira na Amazônia in Macqueen, D (ed.) Exportando sem crises A indústria de Madeira tropical brasileira e os mercados internacionais. Small and medium forest enterprises series No. 1, IIED, London.

Viana, V., May, P., Lago, L., Dubois, O., and M. Grieg-Gran (2002) Instrumentos para o manejo sustentável do setor florestal. Instruments for sustainable private sector forestry series, IIED, London.

Vilela, I. et.al., 2003. Degradação de Pastagens e Indicadores de Sustentabilidade, in: Integração Lavoura-Pecuária, p 118, Embrapa Arroz e Feijão, Brasília.

White, R.P. and Vana sselt, W, 2000. Grassland in pieces, modification and conversion take a toll, Earth Trends, World Resources Institute, Washington DC.

WWF, 2006. Facts about Soy Production and the Basel Criteria, 2006. http://assets.panda.org/downloads/factsheet_soy_eng.pdf

Country study 9 – Paraguay

Summary

This study focuses on soy production and timber harvesting. Total deforestation in Paraguay over the period 1996-2005 has been 2.7 million ha, mostly concentrated in the Eastern region of the country. The main driver of deforestation over the period has been soy production. The Netherlands is an important import market for Paraguayan soy producers accounting for roughly 10% on average of total soy production in the country over this period but declining from 13.3% in 1996-2000 to 7.6% in 2000-2005.

The Dutch contribution to deforestation in Paraguay is summarised in the following table. Despite a decrease in Dutch imports, there has been a 19% increase in the Dutch contribution to deforestation between 1996-2000 and 2001-2005. This is because the second half of the period saw much greater increase in the soy planted area and most of this expansion involved deforestation.

Dutch contribution to deforestation in Paraguay 1996-2005 (ha)

Period	Deforestation associated with soy	Annual average
1996-2000	31,901	6,380
2001-2005	37,907	7,581
Total	69,808	6,981

While there have been imports to the Netherlands of tropical sawnwood over the period, these have been small in both absolute and relative terms. Given the close association between logging and agricultural expansion, the import of tropical sawnwood is likely to be contributing to deforestation rather than forest degradation and to be already covered by the calculations on soy expansion.

1. Trends in deforestation

According to FRA 2005 the net annual loss of forest cover in Paraguay over the period 1990 to 2005 was 179,000 ha equivalent to 0.9% of the remaining forest area. The FAO forest cover figures include plantations and so underestimate deforestation. However the rate of plantation development between 1990 and 2005 was minimal increasing from 23, 000 ha to 43, 000 ha, on average about 1, 300 ha per year (FAO 2005). Other sources suggest that deforestation has been more extensive than indicated by FAO statistics. According to WWF, until recently (2004), Paraguay had the second highest deforestation rate in the world (WWF 2006a). Hansen and DeFries (2004) who measured deforestation in terms of percentage loss of tree cover found that Paraguay had the highest rate of deforestation worldwide over the period 1982-1999.

Table 1: Deforestation trends in Paraguay 1990-2005

Period	Total deforestation (000 ha)	Annual deforestation (000 ha)
1990-2000	1,789	179
2000-2005	893	179

Source: FRA 2005

In 2005, Paraguay had 18.4 million ha of forest, about 45% of its total land area. Over 80% of the forest cover in 2002 was in the sparsely populated Western (Chaco) region of Paraguay and only 18% was in the more populated Eastern region (FAO 2005) where agricultural activity is concentrated. Only 12% of the original area of the Atlantic forest in Paraguay remains and is highly fragmented and degraded (WWF 2006a). Other sources suggest that the destruction of the Atlantic rainforest has been even more extensive and that only 800,000 ha or 7% of its original extent remains (Dros 2004). Much of the concern about Paraguay's forests centres on the Upper Parana Atlantic forest in the Eastern region which, according to WWF (2006b), is one of the world's most ecologically important regions with rich biodiversity and high levels of species endemism.

The government of Paraguay in December 2004 introduced the zero deforestation law, initially for a period of two years but extended it recently for another two years until December 2008 (WWF 2006b). This law, which introduced penalties for deforestation, has helped to cut deforestation in Paraguay by 94% to an estimated 19,000 ha per year (MAG 2006).

2. Drivers of deforestation

Paraguay's development model based on agricultural exports has driven a process of deforestation and conversion to agriculture (EC 2007). Agriculture contributes 27% of GDP and 84% of exports and the main exports are soybeans (35%) and meat (10%) (EC 2007).

Early drivers of deforestation were forestry in the 1930s-60s and cattle rearing (1960s-80s) but in recent decades the main driver has been mechanised soy production (Dros 2004). The 1973 forestry law, which created the national Forestry Service, included a requirement that all rural properties greater than 20 ha maintain at least 25% under natural forest cover. This law and subsequent reinforcing legislation in 1986 proved difficult to enforce (Catterson and Fragano 2004). The World Bank (1995) noted that the major growth experienced by the agricultural sector had been achieved at the expense of the natural forest.

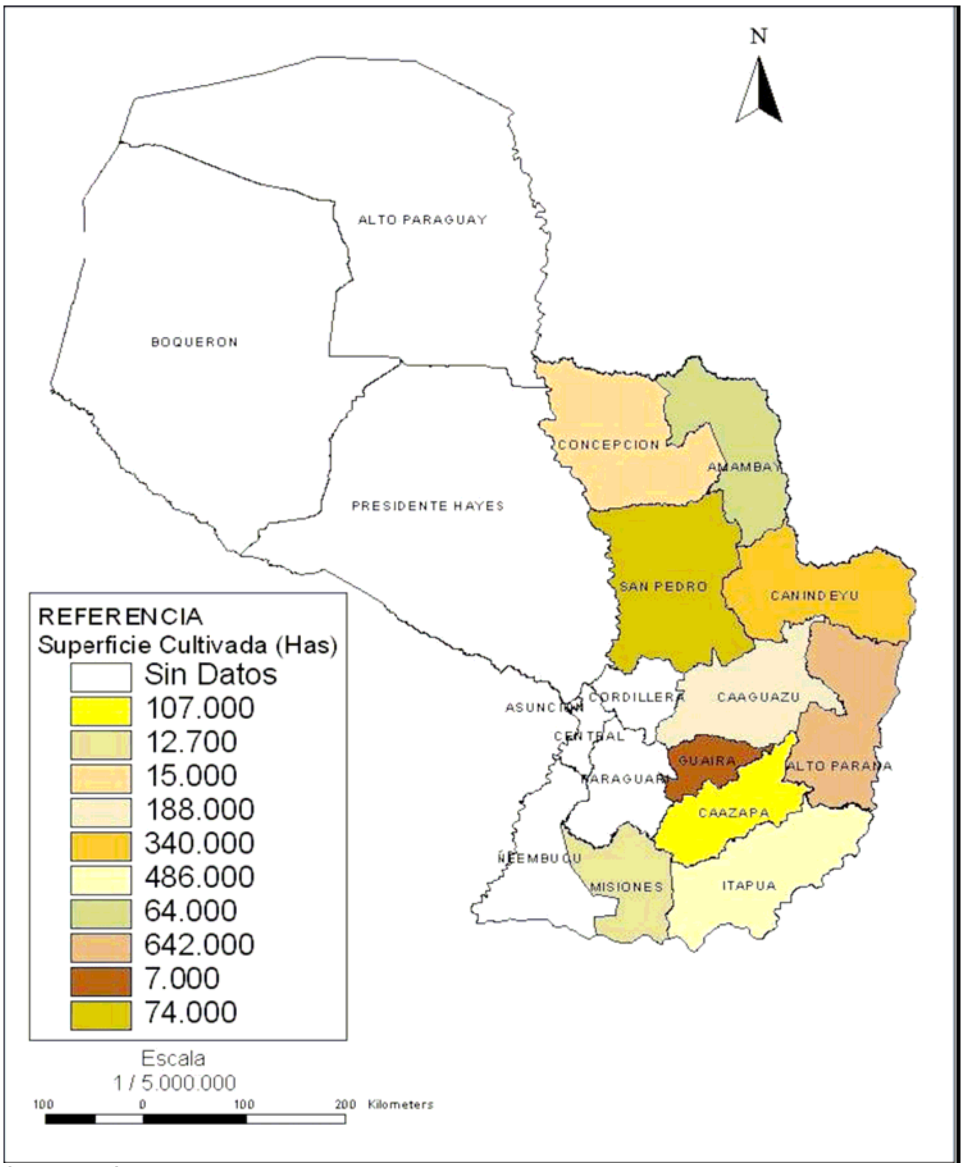
Soybean cultivation started in the early 1970s in the Atlantic rainforest region in the east of Paraguay in the Parana river basin, expanding to other eastern provinces in the early 1980s to reach 650,000 ha (Dros 2004). A slight decrease followed in the late 1980s and early 1990s but from the mid 1990s there was further expansion., Between 1991 and 2005 the area planted with soy increased by 340% (FAO 2006) as shown in Table 2. Current planted areas are shown in Figure 2. Table 3 shows the annual expansion in planted area from 1997 to 2005. It can be seen that the expansion in soy planted area in the second half of the study period was almost four times the expansion in the first half of the period.

Further expansion is expected but not necessarily involving deforestation directly. The Paraguayan soy producers association was aiming to increase the soy planted area to 2 million ha by 2006 and 3.5 million ha by 2008 but with the declared intention of accommodating this expansion in cattle rearing areas rather than forest (Dros 2004).

Table 2: Expansion of soy planted area by province 1991-2005 (ha)			
Province	**1991**	**2005**	**Increase (%)**
Alto Paraná	228,504	710,100	311
Itapúa	210,523	479,225	228
Canindeyú	49,030	329,740	673
Caaguazú	21,799	158,020	725
Caazapá	8,931	112,720	1,264
San Pedro	17,367	75,850	437
Total	**536,154**	**1,865,655**	**340**

Source: FAO 2006

Figure 1: Soy planted areas in Paraguay



Source: MAG (2007)

Table 3: Expansion of soy planted area	
Year	**Soy planted area (000 ha)**
1996	960
1997	1,050
1998	1,150
1999	1,200
2000	1,200
2001	1,350
2002	1,283
2003	1,474
2004	1,870
2005	1,970
Increase 1996-2000	240
Increase 2001-2005	960

Source 1996-2000:CAPECO cited in Semino et al (2006). 2001-2005: MAG(2006)

Cattle rearing is also considered to be a dynamic sector showing substantial growth in value of production between 1998 and 2006 (MAG 2007). However the number of heads of cattle has grown very slowly in recent years (MAG 2007). While the number of heads of cattle increased from 5.8 million in 1980 to 9.8 million in 1995, there was little increase after this, and the number in 2005 was slightly lower at 9.6 million (Glatzle and Stoziek 2006). Beef production also stabilised over this period (ibid). The area of improved pasture (implying forest clearing) in the Eastern region increased rapidly from 1.47 million ha in 1991 (World Bank 1995) to 2 million ha in 1996 (Glatzle and Stoziek 2006) but over the subsequent 10 years increased by only 200,000 ha to 2.2 million ha (MAG 2007)[10]. This suggests that after 1996, cattle rearing was not a major driver of deforestation, leading to about 20,000 ha of forest clearing per year or 11% of the annual deforestation.

3. Commodities production and deforestation

Soy

Paraguay produced 2% of world soy production in 2003/4 (Dros 2004). Both production and area planted with soy increased significantly over the period 1996-2005. Average annual production was about 30% higher in 2001-2005 than in 1996-2000 as shown in Table 4.

Table 4 Soy Production trends	
Year	**Soy production (000 tonnes)**
1996	2,405
1997	2,771
1998	2,988
1999	2,980
2000	2,911
2001	3,511
2002	3,554
2003	4,204
2004	3,584
2005	3,988
Total 1996-2000	14,069
Annual average 1996-2000	2,814
Total 2001-2005	18,842
Annual average 2001-2005	3,768

Source: 1996-2000: CAPECO cited in Semino et al (2006). 2001-2005: MAG (2006)

10 MAG (2007) reports 4,058,475 ha of cultivated pasture in Paraguay of which 54% is in the Eastern Region = 2,191,576 ha.

In 2005, the area planted with soy exceeded the area planted with all other principal crops combined[11].

Expansion of the soy planted area can be on virgin forest, or on land that has already been cleared for cattle rearing or other agriculture. In the latter case the soy expansion would not be contributing to deforestation. However, much depends on what the farmers currently using the land do after they have sold it. If they move to other areas and convert forest to pasture or cropland, the expansion of soy would indirectly lead to deforestation. The total impact of soy expansion on deforestation depends on the magnitude of these direct and indirect different effects.

There is very little firm evidence on which to base estimates, particularly for the indirect effects. However, it appears highly likely that most of the expansion of soy planted area over the period 1996-2006 has been in forested areas. According to Dros (2004), soy has been the main driver of deforestation since the 1990s, and legal and illegal deforestation for soy is common in Paraguay. This is consistent with the figures for expansion of improved pasture for cattle rearing, the other main driver of deforestation, other agricultural crops and the annual deforestation rate. Cattle rearing has involved at most about 20,000 ha annually of deforestation over the 10 years 1996-2005. Other agricultural crops have not involved the same degree of expansion as soy. Both cotton and maize, for example, despite increasing in 2004, had lower planted areas in 2005 than in 2001 (MAG 2006). Other crops such as rice, sugar cane and cassava expanded their planted area over the period 2001-2005 but the areas involved were small, from 1,000-10,000 ha per year.

As expansion of soy planted area has been mostly on forested areas, the indirect effects through displacement of existing land uses are likely to be minimal.
Nevertheless, there is indication that towards the end of the study period there was some change in the pattern of soy production. An FAO article on food security in Paraguay reports that soy cultivation is now expanding into existing cattle ranching and cropping areas in the Eastern region of Paraguay rather than forest as so little forest is left there (FAO 2006). But it appears that the replacement of these land uses by soy is not leading to deforestation elsewhere. In the Northeastern provinces, where soy is replacing pasture, the cattle displaced are being accommodated through more intensive use of the remaining pasture land. In the central and Southeastern provinces, soy is replacing subsistence agriculture but the farmers involved are moving out of agriculture as a result. The small farmers who are being induced to rent or sell their land to soy growers are either migrating to urban areas or setting up small businesses along the main highway (FAO 2006).

This suggests that at least in recent years the expansion of the soy planted areas has not led to deforestation indirectly through displacement of former land uses.

For 2005, it is necessary to take into account the impact of the zero deforestation law which appears to have been effective in reducing forest conversion. Soy production continued to grow in Paraguay from 3.6 million tons in 2004 to 4.0 million in 2005 and the planted area expanded by 100,000 hectares (see Tables 3 and 4). Yet deforestation was only 19,000 hectares in 2005 according to MAG (2006). This suggests that in 2005, the last year of the period of study, the expansion in soy production was largely in existing cleared areas and that there was minimal displacement of former land use activities to clearing of natural forest. This would be

[11] The total planted area for 12 crops including corn, cotton, cassava, wheat and sugar cane was 1,6 million ha in 2005 somewhat lower than the area of soy alone which was 1.97million ha (MAG 2006).

consistent with WWF estimates that expansion in agricultural production was possible without further deforestation as more than 500,000 ha of fallow land was available in the Atlantic forest for farming, ranching or reforestation (WWF 2006).

As deforestation has averaged 179,000 ha per year over the 10-year period with the exception of 2005 when the effects of the zero deforestation law became evident, it seems plausible that the expansion of soy (on average 48,000 per ha in 1996-2000 and 124,000 ha per year in 2001-2005) has been almost entirely through forest conversion. The expansion in pasture for cattle rearing or land for other crops has been the exception would be for 2005 as discussed above.

We therefore base our calculations for the first half of the period on the assumption that 100% of soy expansion involved clearing of natural forest, directly or indirectly. For the second half of the period we reduce this percentage to 80% to take account of the effects of the zero deforestation law in 2005. The results of these calculations are presented in Table 5.

Table 5: Forest conversion effects of soy cultivation 1996-2005

Period		Total area increase of soy (000 ha)	Proportion on forest ecosystems	Total forest area converted due to soy expansion (000ha)	Proportion on already cleared land
1996-2000		240	100%	240	0%
2001-2005		620	80%	496	20%
1996-2005		860		736	

Timber

Timber harvesting is closely linked with agricultural expansion as a driver of deforestation. The decline in the Paraguayan wood industries resulting from a lack of raw material supplies is symptomatic of an industry model based on forest clearance rather than forest management. According to a USAid assessment, the total area of productive forests in the Eastern part of Paraguay is now 5% of its original area and commercial wood production is half of what it was two decades ago (Catterson and Fragano 2004). However, official statistics given in the Paraguay country report for the FRA 2005 show an increase in timber harvested over the period 1988 to 2004 (FAO 2005).

Although timber harvesting through a forest management plan based on sustainable use is a legal means, there has been very little use of this mechanism *(ibid*). Most timber harvesting has been through poorly monitored forest exploitation plans based on 15-year rotations (*ibid*).

4. Best practices

Several initiatives are being developed to produce sustainable or responsible soy and Paraguayan producers have participated in discussions. However, to the best of our knowledge, there is no independently certified sustainable or responsible soy being marketed in Paraguay.

As of August 2007, there were three FSC certificates for forest management covering 2,705 ha on a mix of natural, semi-natural and plantation forest (FSC 2007) This is so small that it is unlikely to have much offsetting effect on the exports of timber from Paraguay.

5. Export data and share of the Netherlands

Soy is an important export crop for Paraguay, accounting for 31%-43% of the value of agricultural exports over the period 1996 to 2005 (MAG 2006). Exports of soy grew in value terms by an average of 6.4% per year over this period (MAG 2006). Production of soy in Paraguay averaged 2.8 million tonnes in the first half of the period increasing to 3.77 million tonnes per year in the second half of the period.

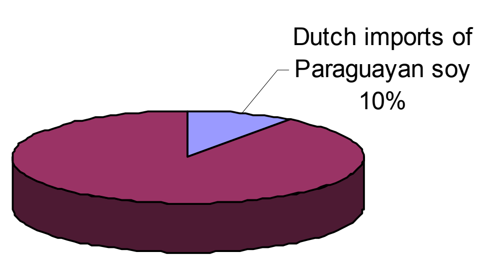
The Netherlands is an import country for Paraguayan soy products, principally soybeans but the amount imported was substantially lower in 2001-2005 than in 1996-2000 as shown in Table 6. Nevertheless, the Netherlands remained a major export market for Paraguayan soy, accounting for roughly 8% of total production in 2001-2005 and 10% over the whole period 1996-2005 (Figure 2).

Table 6: Average annual soy exports to Netherlands and share of Paraguayan production

	1996-2000	2001-2005	Trend (%) 1996-2005
Average annual soy production Paraguay (000 Mt)	2,814	3,768	34%
Average annual Dutch imports of Paraguayan soy (000 Mt)	374	288	-23%
Share of Dutch soy imports in Paraguayan production (%)	13.9	7.6	

Source: Exports: FAOstat, 2007 Production: See sources for Table 4

Figure 2: Dutch soy imports as percentage of total Paraguayan production 1996-2005



Timber

Paraguay's exports of timber declined slightly in value terms between 1996 and 2005 (MAG 2006). Exports of tropical sawnwood, its main export product in volume terms, also declined over the period as shown in Table 7.

Dutch imports of timber from Paraguay are confined to tropical sawnwood. They have been very small in both absolute and relative terms, considerably less than 1% of Paraguayan exports of this product, and have declined since 1997. Although total Paraguayan exports of tropical sawnwood have also declined, the Dutch share of these exports has declined further.

Table 7: Exports of tropical sawnwood to Netherlands

	Total m3 1997-2000	Annual average m3	Total m3 2001-2004	Annual Average m3	Trend % 1997-2000 to 2001-2004
Exports to Netherlands	3,775	944	441	110	-88%
Total Paraguayan exports	1,145,330	363,832	537,874	134,468	-63%
Exports to Netherlands as % of total Paraguay exports	0.26%		0.08%		

Source: Calculated from FAOSTAT data on Paraguayan exports.

6. Results and conclusions

The expansion of soy has been a principal driver of deforestation over the period and Dutch imports have constituted a significant share of total soy production in Paraguay.

Based on the area of soy expansion involving deforestation and the ratio between Dutch imports and total production of soy in Paraguay we calculate the Dutch contribution to deforestation as follows: (proportion imports of Paraguay production X the area of deforestation associated with soy expansion).

1996-2000: 13.3% of 240,00 ha = 37,907
2001-2005: 7.6% of 496,000 ha = 31,901

Table 8: Dutch contribution to deforestation in Paraguay 1996-2005 (ha)

Period	Deforestation associated with soy	Annual average
1996-2000	31,901	6,376
2001-2005	37,907	7,581
Total	69,808	6,981

While there have been imports to the Netherlands of tropical sawnwood over the period these have been small in both absolute and relative terms. Given the close association between logging and agricultural expansion the import of tropical sawnwood is likely to be contributing to deforestation rather than forest degradation and will be covered by the calculations on soy expansion.

References

Catterson, T.M. and F.V. Fragano (2004) Tropical Forestry and Biodiversity Conservation in Paraguay: Final Report of a Section 118/119 Assessment EPIQ II Task Order No.1. Prepared for USAID, December 30, 2004 d

EC 2007 Paraguay Country Strategy Paper 2007-2013 European Commission 11.04.2007 (E/2007/614).

FAO 2005 Evaluación de los recursos forestales mundiales 2005. Paraguay Informe Nacional. Food and Agricultura Organization, Rome.

FAO 2006 La ampliación de la frontera de la soja y sus repercusiones en la seguridad alimentaria en el Paraguay. Perspectivas de Cosechas y Situación Alimentaria. No. 3, Octubre 2006 www.fao.org/giews/spanish/cpfs/special_features/soja.htm

FSC 2007 FSC Certified forests 09 August 2007 www.fsc.org Viewed on 25th August 2007

Glatzle, A. and D. Stosiek 2006 Country Pasture/Forage Resource Profiles Paraguay. Food and Agriculture Organization, Rome. Prepared in 2001 and updated by S. G. Reynolds in 2006 www.fao.org/ag/agp/agpc/doc/counprof/paraguay/paraguay.htm

Hansen, M.C., and R.S. DeFries 2004 Detecting Long-term Global forest Change Using Continuous Fields of Tree-Cover Maps from 8-km Advanced Very High Resolution Radiometer (AVHRR) Data for the Years 1982-1999. Ecosystems Volume 7, No. 7, November, Springer New York.

MAG 2006 "El Sector Agropecuario y Forestal en Cifras" Ano 2006, Ministerio de Agricultura y Ganadería, Octubre, 2006, Paraguay http://www.mag.gov.py/Estadisticas/rev2006.pdf

MAG 2007 Boletin Informativo de Rubros de Importancia Económica Carne Bovina. Ano 1 – No. 3 Junio de 2007

Semino, S., Joensen, L. and J. Rulli 2006 Paraguay Sojero Soy Expansion and its Violent Attack on Local and Indigenous Communities in Paraguay. Repression and Resistance. Grupo de Reflexion Rural, Argentina. www.grr.org.ar

World Bank 1995. Paraguay Agricultural Sector Review. Report No. 12123-PA Country Department 1, Natural Resources, Environment and Rural Poverty Division, Latin America and the Caribbean Regional Office, World Bank.

WWF 2006a Paraguay: Zero Deforestation Law contributes significantly to the conservation of the Upper Parana Atlantic Forest. Leaders for a Living Planet, August 30, 2006. www.wwf.org.py

WWF 2006b Paraguay extends forest conservation law 18 December 2006. Viewed on 24th August 2007. www.wwf.org.py