

Asia Pulp & Paper's Hidden Emissions: Calculating the Real Carbon Footprint of APP's Paper

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Summary

In order to develop a more complete carbon footprint estimate for Asia Pulp and Paper's (APP) paper production in Sumatra, we estimated the carbon emissions from peat land decomposition and harvest biomass related to APP's pulp mills woodchip supply, both of which carbon sources had not been properly included in a published carbon footprint analysis conducted for APP by Environmental Resources Management (ERM). Our analysis estimates the carbon footprint of APP's paper production in Sumatra to be in the range of 16 – 21 tons of CO₂e per ton of paper. This is nearly 550 - 700 times higher than the ERM estimate, which did not include these land use sources of carbon emissions, of 0.03 tons of CO₂ per ton of paper. Our estimate of APP's total emissions is 67-86 million tons of CO₂e from its Indonesian pulp and paper mills and forest concessions. This ranks APP ahead of the emissions of 165 countries around the world in 2006. Buyers of APP paper should be aware that APP's paper has a huge carbon footprint that is not being disclosed by the company.

Introduction: Rainforests, Climate Change and Paper

The degradation and loss of tropical rainforests and peatlands contributes 15 percent of global greenhouse gases each year, as much as those from the world's transportation sector.¹ The biggest drivers of this tropical forest loss come from the production of a handful of globally traded commodities.² In Indonesia, which loses 1.2 million hectares of rainforest every year, logging for the pulp and paper sector is widely recognized as a leading cause of rainforest and peatland emissions.³ Paper from Indonesian-fed mills is, in turn, entering the supply chains of major companies and being sold to consumers in countries around the world including the U.S., Europe and Japan.

The business link to deforestation and climate change is sparking growing attention from a wide range of companies interested in reducing the carbon footprint of their operations and supply chains. For example, in 2010 investors, working with the London based Forest Footprint Disclosure Project, contacted 200 leading companies in 20 sectors seeking assessments and public disclosure of how their activities and supply chains contribute to deforestation, a measure of their "forest footprint."⁴ Similarly, the Consumer Goods Forum, a network of over 600 companies in 70 countries with nearly \$3 trillion in annual sales,⁵ recently launched a global initiative to persuade its members to work together to put an end to deforestation.

“Whether we like it or not it is very largely our industry which is providing the economic incentives for individuals and companies to chop down trees.... Between us, we spend billions of dollars buying these commodities. We can make a difference if we buy them differently and better.”⁶

Indonesia is the third largest emitter of global warming gases after China and the United States.⁷ According to an August 2010 report from Indonesia’s National Office on Climate Change (DNPI), Indonesia was responsible for 2.1 gigatons of CO₂ emissions in 2005, or about 5 percent of total global emissions⁸. However, unlike China or the U.S., where the vast majority of emissions come from burning fossil fuels, Indonesia’s greenhouse gas profile is dominated by emissions from land use, with deforestation contributing an estimated 41 percent and peat land degradation 38 percent of the total, according to DNPI.⁹ Indonesia contains 7 percent of global peat land area, yet it is responsible for more than half of the emissions from peatlands worldwide.¹⁰ Despite the globally significant climate impacts and costs of these peat emissions, the associated economic activity on peatlands contributes only 1 percent of Indonesia’s gross domestic product according to the Indonesian government agency, BAPPENAS.¹¹

Consumers are increasingly aware and responsive to carbon footprint reporting. According to a major UK consumer goods corporation, *“One in two [of our] customers now has a good idea of what a carbon footprint is, and nearly half said they would seek products with lower emissions,”*¹²

As corporate buyers of forest products are placing greater scrutiny on their paper supply chains, they are adopting more robust environmental and social safeguards criteria for the paper they buy in order to reduce their forest footprint and implement their corporate social responsibility mandates.¹³ These initiatives are increasing the need for greater transparency and traceability in every link of paper supply chains, from consumer back to the forest, and consistency with standards for responsible forest management.¹⁴ This poses particularly large challenges for suppliers like Asia Pulp and Paper (APP) and APRIL in Indonesia. Their production methods are associated with long-running and exceptional levels of social and environmental controversy, which has led them to become the focus of numerous international NGO campaigns to end these destructive forestry practices.¹⁵

Indonesia’s largest pulp and paper manufacturer is APP, with eight large pulp and paper mills (two of its largest are located in Sumatra) and revenues of \$4.3 billion.¹⁶ Sumatra contains some of the highest concentrations of peatlands in Indonesia. Large areas of acacia pulpwood plantations are located on cleared and drained peatlands, and the pulp sector continues to expand its plantations into these landscapes with resultant very high carbon emissions.¹⁷

Asia Pulp and Paper’s Carbon Footprint

In an attempt to rebrand itself as a responsible company in the context of growing market concerns with the high carbon footprint of Indonesia's pulp and paper sector, APP commissioned the U.K based consultancy firm, Environmental Resource Management (ERM), to conduct a carbon footprint calculation of APP's pulp and paper production in Sumatra.¹⁸ Neither the full study nor the underlying data has ever been made publically available, despite repeated requests from various stakeholders. The executive summary, which is public, is very murky on some fundamental methodological issues.¹⁹ Surprisingly, ERM came up with a carbon footprint figure for its client of 0.03 tons of CO₂e per ton of paper produced in 2006, which, if true, would make APP paper virtually "carbon neutral". APP now actively and repeatedly profiles the ERM study results in its public relations and marketing efforts.²⁰

The implausibly low ERM/APP carbon footprint calculation raises some serious questions. **How can the biggest pulp and paper company in Indonesia, using a business model that's reliance on cutting natural forests and draining peatlands is well-documented, operating in the sector that is a leading driver of deforestation in Indonesia, which in turn is the country responsible for 25 percent of the deforestation emissions in the world, credibly claim to be making paper that is virtually "carbon neutral?"**²¹ Or, did ERM use a methodology that simply failed to include the full suite of land use land use change and forestry (LULUCF) emissions, including peat emissions, associated with APP's production of pulp and paper in Indonesia. If so, why did ERM choose to exclude APP's largest source of carbon emissions? Why were the assumptions that ERM used to underpin its results not made public? And why has ERM allowed APP to repeatedly exaggerate these results in their public communications?

With these questions in mind, Rainforest Action Network and JATAN, using the limited information provided in the Executive Summary, set out to analyze the assumptions and methodologies of the APP/ERM carbon footprint study.

Dodgy Accounting

Our first hypothesis was that the ERM methodology simply excluded entire categories of emissions sources from its calculations. The APP/ERM Executive Summary fails to explicitly discuss emissions from peat soil decomposition or natural forests leaving it unclear as to whether or why they were excluded. However, additional, originally undisclosed information about this aspect of the ERM study methodology was found in a posting on the APP website dated 10 months after the release of the original ERM study executive summary and buried at the end of a long footnote:

*"ERM calculated GHG flows from two dedicated sources of fiber supply operated by Sinarmas Forestry and its partners in Sumatra, Indonesia. This analysis included carbon inflow due to sequestration in plantation above-ground live-biomass, **without taking into account the previous land use and management; and carbon outflow due to above-ground Carbon release (from harvesting standing pulpwood stock only).**"*²² (Emphasis

added to original.)

In other words, this explicitly confirms that emissions from logging or clearing natural forests and from decomposition of peat soils on lands associated with APP's paper fiber supply were simply written out of ERM's carbon footprint equations and not counted. At the same time, ERM allowed APP to take credit for the above ground sequestration that occurred on their plantations.

This accounting is reminiscent of that mythical, magical checking account that only credits your deposits and never debits your withdrawals.

In reality, such an unbalanced approach violates numerous basic forest carbon accounting principles and procedures including those published by the Intergovernmental Panel on Climate Change (IPCC), the Clean Development Mechanism (CDM) under the UN Framework Convention on Climate Change (UNFCCC) and peer reviewed scientific papers.^{23,24} For example, according to scientists at the Center for International Forest Research (CIFOR), *"in order to claim credit for sequestration, plantations that replace the natural ecosystems must first replace the carbon that was lost during conversion, before additional carbon storage can be claimed."*²⁵ In other words, to accurately represent the impact on the atmosphere, the carbon debt associated with APP's plantation development, maintenance and harvest should be counted, but ERM failed to do so. The UN Framework Convention on Climate Change's Clean Development Mechanism, in its approved methodologies for afforestation and reforestation project carbon accounting, states definitively that for soil carbon emissions for plantations on peatlands must be counted, something that ERM also failed to do.²⁶ ERM states that it used carbon footprint guidelines and protocols developed by the World Resources Institute and the International Council of Forest and Paper Associations, presumably "Calculation Tools for Estimating Greenhouse Gas Emissions from Pulp and Paper Mills" from 2005.²⁷ According to this protocol's authors, however, *"Issues related to carbon sinks or forest sequestration are not addressed."*

This raises a second and obvious question. If the peat decomposition and rainforest harvesting emissions missing from ERM's analysis were counted and included, what impact would this have on the size of APP's carbon footprint? Below, we've attempted to calculate a more realistic figure for APP's carbon footprint.

Review and Recalculation of ERM's Carbon Footprint for APP

Calculating the total emissions of pulp and paper production requires a comprehensive approach that considers all the major components of emissions in each step of the paper production process, including those related to land use, land use change and forestry (LULUCF).²⁸

In our re-calculated estimate of APP's carbon footprint, we used a combination of the data

provided in the ERM report summary²⁹, supplemented with data to estimate a reasonable range of the land use emissions that are missing in the ERM analysis. This supplemental land use data is drawn from published technical and scientific data and reasonable assumptions and estimations based on evidence collected from field investigations. The land use emission calculations are meant to provide first order estimations that can give a reasonable sense of the scale of carbon emissions associated with APP's natural forest and plantation fiber supply in Sumatra that are missing from the ERM analysis.

APP and ERM, despite repeated requests from various parties, have refused to release the full report or the underlying set of data from APP that ERM used to make the footprint calculation. Without this, it is impossible to verify the quality of the data or the accuracy of the company's carbon footprint assessment. It is unclear what, if any, checks ERM did to verify the data provided to them by APP. So while we use the limited data ERM and APP have made available, we cannot be certain as to its accuracy.

What Was Counted: ERM Emissions and Sequestration Data:

ERM's carbon footprint assessment provided amounts for the following emissions, which were included in this assessment as well:

- CO₂ emissions from burnt plantations. (However, there is no explanation of what this exactly means and how it was calculated in the APP/ERM executive summary, for example including what portion of these emissions are allocated to the burning of above and below ground carbon pools. APP is known for many devastating fires in its plantations, many of which have burnt deep into the peat soils. For example, eleven percent of fires in Riau in the first nine months of 2006 were found to have occurred in APP controlled concessions.³⁰ Six percent of Indonesia's peatlands were estimated to have burned in 2006, emitting on average 682 tons of CO₂ per hectare burned.³¹ The burnt plantation emissions number given by ERM seems to be too low for these to have been fully included. We do not recalculate this number here, although it appears that the APP/ERM number could be a very significant underestimate.³²)
- CO₂ emissions from biodegradation of logging residues in plantations.
- CO₂ emissions from transport of logs from plantations.
- Total GHG emissions from fossil fuel use in APP's pulp mills in 2006.
- Sequestration by growth of trees in APP plantations. ERM's assessment added CO₂ sequestration by trees growing in APP plantations in 2006 to the carbon footprint equation. Plantations for pulp production sequester carbon every year, however, the sequestering trees are clear-cut and pulped for paper approximately every 6 years thus emitting all the sequestered carbon. ERM/APP decided to only include the sequestration but not the emission of harvested acacia in their carbon footprint equation.

Missing Emissions: Filling the Gaps in ERM's Carbon Footprint Assessment of APP Paper

There are a large number of accounting gaps in ERM's carbon footprint assessment for APP.

We estimated the carbon emissions from the following sources that were not included in the ERM carbon footprint assessment of APP:

- **The loss of biomass carbon in natural forest wood harvested and pulped in 2006 by APP's Riau and Jambi pulp mills.** The ERM report operational boundary includes logs provided to APP by its pulpwood plantations, but not from natural forests, with the result that for the purposes of the carbon footprint, ERM calculated it as if 100 percent of the fiber supply for APP's mills came from plantations. However, plantation logs are estimated to have provided only 30-50 percent of fiber supply for APP's pulp mills in 2006, with the remainder being mixed tropical hardwood (MTH) fiber coming from natural rainforests.³³ ERM reports that, "In 2006, logs for the two pulp mills were primarily supplied from the plantations in Riau...and from the Jambi and & South Sumatra plantations....[O]nly the sequestration by the plantations in Jambi, South Sumatra and Riau provinces were considered in the carbon balance." Separately, however, APP reports that only half the fiber for its mills comes from plantations.
- **The loss of biomass carbon in acacia wood harvested and pulped in 2006 by APP's Riau and Jambi pulp mills.** ERM accounts for the carbon sequestration by the acacia plantations, but, contrary to IPCC best practice accounting guidelines, does not count the harvested wood as emissions, even though it is being used to make paper, a very short-lived product.³⁴
- **The decomposition of peat soil in APP's plantations in Sumatra.** Annual CO₂ emissions from decomposition of peat soil on drained peat land areas, both in the existing plantations and in drained areas about to be cleared of natural forest or cleared in 2006 for plantation establishment, are extremely high on a per hectare basis, but this category of emissions was not included in the ERM assessment.³⁵

Missing Emissions 2: Emissions excluded from both ERM and our assessment

A number of other additional sources of emissions were not counted in the ERM study and were also not included or re-calculated in this assessment due to information gaps. Sources of still not fully accounted for APP carbon emissions include:

- Peat decomposition on peatlands from which the APP pulp mills sourced MTH fiber from natural rainforests but which were not planted with acacia, both inside and outside of APP's own concessions.
- Peat burning inside APP's plantations associated with the pulpwood supply for the APP mills.
- Peat burning on areas where the APP mills have sourced MTH fiber from logged or cleared natural rainforests but which have not been replanted and converted to plantations.
- Transport of logs from harvested natural forest (fuel consumption).
- Production and transport of external pulp used by APP such as that which is imported from overseas.
- Collection, transport and pulping of post consumer waste used by APP.
- Conversion of jumbo paper rolls into various final products.

Some of these still unaccounted for emission sources, particularly those related to peatlands, are likely to be very large. If fully accounted for, we believe that they could prove to contribute on the order of tens of millions of tons of additional CO₂ emissions to APP's total carbon footprint.

Methodology:

To recalculate APP's carbon footprint we used methodology consistent with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and UNFCCC Clean Development Mechanism approved accounting methodologies.³⁶ We used the same period as the ERM report, January 1, 2006 – December 31, 2006. This study included the emissions from APP's eight pulp and paper mills (including the power generation facilities associated with each mill), APP's sister and joint venture companies, as well as any other relevant community level groups involved in concession management. We included the carbon emissions from deforestation, forest degradation and the drainage of peatlands associated with APP's fiber supply. Our biomass calculation consisted of both above- and below-ground biomass, including dead wood, litter and soil organic matter. We also included estimates from biomass loss (harvested logs) as well as biomass loss from organic soils (including the decomposition of peat soils where pulp woods were harvested.) The calculation of emissions from peat decomposition followed data and assumptions provided by peat scientists in published sources.³⁷ Land use, land use change and forestry emissions data were added to the data provided by ERM and used to re-calculate the carbon footprint of APP's paper. The new assessment needed various conversion rates and parameters, e.g. conversion rate from tons of wood chips to m³ of wood chips; standing wood volume per hectare of natural forest; acacia's annual volume growth (m³/ha year); and biomass carbon growth (t/ha/year). These were estimated using published data.

Basic data

- APP produced 4,102,076 tons of paper jumbo rolls in 2006.³⁸
- APP pulped 10,582,118 tons of wood chips in 2006.³⁹ ERM did not provide details on the sources of the woodchips. We estimate these using data from various sources:
 - 50-70 percent is estimated to come from natural forests,⁴⁰ of which 63 percent is estimated to come from natural forests on peat soils.⁴¹
 - 30-50 percent is estimated to come from pulpwood plantations, of which 40 percent is estimated to come from plantations on peatlands in 2006.⁴²
- APP's pulpwood plantation estate in Sumatra are estimated to cover 570,316 hectares,⁴³ of which 50-70 percent are estimated to be on peatlands.⁴⁴
- Peat decomposition emissions are calculated using a median decomposition rate of 85 tons of CO₂/ha/year for drained tropical peatlands under acacia plantations, as derived from various studies reported in the scientific literature.⁴⁵

Results: What ERM should have found

Table 1: APP's carbon footprint for paper production in Indonesia in 2006

Tons of CO2 emissions from loss of biomass carbon in natural forest and acacia wood harvested and pulped in 2006 by APP's Riau and Jambi pulp mills. (new)	43,335,732 – 50,388,402
Tons of CO2 emissions from peat decomposition associated with pulp plantations on peatlands for the pulp mills. (new)	27,743,358 – 38,840,685
Tons of CO2 emissions from other causes before the mills (from ERM report).	8,612,949
Tons of CO2 emissions from burning of peatlands associated with fiber production for APP's Riau and Jambi pulp mills. (not calculated)	n.a.
Tons of CO2 emissions from pulp and paper production at APP's eight mills (from ERM report)	6,416,058
Tons of CO2 sequestration by growth of all Sumatra plantations in 2006 (from ERM report)	-18,711,164
Net Emissions of CO2 (all emissions plus sequestration)	67,396,933 – 85,546,930
Tons of paper jumbo rolls produced in 2006 (ERM report)	4,102,076
Carbon Footprint per ton of paper (tCO₂e/ton of paper) (new)	16.4 – 20.8

Our recalculation indicates that ERM vastly understated APP's overall carbon footprint by several orders of magnitude. The ERM assessment concluded that APP's carbon footprint with plantation sequestration was 0.03 tons of CO₂ equivalent per ton of paper produced for the period of 1st January 2006 to 31st December 2006. By contrast, we calculate the carbon footprint of APP paper to be in the range of 16.4 to 20.8 tCO₂e/ton of paper produced when losses of above ground biomass and peat land decomposition emissions associated with the APP mills' fiber supply are included in the accounting (see table 1). That is nearly 550 to 700 times more than the ERM assessment, and still does not include all sources of emissions associated with the production of APP's paper. Inclusion of emissions from peat land burning, for example, that were not counted in this study would further increase APP's carbon footprint.

APP's estimated 16-21 tons of CO₂ per ton of paper contrasts sharply with comparable averaged North American estimations, which also, included changes in forest carbon stocks, of 4.2 tons of CO₂ per ton of paper using virgin fiber, and 1.8 tons of CO₂ per ton of paper using 100 percent recycled fiber. Cascades paper is believed to be best in class for North American recycled papers with an estimated carbon footprint of 0.3 tons of CO₂ per ton of paper.⁴⁶ A 1997 life cycle assessment (LCA) study of Japanese 100 percent recycled paper by Ricoh estimated the carbon footprint at 2.4 tons of CO₂ per ton of copy paper.⁴⁷

APP said it produced 4.1 million tons of paper in 2006. This assessment finds that APP's carbon footprint in that year was 67 – 86 million tons of CO₂ equivalent net emissions. That was more than **Denmark's total anthropogenic carbon dioxide emissions including emissions/removals from**

land use, land-use change and forestry in 2006 (57 million tons).⁴⁸ It exceeds the 2006 reported emissions of over 165 countries including those of Bulgaria, Bangladesh, Switzerland, Ireland and New Zealand.⁴⁹

Recommendations

This paper demonstrates that ERM's overall findings fail to truly represent APP paper's total carbon footprint. A full carbon accounting must take into account APP's entire system of production, including emissions associated with the company's continued reliance on expansion into natural forests, forest clearing and forest conversion as well as APP's leading role in draining and clearing carbon rich soils in peatlands.⁵⁰

Based on these calculations, APP appears to be producing one of the most carbon intensive papers available on the market today. Until there is a full and reliable carbon footprint accounting, and significant change to APP's business model to reduce that footprint, international companies concerned about their climate and forest footprint should avoid APP papers and beware of the misleading nature of APP's marketing claims.

With specific reference to the ERM Carbon Footprint assessment, RAN and JATAN recommend the following steps:

- ERM and APP should release the full reports and associated information so that the carbon footprint assessment can be independently reviewed.
- ERM should immediately release a public clarification statement, highlighting the limitations of their carbon footprint assessment for APP and correcting any public misreporting of the study's findings by APP.
- ERM should not continue to support APP in its greenwashing, and either decline to conduct further studies using their current methodology or conduct a realistic and comprehensive study that includes all relevant land use emissions.
- Buyers of paper products from APP should be aware that the company is misrepresenting their carbon footprint through the ERM report.
- Buyers of APP paper said to be produced from 100 percent acacia plantation pulp should be aware that their paper has a huge carbon footprint not disclosed by the company.
- Buyers of APP paper said to be produced from 100 percent acacia plantation pulp, from 100 percent external pulp or from post consumer waste should be aware that they finance a company that is actively destroying tropical rainforests, threatening biological diversity and causing huge GHG emissions.
- Investors in APP should be aware of the devastating impact of this company on the global climate and the world's tropical forests.
- Climate mitigation actions designed for Reducing Emissions from Deforestation and Degradation (REDD) should not provide incentives to clear or convert natural forests and

drain peatlands to develop pulp wood plantations. Pulp and paper companies should not be eligible for REDD project funding as long as they continue to source fiber for their mills from such activities. The recent APP Kampar Carbon Reserve project raises serious questions in this regard.⁵¹

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[www.wldelft.nl/cons/area/rbm/PEAT-CO₂.pdf](http://www.wldelft.nl/cons/area/rbm/PEAT-CO2.pdf) This study estimated total CO₂ emissions from peat decomposition and peat fires in Indonesia at 1.8 Gt CO₂ on average per year for the period 1997-2006. This was the first study to rank Indonesia as the third largest emitter of CO₂ after China and the U.S. This was based on its peat emissions alone. The recent government climate change agency DNPI (2010), report estimates total national emissions from both land use and fossil fuels at 2.1 Gt of CO₂ for 2005. This would still rank Indonesia as the third largest emitter by comparison to other countries’ fossil fuel GHG emissions data for 2005 www.eia.doe.gov/pub/international/iealf/tableh1co2.xls
- ⁸ http://www.dnpi.go.id/report/DNPI-Media-Kit/reports/indonesia-ghg_abatement_cost_curve/Indonesia_ghg_cost_curve_english.pdf
- ⁹ http://www.dnpi.go.id/report/DNPI-Media-Kit/reports/indonesia-ghg_abatement_cost_curve/Indonesia_ghg_cost_curve_english.pdf DNPI uses an estimate of 0.77 GtCO₂e emissions from peatlands for 2005, which they note is on the low end of scientific estimates. “Most analyses of Indonesia’s emissions related to peat decomposition and fire fall within the range of 0.75 to 1.5 Gt CO₂e.”
- ¹⁰ See full Wetlands International “Global Peatland CO₂ Picture” report, found at <http://www.wetlands.org/NewsandEvents/NewsPressreleases/tabid/60/articleType/ArticleView/articleId/1923/Default.aspx> This report gives estimates from 400-1,400 million tons of CO₂ e per year from peat land fires in SE Asia.
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- ¹² http://www.unilever.com/images/Consumer%20Goods%20Forum%20nu23%20June%202010%20FFW_tcm13-221229.pdf Statement by Sir Terry Leahy, CEO, TESCO, June 23, 2010, London
- ¹³ The Forest Footprint Disclosure Project includes participation from 35 financial institutions with \$3.5 trillion in assets under management. Paper is assessed as one of the top global commodity drivers of tropical deforestation and degradation. <http://www.forestdisclosure.com/>
- ¹⁴ See for example the standards developed by the Environmental Paper Network <http://www.environmentalpaper.org/commonvision.html>
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www.cathaybr.com/pdf/APP_CarbonFootPrint.pdf

¹⁹ <http://environment-analyst.com/3213>

²⁰ [http://www.asiapulppaper.com/portal/app_portal.nsf/Web-MenuPage/25789CB95E09B9F54725777C0023C42A/\\$FILE/Mazars.pdf](http://www.asiapulppaper.com/portal/app_portal.nsf/Web-MenuPage/25789CB95E09B9F54725777C0023C42A/$FILE/Mazars.pdf)

²¹ ERM, Asia Pulp & Paper- Indonesia: Executive Summary of APP's Carbon Footprint Assessment, 2008
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<http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html>

²⁵ Verchot, L.V., et al. 2010. Reducing forestry emissions in Indonesia. CIFOR, Bogor, Indonesia.

²⁶ <http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-06-v1.pdf>

²⁷ The ERM executive summary does not give a reference to a specific protocol, but this is the most relevant and applicable protocol and the only one released by WRI with the International Council of Forest and Paper Associations.
<http://www.ghgprotocol.org/calculation-tools/pulp-and-paper>

²⁸ http://www.environmentalpaper.org/carbonneutralpaper/EPN_CNPaperFINAL.pdf

²⁹ ERM, Asia Pulp & Paper- Indonesia: Executive Summary of APP's Carbon Footprint Assessment, 2008
www.cathaybr.com/pdf/APP_CarbonFootPrint.pdf

³⁰ WWF Indonesia, 2006. WWF Monitoring Brief October 2006: Asia Pulp & Paper (APP); Hiding Destruction behind False Advertisements: *APP continues to ignore calls for conservation beyond "legal compliance", and even fails on the latter.* http://www.wwf.or.jp/activities/lib/pdf/APP_Oct06_MonitoringRpt.pdf.

³¹ Uwe Ballhorn, Florian Siegert, Mike Mason, and Suwido Limin, 2009. Derivation of burn scar depths and estimation of carbon emissions with LIDAR in Indonesian peatlands. PNAS, December 15, 2009, vol. 106, no. 50, 21213–21218.
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³² A proper calculation would require verifiable estimates of the area of APP plantations on peatlands that burned in 2006 as well as of other burned peat areas that were sources of fiber for APP's mills. Using average peat fire emission factors for Indonesia as reported by Ballhorn et al (2009), ERM's reported emissions from APP burnt plantation would correspond to a burned area of around 4,000 hectares, or less than 1 percent of APP's reported 646,994 hectare plantation estate in 2006, assuming that ERM was not also reporting above ground burning emissions. The ERM executive summary does not provide information on how this was calculated.

³³ ERM, Asia Pulp & Paper- Indonesia: Executive Summary of APP's Carbon Footprint Assessment, 2008
www.cathaybr.com/pdf/APP_CarbonFootPrint.pdf; Using data from satellite images and inspections of APP operations, WWF scientists found that seventy percent of total wood chips supplied to these two APP pulp mills were from logging and conversion of natural forests and thirty percent from plantations. WWF Indonesia (2006) WWF Monitoring Brief June 2006: Asia Pulp & Paper (APP)
http://assets.wwfid.panda.org/downloads/mon_brief_june_2006.pdf; APP reports that its fiber supply is evenly divided between plantations and natural forests. Asia Pulp & Paper, 2007 Growing A Sustainable Future: Environmental and Social Sustainability for Indonesia, 2009 (ESS-2007 report)
[http://www.asiapulppaper.com/portal/APP_Portal.nsf/Web-MenuPage/5BFB083D5FD9781C472575EF0035E314/\\$FILE/090724%20APP-2007-New%20Rev1Final.pdf](http://www.asiapulppaper.com/portal/APP_Portal.nsf/Web-MenuPage/5BFB083D5FD9781C472575EF0035E314/$FILE/090724%20APP-2007-New%20Rev1Final.pdf)

³⁴ 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Agriculture, Forestry and Other Land Use
<http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html>

³⁵ A. Hooijer, S. Page, J. G. Canadell, M. Silvius, J. Kwadijk, H. Wösten, and J. Jauhiainen, 2010. Biogeosciences, 7, 1505–1514, 2010 www.biogeosciences.net/7/1505/2010/ doi:10.5194/bg-7-1505-2010; WWF Indonesia (2008) Deforestation, Forest Degradation, Biodiversity Loss and CO₂ Emissions in Riau, Sumatra, Indonesia. One Indonesian Province's Forest and Peat Soil Carbon Loss over a Quarter Century and its Plans for the Future.
<http://www.worldwildlife.org/who/media/press/2008/WWFBinaryitem7625.pdf>;

³⁶ 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Agriculture, Forestry and Other Land Use
<http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html>;
<http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-06-v1.pdf>

³⁷ A. Hooijer, S. Page, J. G. Canadell, M. Silvius, J. Kwadijk, H. Wösten, and J. Jauhiainen, 2010. Biogeosciences, 7, 1505–1514, 2010 www.biogeosciences.net/7/1505/2010/ doi:10.5194/bg-7-1505-2010 These authors report average emissions for plantations of 86 tons of CO₂/ha/year; WWF Indonesia (2008) Deforestation, Forest Degradation,

Biodiversity Loss and CO2 Emissions in Riau, Sumatra, Indonesia. One Indonesian Province's Forest and Peat Soil Carbon Loss over a Quarter Century and its Plans for the Future.

<http://www.worldwildlife.org/who/media/press/2008/WWFBinaryitem7625.pdf> This report compiles emission rates from a variety of scientific sources and gives a relevant median value of 85 tons of CO₂e/ha/year from decomposition of peat soils, but not including burning.

³⁸ ERM, Asia Pulp & Paper- Indonesia: Executive Summary of APP's Carbon Footprint Assessment, 2008
www.cathaybr.com/pdf/APP_CarbonFootPrint.pdf

³⁹ ERM, Asia Pulp & Paper- Indonesia: Executive Summary of APP's Carbon Footprint Assessment, 2008
www.cathaybr.com/pdf/APP_CarbonFootPrint.pdf

⁴⁰ Asia Pulp & Paper, 2007 Growing A Sustainable Future: Environmental and Social Sustainability for Indonesia, 2009 (ESS-2007 report) [http://www.asiapulppaper.com/portal/APP_Portal.nsf/Web-MenuPage/5BFB083D5FD9781C472575EF0035E314/\\$FILE/090724%20APP-2007-New%20Rev1Final.pdf](http://www.asiapulppaper.com/portal/APP_Portal.nsf/Web-MenuPage/5BFB083D5FD9781C472575EF0035E314/$FILE/090724%20APP-2007-New%20Rev1Final.pdf)

While APP reports that close to 50 percent of its fiber supply as of mid-2006 came from plantations, WWF Indonesia, based on satellite studies and field assessments of APP operations, estimates that 70 percent of APP's fiber supply came from natural forests. WWF Indonesia (2006) WWF Monitoring Brief June 2006: Asia Pulp & Paper (APP)
http://assets.wwfid.panda.org/downloads/mon_brief_june_2006.pdf

⁴¹ WWF Indonesia reported in 2008 that 63 percent and 64 percent of annual deforestation for 2005-2006 and 2006-2007 periods, respectively, in Riau province, in which APP has most of its plantation development operations, were on peatlands. In this province at that time, the pulp & paper industry was considered the biggest driver of deforestation. WWF Indonesia in 2006 also published two reports showing APP's high reliance on natural forest in peat areas. Accordingly, we assumed that 63 percent of the natural wood APP reports to have harvested were from forest on peat soil and 37 percent were from forest growing on non peat soil. WWF Indonesia (2008) Deforestation, Forest Degradation, Biodiversity Loss and CO₂ Emissions in Riau, Sumatra, Indonesia. One Indonesian Province's Forest and Peat Soil Carbon Loss over a Quarter Century and its Plans for the Future.

<http://www.worldwildlife.org/who/media/press/2008/WWFBinaryitem7625.pdf>; WWF Indonesia (June 2006) WWF Monitoring Brief June 2006: Asia Pulp & Paper (APP)

http://assets.wwfid.panda.org/downloads/mon_brief_june_2006.pdf; WWF Indonesia (October 2006) WWF Monitoring Brief October 2006: Asia Pulp & Paper (APP) Hiding Destruction behind False Advertisements: APP continues to ignore calls for conservation beyond "legal compliance", and even fails on the latter.

http://www.wwf.or.jp/activities/lib/pdf/APP_Oct06_MonitoringRpt.pdf

⁴² Acacia pulpwood plantations on average take 6 years to reach harvestable age and plantations harvested in 2006 thus were planted in 1999-2000. WWF Indonesia (2008) reported that 39 percent and 80 percent of average annual deforestation between the 1996-2000 and 2000-2002 periods, respectively, in Riau occurred on peat soil. Natural forest wood harvest switched from mineral soil areas (non peat soil) to peat areas around 2000 since available natural forest on mineral soil became very scarce by then. Based on this information, we very conservatively assume that 40 percent of APP's pulp wood chips to have come from plantations on peat. WWF Indonesia (2008) Deforestation, Forest Degradation, Biodiversity Loss and CO₂ Emissions in Riau, Sumatra, Indonesia. One Indonesian Province's Forest and Peat Soil Carbon Loss over a Quarter Century and its Plans for the Future.

<http://www.worldwildlife.org/who/media/press/2008/WWFBinaryitem7625.pdf>

⁴³ We estimate 570,316 ha of pulpwood plantations in Sumatra, assuming 83 percent of APP's total plantation estate in 2006 is found on this island. The remaining 17 percent is located in Kalimantan, but ERM reports that logs from these plantations did not supply APP's pulp mills in 2006. Therefore they were excluded from ERM's calculations.

⁴⁴ Romain Pirard and Christian Cossalter (2006), *The Revival of Industrial Forest Plantations in Indonesia's Kalimantan Provinces: Will they help eliminate fiber shortfalls at Sumatran pulp mills or feed the China market?*, p53 Table 26 said that 50 percent plantation is on peat land and 50 percent plantation on non-peat land. This was based on data from APP. [http://www.cifor.cgiar.org/publications/pdf_files/research/governance/foresttrade/Attachment47-](http://www.cifor.cgiar.org/publications/pdf_files/research/governance/foresttrade/Attachment47-The_Revival_of_Industrial_Forest_Lowres.pdf)

[The Revival of Industrial Forest Lowres.pdf](http://www.cifor.cgiar.org/publications/pdf_files/research/governance/foresttrade/Attachment47-The_Revival_of_Industrial_Forest_Lowres.pdf); A report by Noor and Syumanda (2006) states that, "70 percent of APP's plantations are on peat soils, 30 percent on mineral soils". Rivani Noor and Rully Syumanda, 2006. Social conflict and environmental disaster: A report on Asia Pulp and Paper's operations in Sumatra, Indonesia, <http://www.wrm.org.uy/countries/Indonesia/Book8.pdf> ;

⁴⁵ The standard deviation is given as +/- 41 tons of CO₂/ha/year. In this assessment we only report calculations made using the median value. Uryu, Y. et al. Deforestation, Forest Degradation, Biodiversity Loss and CO₂ Emissions in Riau, Sumatra, Indonesia. WWF Technical Report, Jakarta, Indonesia.

http://assets.panda.org/downloads/riau_co2_report_wwf_id_27feb08_en_lr.pdf

⁴⁶ Ford, J. 2008. 100 percent Recycled Papers made by Cascades: Greenhouse Gas Emissions Performance and Competing Products http://www.cascades.com/papers/CarbonFootprintReport_CFI.pdf

⁴⁷ Kohki Isago, Mitsumasa Ohmura, Shigeru Fujita and Makiko Nakatan 1997. LCA of a sheet of copy paper. RICOH Company Ltd., IPP Business Division, R&D Center, Environmental Administration Office, Japan.

⁴⁸ UNFCCC (2008) National greenhouse gas inventory data for the period 1990–2006.

⁴⁹ United Nations Statistics Division, Millennium Development Goals indicators: [Carbon dioxide emissions \(CO₂\), thousand metric tons of CO₂](#)

⁵⁰ http://www.environmentalpaper.org/carbonneutralpaper/EPN_CNPaperFINAL.pdf

⁵¹ <http://climatevoices.wordpress.com/2010/10/05/carbon-conservation-gets-into-bed-with-asia-pulp-and-paper-one-of-indonesia%E2%80%99s-biggest-forest-destroyers/>