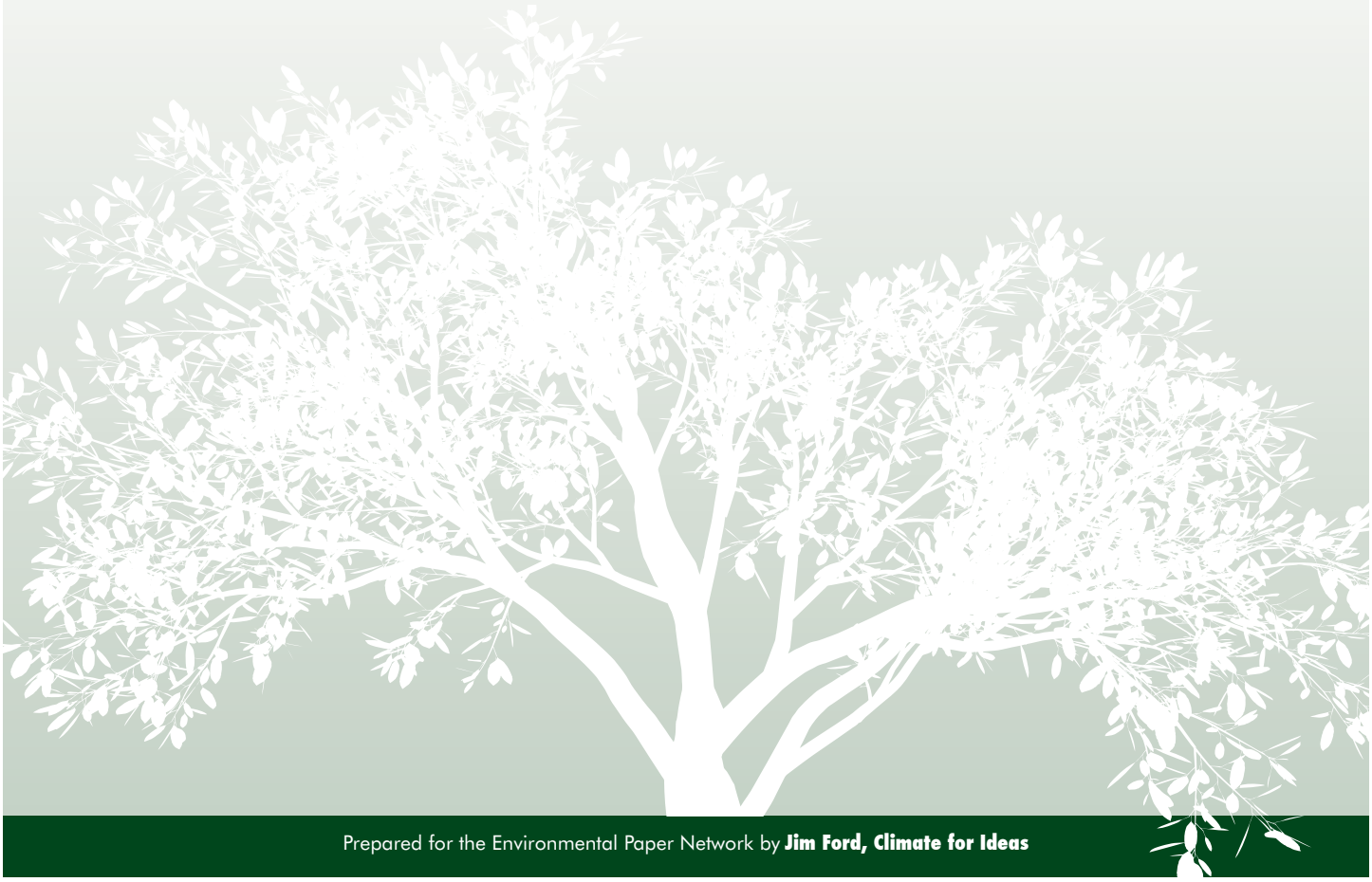
Environmental Paper Network

CARBON NEUTRAL PAPER
FACT OR FICTION?

A Report on the Greenhouse Gas Emissions of Paper Products



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The Environmental Paper Network links environmental organizations that collaborate to support the transformation of the pulp and paper industry to socially and environmentally sustainable processes. For more information visit: www.environmentalpaper.org

Steering Committee of the Environmental Paper Network

As You Sow, Conservatree, Green America, Green Press Initiative, Dogwood Alliance, ForestEthics, Markets Initiative, National Wildlife Federation, Natural Resources Council of Maine, and Rainforest Action Network.

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I. INTRODUCTION

Go into a forest today. The world around you is full of carbon in the trees and soil, the dead wood on the ground and in the underbrush. The next day the forest is harvested for a paper company. Trucks and other machinery clear the forest and transport the trees to a paper mill. It is likely that the harvesters will then gather up a large amount of the remaining carbon in piles and burn it. This is called 'site preparation.'

We follow the trees (where most of the carbon is) to the mill. Only one of every two to four of those trees will eventually become paper.[1] Much of the rest will be burned as fuel. We watch the trees actually being burned and another large portion turned into 'waste' which then becomes fuel. Take a look around the mill. You can see long trains laden with chemicals (according to one estimate, 600 lbs. of chemicals per ton of paper)[i] and fossil fuels (oil, gas and coal) to power the mill and paper dryers.

Now let's go back to where the forest stood. Little of the above-ground carbon that was once in the forest is there. Where is it? Perhaps a third is actually in a paper product, while the remainder is *in the atmosphere* as carbon dioxide. This place that was once a forest will require decades to recover the carbon that was stored here.

The forest stand next to it is still standing. It is still growing. If not harvested, it will continue to grow and sequester carbon, likely at a rate that is far greater than the newly planted trees or plantation next door. With its small trees and few leaves that do the photosynthesizing work turning carbon dioxide into carbon, the new trees actually absorb less carbon from the atmosphere than the older forest. For the first years after harvest, from five to twenty years, the new trees absorb less carbon than is released through the decomposition because of the logging disturbance.[ii]

And yet many in the paper industry will have us believe that making paper is carbon neutral. Indeed, some go so far as to count that carbon twice in their favor: once when they don't count the biomass burning in their 'carbon footprint'[2] analyses, and a second time when they claim that this offsets fossil fuels and thus should be counted as a carbon benefit.

This former caribou habitat and old-growth forest is left with little of the carbon it once held. It will take decades or centuries to return to the original levels of carbon. (Photo: Global Forest Watch Canada)

The paper industry is one of the most energy intensive industries of our modern economy.[iii] It uses large amounts of fossil fuels and energy-intensive chemicals that make it one of the highest industrial emitters of greenhouse gases. Recently, there have been a series of unsupported claims regarding the 'carbon neutrality' of paper products.

The notion of 'carbon neutral paper' is an assertion without validity and poses a threat of fraudulent claims for the consumer. This report will demonstrate the inaccuracy of many of the assertions of paper companies who promote 'carbon neutral paper.'

1 - Depending on the type of pulp, mills can consume up to four times the weight of the pulp or paper, often using large amounts of the biomass for energy production. Other biomass decays at other stages or where it was left in the forest or plantation.

2 - A carbon footprint assessment estimates the total greenhouse gas impact of a product, company or industry. Methodology for these assessments is developing, but there is no single, accepted methodology.

II. WHAT IS CARBON NEUTRALITY?

The advocates of the notion of carbon neutral paper essentially assert that the paper they make has no negative impact on the climate and "adds no carbon dioxide to the atmosphere."[iv] Carbon neutrality would require that no fossil fuels were used to create the product; that no other activities interfered with forest ecosystems' ability to sequester and store carbon; and did not release any other greenhouse gases, such as methane.

Many people have in the past accepted the position that biomass fuel from forests is carbon neutral. New studies and deeper analysis have demonstrated very clearly that this position is not tenable and we as a society need to rethink how we measure the impacts of the use of biomass on carbon storage in ecosystems.[v] The question of carbon neutrality in forest ecosystems or plantations needs to be explored on different levels, including the landscape level and the forest or plantation stand level. We are seeking to understand how our many specific activities and decisions regarding how many trees to harvest and at what intervals ultimately will lead to landscape level changes if they are widely employed.

[Our] research finds that only 6 percent of the publishing industry's greenhouse gas emissions result from its [direct and indirect] uses of petroleum products and electricity. However, there are large emissions from electricity and paper in the supply chain that would otherwise be ignored.

— Carnegie Mellon researchers H. Scott Matthews, Chris T. Hendrickson and Christopher L. Weber

This report concludes that the concept of 'carbon neutral' paper does not consider a full accounting for the many temporal and spatial complexities inherent in accounting for ecosystem carbon and is therefore not a valid concept. While most (but not all) plantations or forests could eventually recover the carbon lost through harvest, biomass burning and decay of products over time, there are opportunity costs. The lost opportunities that must be accounted for include additional carbon storage capacity, temporal losses of carbon and higher levels of carbon dioxide in the atmosphere that result from our paper consumption patterns.

There are two major inaccurate claims that some in the paper industry and their advocates have made in order to claim that paper is carbon neutral, to 'cover up' the large emissions of greenhouse gases from energy use, transport, chemical production and other large impacts.[vi] The first claim is that the burning of biomass is 'carbon neutral' and therefore emits no carbon to the atmosphere. The second claim is that any biomass used to power the paper industry itself is not only neutral, but displaces fossil fuels and thus should be counted (again) on the positive side in their carbon ledger. These 'avoided emissions' are also applied to recycling and technologies that use less fossil fuels and some industry advocates double count these benefits as well. To make these claims, these paper industry advocates essentially argue the following:

- We can burn a tree or not burn a tree, the impact on the climate is the same.
- Logging and burning of forests has no impact on the amount of carbon in the atmosphere because trees grow back.

As we shall see, the truth is that burning a tree does send carbon dioxide into the atmosphere and the logging and burning of forests has real impacts on the amount of carbon dioxide in the atmosphere.

While this report does not conclude that all biomass burning is inherently 'bad,' correct accounting must be applied that reflects the reality of forest ecosystems and gives the right incentives to land managers to increase carbon storage in forests and protect other values of forests, such as biodiversity and the protection of water supplies.

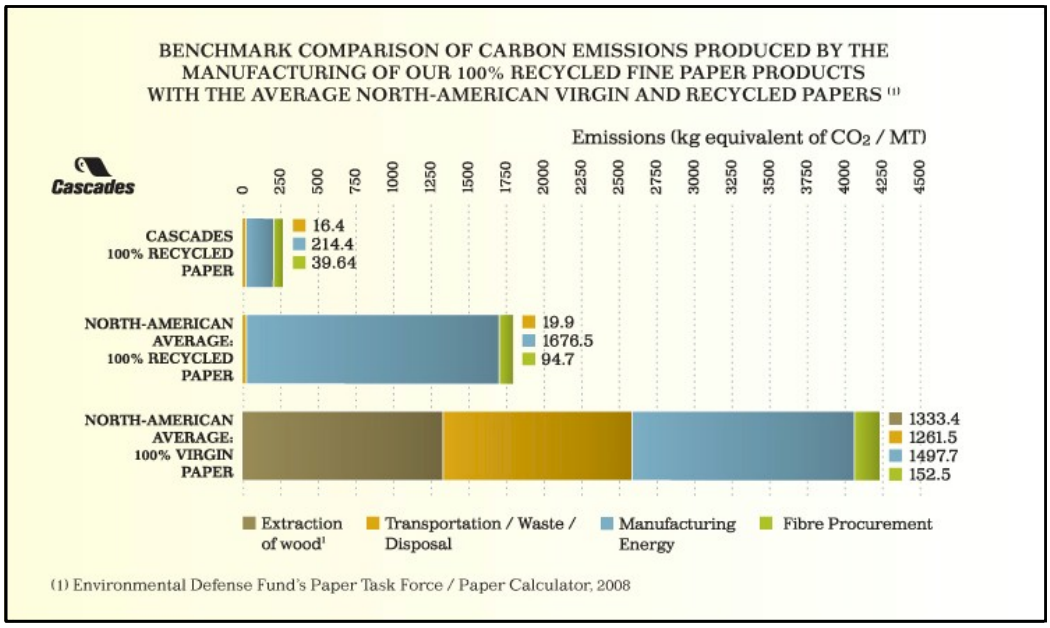
LOW CARBON PAPER

Instead of making stretched claims of 'carbon neutral' paper, producers of paper should seek to make low carbon paper. Our purpose here is not to make any judgment about voluntary carbon offsets, their validity or usefulness for companies, individuals or products. This report focuses on the performance of the products themselves.

A low carbon paper is a product that requires the minimum emissions to produce. Recycled content uses far less energy than virgin paper and has no impact on forest carbon storage. Ensuring that paper that is produced does not enter landfills

but comes back to the mill for reprocessing is a critical piece of this puzzle. Natural gas can be replaced with methane from landfills. Electricity can be generated using wind, hydro[3] or solar energy rather than buying electricity from fossil fuel burning power plants. There are a great number of technologies that can be installed in pulp and paper mills that would consume less energy.

A recent report demonstrated the range of greenhouse gas emissions intensities for different paper products.[vii]



The range in this case is from 4.25 metric tonnes of emissions in carbon dioxide equivalent per tonne of product for 100% virgin paper to just over 0.25 metric tonnes for Cascades' 100% recycled paper. Cascades employs several techniques to keep their carbon intensity to a minimum. First, they benefit from local hydro power in Quebec, which means electricity purchases are from renewables and therefore have zero emissions. Second, the company uses recovered 'biogas,' or methane, collected from a local landfill to replace a large portion of natural gas that is often used in boilers. Third, is the use of wet-lap pulp rather than dried pulp. Wet-lap pulp is pulp that has not been dried using energy other than pressing it. Although the wet-lap pulp is heavier to transport, the additional transportation emissions are far lower than the substantial amount of energy used to dry pulp. This is all in addition to the already very efficient and low-energy intensive use of recycled paper compared to virgin. As shown here, the average emissions for 100% recycled paper are in between the two values, at just over 1.75 metric tonnes per tonne of product in carbon dioxide equivalents.


Clear cut in Canadian boreal forest. (Photo: ForestEthics)

The Environmental Paper Network recommends paper producers aim to produce low carbon products by adopting the most efficient practices, investing in renewable energy technologies, diverting methane from landfills for biogas and maximizing the use of recycled content, thus leaving forests healthy and intact and getting the most of our fiber resources.

3 - New hydro projects must be carefully scrutinized for potential damage to the environment and to natural ecosystems. Some hydro installations have high environmental costs such as loss of fish breeding habitat and loss of other ecological services.

III. THE ENERGY EFFECT

Fossil fuels, biomass, and increasingly, other renewable sources such as wind, are used to power the paper manufacturing process. According to U.S. EPA, measured in terms of CO_2 equivalent emissions from fossil fuel use only, excluding biomass, the paper industry ranks third after the petroleum and chemical industries in the U.S for fossil fuel emissions.

Currently, most assessments of the paper industry do not include biomass energy in their assessments of emissions because to do so would be double-counting: under the greenhouse gas accounting rules of the Intergovernmental Panel on Climate Change (IPCC), the removal of carbon from a forest or plantation is considered an emission at the time of harvest. While biomass energy has a lower carbon emissions intensity than coal (i.e., it has lower emissions per unit of energy produced), inclusion of this energy and emission source in the Life Cycle Analysis of paper would likely make paper second only to petroleum refining in terms of emissions. It is important to note that while biomass must not be counted twice, it must be accounted for in the life cycle analysis of a product. Methodology and the reasons for including biomass are presented in the Appendix of this report.

The many other types of emissions and pollutants from paper with health and environmental impacts include:

- carbon dioxide (CO_2)
- carbon monoxide
- nitrogen oxides (NO_x) which contribute to acid rain and cause lung damage and respiratory illness
- particulate matter (PM) which forms haze (smog) that reduces visibility
- sulfur dioxide (SO_2) which also contributes to acid rain and causes respiratory illness
- volatile organic compounds (VOCs) which react with nitrogen oxides to form ozone as well as a variety of human illnesses
- and ozone, which forms smog.

The pulp and paper industry is one of the largest contributors of sulfur dioxide and nitrogen oxides in the U.S.[ix] Energy consumption also contributes to emissions of other hazardous air pollutants (HAPs), including mercury. Reducing paper use, increasing energy efficiency, promoting a cleaner fuel mix, and using recycled pulp in this sector is likely to have the greatest impact on emissions of these pollutants.

The paper industry has made some modest changes in recent years with respect to energy consumption. It is still one of the largest users of energy, but by moving to Combined Heat & Power generation and a limited amount of new renewable energy sources and away from traditional fossil fuel-based energy sources, pulp and paper mills can significantly reduce their generation of CO_2. Emissions from the use of biomass from the forest remains and must be accounted for.

Using forest products as a source of biomass energy can present a conflict between climate mitigation and other environmental objectives. While increased forest carbon storage yields climate benefits, some limited use of biomass as energy (biofuels) may also produce climate benefits. Recent studies suggest that caution is needed in embracing biofuels fully as an energy panacea and more research is needed to determine the safe boundaries for the use of biomass as an energy source.[xi]

INDUSTRY	FOSSIL FUEL GHG
Petroleum Refining*	513.8
Chemicals**	232.7
Pulp & Paper	198.8
Iron & Steel	157.1
Plastics	68.1
Wood Products	36.5

* Excludes petrochemicals
** Excludes plastics, rubber, and agricultural chemicals, includes petrochemicals

Figure 1: Emissions by Industrial Sector, Teragrams of CO_2 equivalent emissions.
This table only includes fossil fuel emissions and excludes emissions from biomass energy consumption. Not all sectors below pulp & paper are listed and are here for comparison purposes.[viii]

ENERGY TYPE	SHARE OF ENERGY PRODUCTION
Biomass	54%
Natural Gas	21%
Coal	10%
Purchased Electricity	8%
Fuel Oil	5%

Figure 2: Primary Fuel Input Shares Supplied in 2002 for the Pulp and Paper Sector.[x]

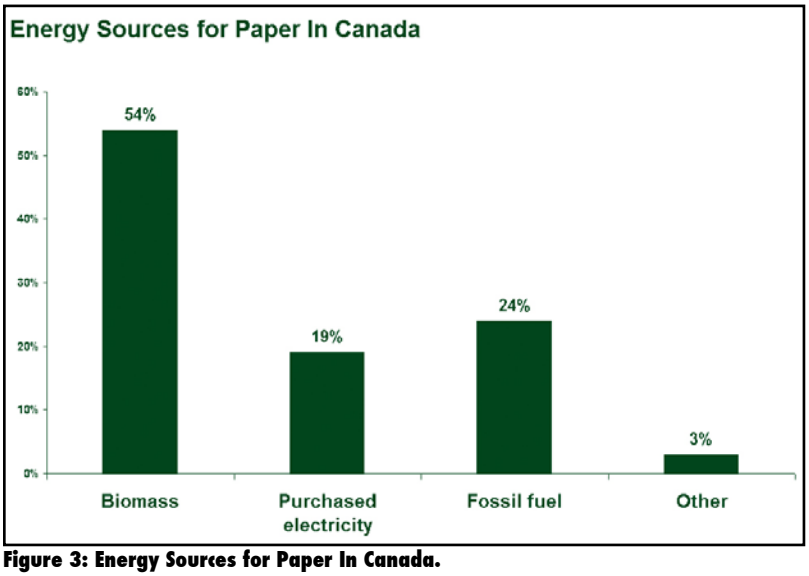


Figure 3: Energy Sources for Paper In Canada.
Source: Industry Canada. Manufacturing Industries Branch. 2002.

GREENHOUSE GAS EMISSIONS AND RECYCLED PAPER

Using recycled paper considerably reduces the climate impact of paper. Recycling reduces the impact on forests; uses less energy than virgin production processes; reduces the need for chemicals and water that have large embedded greenhouse gas emissions; and diverts paper from landfills where it creates methane, a powerful greenhouse gas.

The impact in the forest is the largest gain from recycling and using recycled paper. Trees are left behind in the forest that would otherwise be cut, and leaving the forest intact allows the mature trees to continue to sequester carbon. There is less or no need for additional chemicals and fertilizers in the forest. There is no need for site preparation and the burning of left-over trees that often occurs after industrial clearcut harvesting. The transportation impacts of recycling are less than virgin fiber procurement, and are almost insignificant when compared to the major impacts in the forest and the other emissions in paper production.[xii] The impact of road-building and the permanent presence of roads in forests – that reduce the total area of forest and thus the carbon stored – should be accounted for when comparing the transportation impacts of recycled and virgin fiber sources.

Improving your paper use efficiency and choosing recycled paper can save energy and reduce greenhouse gas emissions. A common misconception is that recycling paper uses more energy than making paper from virgin fiber sources. The total energy consumption when making pulp from recycled material is significantly lower than that of virgin pulping. In fact, every ton of 100% recycled fiber copy paper saves 17 million BTUs over virgin paper, enough to power the average U.S. home for more than two months.[xiii]

IV. THE LANDFILL EFFECT

Landfilling paper truly is a waste – not only does it waste recycling's potential to conserve resources many times over, but the decomposition of paper and other organic materials in landfills releases air emissions, including methane, a major contributor to global climate change. Methane is a greenhouse gas with 25 times the heat-trapping power of carbon dioxide, and paper is the single largest component of U.S. landfills.[xiv]

The U.S. sends more paper to landfills and incinerators than any other country, totaling 41.2 million tons in 2006.[xv] U.S. consumption of paper totaled nearly 100 million tons in the same year. Thus, while the EPA reports a 51.6% recycling rate of paper, that rate only applies to paper that makes its way to the Municipal Solid Waste system and thus the actual recycling rate of paper is much lower than what the EPA reports. Some of the remainder is stored long-term as books and files, but another portion is lost to decay along roadsides, burnt or lost through use. Non-recycling options for reducing paper in landfills have other environmental impacts. For example, incinerators, including waste-to-energy facilities, release toxic air emissions and generate toxic ash that must be landfilled.


(Photo: ForestEthics)

V. THE FOREST EFFECT

Photo: Natural forests can store and sequester large amounts of carbon. Many of these forests are being replaced by plantations or short-rotation forests that store a fraction of the carbon as these old trees. (Photo taken on the Cumberland Plateau by Mark Pritchard for Dogwood Alliance.)

Harvesting forests has a direct impact on the amount of carbon stored in forest ecosystems and the amount of carbon dioxide in the atmosphere. This section of the report explains the inaccuracy of the major claims by certain advocates of the paper industry and proposes the correct framework and science for a methodology to calculate the actual impacts.

BIOMASS AND EMISSIONS

INDUSTRY CLAIM:

"Biomass energy is fundamentally different from fossil fuel energy because biomass recycles carbon to the atmosphere, whereas fossil fuels introduce 'new' carbon. This is why biomass is called 'carbon-neutral'."[xvi]

— John Luke Jr., MeadWestvaco, and Elisabet Salander Björklund, Stora Enso, Co-chairs, WBCSD Sustainable Forest Products Industry working group.

INDUSTRY CLAIM:

"If the amounts of carbon removed from the atmosphere by forests are exactly balanced by the amounts of forest-derived carbon returning to the atmosphere (as a result of biomass combustion and the decay of organic matter in forests and wood products) the net effect on the atmosphere is zero – i.e., atmospheric levels of CO2 do not change."

— NCASI, 2007

WHAT THE SCIENCE REALLY SAYS:

"Simulations of carbon storage suggest that conversion of old-growth forests to young fast-growing forests will not decrease atmospheric carbon dioxide (CO2) in general, as has been suggested recently. During simulated timber harvest, on-site carbon storage is reduced considerably and does not approach old-growth storage capacity for at least 200 years. Even when sequestration of carbon in wooden buildings is included in the models, timber harvest results in a net flux of CO2 to the atmosphere."

— Mark E. Harmon, William K. Ferrell and Jerry F. Franklinxvii

Biomass burning for energy is not 'carbon neutral' because it does contribute to atmospheric levels of carbon:

- Harvesting forests reduces the carbon storage in these forests for long periods of time, oftentimes permanently in terms of the time society needs to respond to climate change.
- Harvesting trees often reduces the rate of carbon accumulation in remaining stands compared with more mature trees.
- Clearcut areas following the harvest of trees for paper can emit carbon for up to 20 years as exposed soils "exhale" more carbon dioxide than the new trees can breathe in.
- Dedicating land to plantations and low-carbon forests for paper reduces the opportunities for carbon storage across the landscape.

Photo: A recent report by Global Forest Watch Canada depicts a number of impacts on forests. These two side-by-side photos are perhaps most illustrative of the emissions from forests. In the photo to the left one can see the vast majority of the above-ground carbon has been removed from the ecosystem, while in the photo to the right, one can actually see the smoke from the pulp mill in which the carbon is emitted to the atmosphere as carbon dioxide. This formerly old-growth forest in Alberta will requires many decades to re-capture the carbon dioxide it once held – a period much longer than the time required to take action on climate change.

- Wood products can and do store carbon, but this effect does not fully offset the losses in forests. Paper products store very little carbon relative to sawn wood and other products.
- Biomass burning creates soot (particulate pollution) that has global warming potential in addition to the carbon dioxide released.[4]

When forests are harvested, storage of carbon is reduced substantially and this carbon will not recuperate for decades for intensively managed forests or centuries for old-growth forests if it is allowed to recuperate and no further harvest takes place. When younger forests are harvested, carbon is reduced and the opportunity for that forest to accumulate more carbon is lost. Old-growth forests subject to harvest could lose their carbon storage permanently. In the U.S. south the paper industry has actively replaced a large area of natural forest (high in carbon storage) with pine plantations (low in carbon storage).[xvii] The graphs presented in this section of the report demonstrate the clear low carbon storage of forests managed for paper, or even a mix of paper and other wood products. The same graphs demonstrate the much greater carbon storage in natural forests.

The impact on total carbon storage is clear from these studies: harvest for wood products directly results in lower carbon storage in that particular location and therefore across the landscape. Harvest for wood products also reduces the rate of accumulation of carbon in these same forests in many cases. While many believe that younger forests absorb more carbon, this is not true. In fact, recently harvested forests absorb less carbon due to the small size of the trees and the fewer leaves available to photosynthesize carbon dioxide from the atmosphere that turns the carbon dioxide into carbon in the trees.

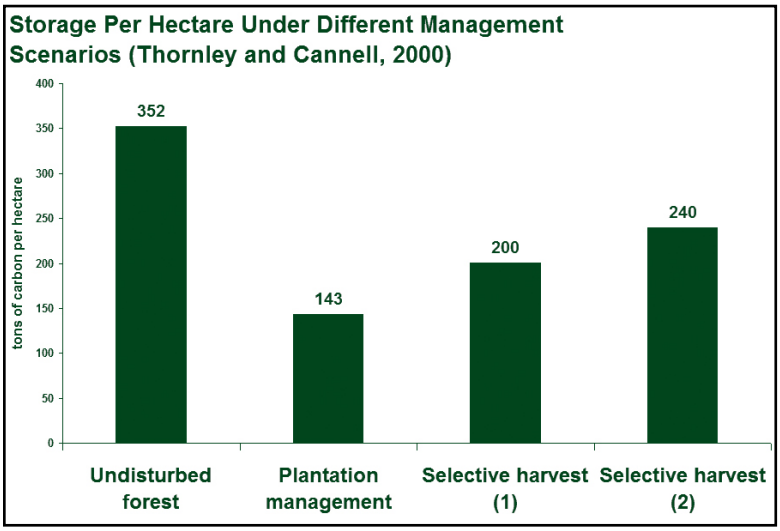


Figure 4: Thornley and Cannell modelled different management scenarios and the resulting carbon storage.
The plantation management is typical for many management regimes for paper in which all trees are removed, while selective harvest scenarios remove only some of the trees and are used more commonly for a mix of products and landscape values.[xx]

IPCC REPORTING AND BIOMASS

In terms of reporting the emissions, national greenhouse gas reporting actually does require that the biomass be accounted for. Under the rules of the UN Climate Change Convention as developed by the Intergovernmental Panel on Climate Change (IPCC) all countries record removals of biomass from ecosystems and accurately report the total carbon in forests from year to year. At this stage, some assert that this carbon simply disappears from the accounting when they state that there are no emissions reported in the energy accounts of industry. It is important to note that activity-based accounting and national accounting of greenhouse gases must be approached from different perspectives, although there are rules that can apply to both. The key difference is the need for a baseline in activity-based management,[xix] while national greenhouse gas accounting for purposes of compliance with international treaties records annual changes in stocks of carbon.

Figure 8 (on page 10) shows one study's finding of carbon accumulation in forests of different age groups. The lowest carbon accumulation rates are evident in the youngest forests, while intermediate aged forests have the quickest accumulation. Thus, carbon accumulation rates are not only lower in younger forests, but stands can actually emit carbon for a number of years post-harvest. This is a similar finding to a study by Janisch and Harmon, 2002 that looked at carbon accumulation in forests of different ages. This study found that carbon accumulation was actually ***negative*** for approximately ten years after harvest. Using a different methodology, eddy flux measurements that measure the respiration of carbon dioxide from forests and clearcuts in the Pacific Northwest found that carbon dioxide releases are greater than sequestration for up to 20 years following harvest as soils release carbon dioxide.[xxii]

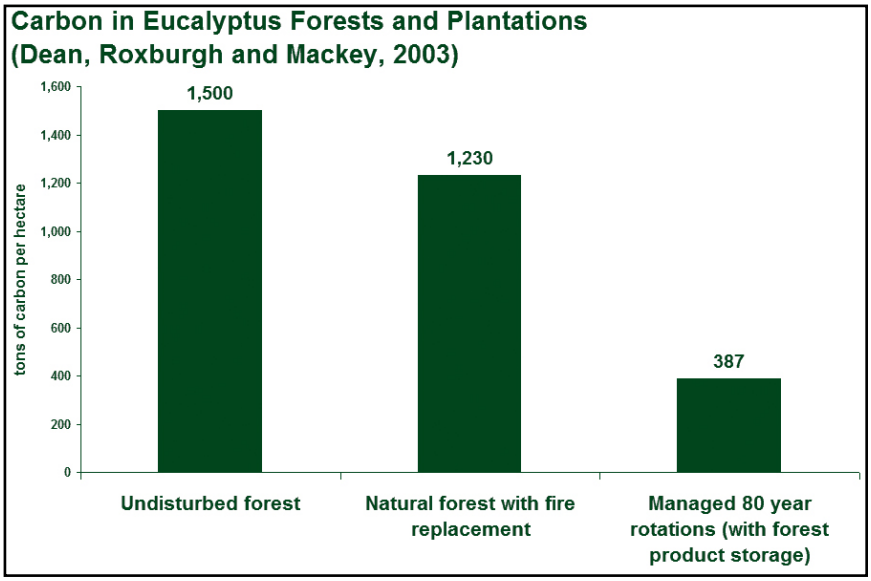
REGIONAL FOREST CARBON DIFFERENCES

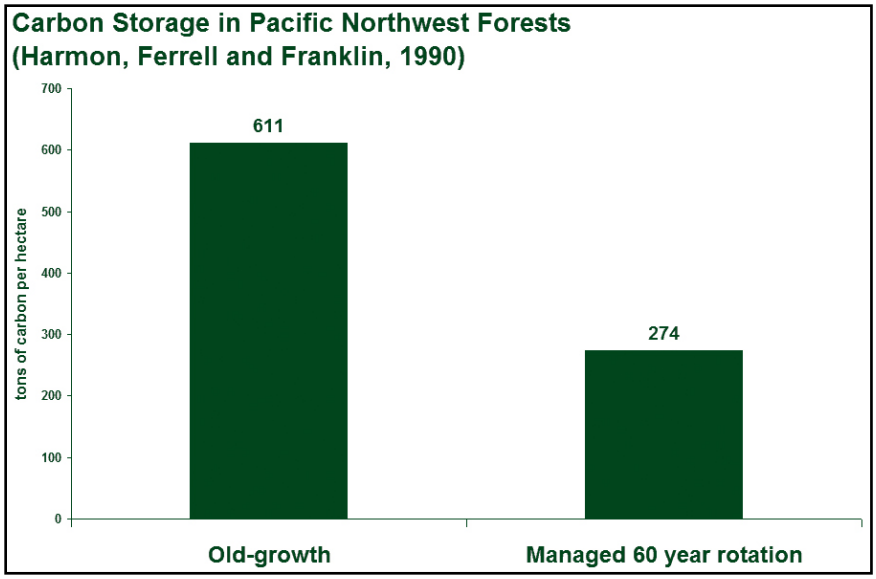
It is also useful to consider the major regions where harvesting takes place for the paper industry around

4 - Soot pollution varies with pollution controls and more research is needed. A recent study indicates that soot is much more powerful greenhouse pollutant than previously acknowledged. See, for example, the article in Science Daily from 24 March 2008 at http://www.sciencedaily.com/releases/2008/03/080323210225.htm

the world to understand the state of carbon storage across the landscape. In the U.S. Southeast, where a considerable portion of the world's paper is made, natural forests are being harvested for paper and many are being replaced with plantations. Only a portion of these low-carbon storage plantations are being established on land that formerly contained little or no carbon (e.g., old fields or agricultural land). An in-depth study of the region's forest resources, the Southern Forest Resource Assessment, found that 75% of new plantations were established at the expense of natural forests and only 25% on formerly agricultural land.[xxiv] Left to grow, in general the second-growth natural forests of the region would continue to accumulate carbon, while maintaining their carbon stores in the ecosystem rather than in the atmosphere. Some gains of establishing trees on formerly treeless land offset a portion of the losses. Even in these cases, the abandonment of agricultural land often leads to the re-establishment of natural forests, as has been the case over the last hundred years across the United States. Thus, in most cases, there is an opportunity cost of land-use and thus for carbon storage for all plantations and agricultural lands.

In boreal regions such as northern Canada, Sweden, Finland and Russia, large areas of forest are harvested that require very long periods to recapture the carbon. In Finland and Sweden, the majority of forests were previously harvested and require up to 100 years to recapture all of the carbon released in these cases. In Russia and Canada, many old-growth forests are being harvested and converted to shorter-rotation forests (in Canada, for example, it is estimated that eighty percent of all forests currently being harvested are old-growth[xxv]), releasing large amounts of carbon dioxide to the atmosphere. While industry advocates would point to the carbon accumulating in the new forests, it should be emphasized that second-growth forests harvested today will require up to 100 years to re-sequester carbon. Conversely, second-growth forests harvested today are only now re-sequestering carbon released to the atmosphere during the same amount of time.





Figures 5 and 6: Natural forests store far more carbon even when the carbon stored in the products after harvest is included.
The first bar, 'undisturbed forest,' contains the greatest amount of carbon while plantation forests contain the least amount of carbon. Two different regimes that allow for longer rotations (i.e., the intervals between logging) store intermediate amounts of carbon. The third and fourth bars (on the right) include the carbon stored in products such as houses or paper. [xxi] The two graphs below show similar results from different forest types.

In the Pacific Northwest of the U.S. and Canada, old-growth forests are still being harvested while the second-growth forests are only now being re-established and re-capturing the carbon released from harvest.[xxvi] Much of these harvests occurred in the last fifty years.[xxvii] Coastal forests, or temperate rainforests, of the region in particular can store large amounts of carbon.[xxviii] Continued harvest of these

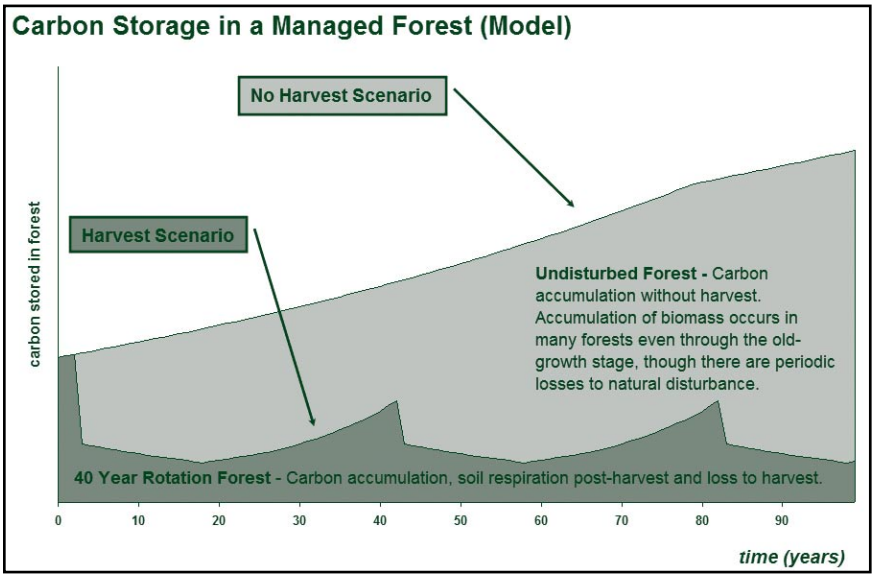


Figure 7: A model of forest accumulation in a managed forest.
Unless harvested, forests continue to accumulate carbon, generally removing more and more carbon over time. After several decades, forests may slow their carbon accumulation, varying by forest type and location. See Figure 8 below for the findings of one study on the **rates** of carbon accumulation at different stages of growth since disturbance.

forests will preclude these forests from obtaining their natural, landscape-level and historic carbon storage levels.

Finally, in tropical regions such as Indonesia and in some temperate regions such as Tasmania, areas of old-growth tropical rainforest are being replaced with exotic tree plantations. The carbon loss to the atmosphere is dramatic in such cases.[xxix] Losses of peatland forests in Indonesia are responsible for very large emissions of carbon. When the forests are converted to plantations for the paper industry, there are immediate emissions from the biomass that is cleared, but also over time the ditches dry out the massive stores of carbon in the peat, releasing much of it to the atmosphere as the peat dries and decays.[xxx]

In Tasmania, natural eucalypt forests containing up to 2,500 metric tons of carbon per hectare are being reduced to plantations that, when re-established, will contain only around half of that amount of carbon across the landscape.[xxxi] The Intergovernmental Panel on Climate Change estimates that the average storage for temperate forests worldwide is 217 metric tons of carbon per hectare, so this loss, currently being caused by the paper industry, is particularly dramatic.[xxxii]

AVOIDED EMISSIONS IN THE PAPER INDUSTRY

INDUSTRY CLAIM:

"[T]he objective is to maximize the production of products that displace fossil fuels and fossil fuel-intensive products. […] The industry has created and supports an extensive infrastructure necessary for collecting biomass from forests and essentially all of the material removed from the forest is used either in products or as a source of biomass energy in the manufacturing process."
— World Business Council for Sustainable Development

There are an almost infinite number of possible avoided emissions so it is not possible to offer specific guidance. While avoided emissions can be very useful in illustrating important connections to the climate change issue, their use in balance sheets can be controversial.
— Confederation of European Paper Industries, 2007

An analysis of how to reduce emissions in the pulp and paper industry and where gains can be made, such as increasing Combined Heat & Power, is a valuable effort. However, the claim of 'avoided emissions' is an especially egregious and inaccurate one. The claim and the math behind it would mean that the more forests are burned for energy to make paper, the more positive the effect for the climate. This notion of avoided emissions simply states that since the industry uses energy sources that are not fossil fuels, the industry should be credited with an offset for this energy use. That is, since we can imagine a world in which the paper industry uses more fossil fuels, the paper industry should get credit for not doing so.

A single example of avoided emissions will suffice to demonstrate that 'avoided emissions' are a useful tool of analysis where gains can be made, but must not be included

IMPROVING THE ESTIMATION OF CARBON FOOTPRINTS FOR PAPER

When companies or individuals calculate their carbon footprint or climate impact, the following must be taken into consideration:

- Forest carbon loss, including soil respiration
- Embedded impacts from chemical and fossil fuel use
- Particulate emissions
- Total real emissions from energy use, i.e., emissions to the air of all greenhouse gases, including biomass[vi]
- Emissions from all activities (e.g., distribution, secondary and primary manufacturing) through the supply chain

As discussed in this report, some of these impacts have not yet been fully calculated or researched. While more definitive answers are sought, declarations of climate impact should contain caveats that more information is needed to determine the total impact.

in the internal footprint of products. A factory emits 10 tons of carbon dioxide equivalent greenhouse gases in year one. At the beginning of year two, the factory makes an investment into equipment that will reduce its emissions by two tons. According to the avoided emissions logic, the mill now emits 6 tons CO_2 equivalent. That is, the emissions are eight tons, but the mill gets a credit of two tons for the 'avoided emissions.'

This is simple double counting of the impact. The industry already has lower emissions because it did not use the fossil fuels, which is in essence 'to its credit.' But the credit must not be overstated or over-counted. The emission by the industry must be counted as the release of carbon from forest, the use of biofuels and decomposition, minus the ultimate storage of that carbon in products. To credit the industry a second time for the phantom fossil fuel is to count this non-emission twice. In effect, it is the same as if rather than simply state the relatively low emissions for driving a hybrid car, one were to ask for additional credit for not having driven an SUV.

There are some cases where it makes sense to apply offsets to the ledger of the carbon footprint of the industry and its products. When the paper industry sells surplus energy to the grid or other second parties, it is reasonable to credit the lower releases of carbon from biofuels as an offset against fossil fuels that might otherwise actually have been used for energy not related to the industry or the product itself. The emission from harvest must still be counted, however. Moreover, creative accounting must never be used to 'hide' emissions from any product.

Photo: This pine plantation stores very little carbon and sequesters carbon at rates far below healthier, natural forests. These plantations have spread widely across the South and in other parts of the US and around the world. This plantation strategy directly reduces the amount of carbon stored across the landscape. (Photo: J. Ford, Climate for Ideas)

The use of avoided emissions in carbon footprint analyses has not been widely implemented, but it is a theme around which society must be vigilant in order to avoid extravagant claims of 'carbon neutrality.'

WOOD PRODUCTS VERSUS PAPER PRODUCTS

We should draw a sharp distinction between wood products and paper products. The two are distinct in their impacts and should be considered separately in terms of both policy response and market response.

While the accounting methods for carbon emissions from wood products should be the same as for paper products, wood products for building and other uses present many benefits that paper as a product does not:

- Wood products are in general long-lasting and store carbon for relatively long periods.
- Rotations lengths for sawn and other wood products are longer than rotation lengths managed for paper.
- Sawn wood products require relatively little energy to produce compared to paper products.[5]
- Wood products may substitute for other products, such as cement, plastic, or steel, that require a great deal more energy to manufacture than lumber.

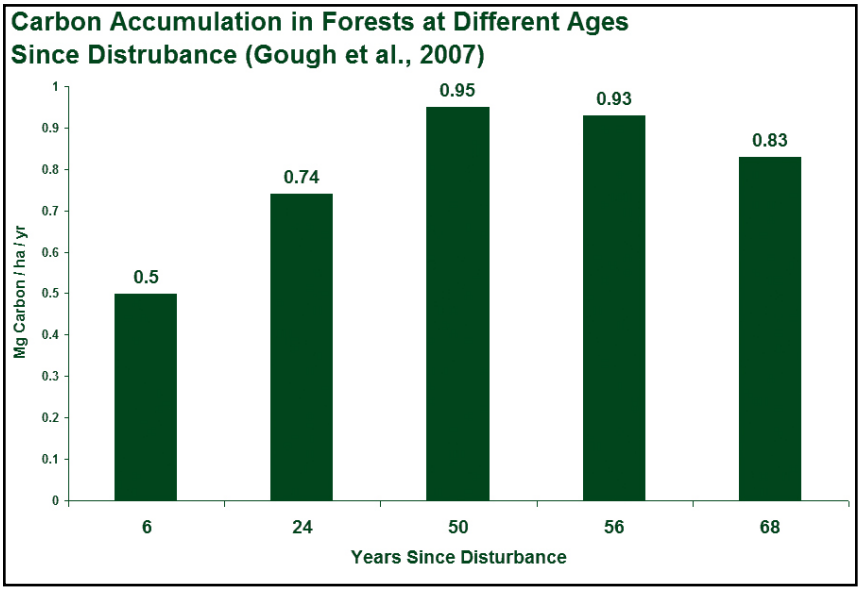


Figure 8: Forests of different ages accumulate carbon at different rates.
This chart demonstrates the net lower carbon accumulation of younger forests.[xxiii]

5 - For an example of the discussion of the residence times of carbon stored in wood products, see Skog, Kenneth E. et alia. "A Method Countries Can Use to Estimate Changes in Carbon Stored in Harvested Wood Products and the Uncertainty of Such Estimates." Environmental Management Vol. 33, Supplement 1, pp. S65-S73.

VI. OTHER MAJOR IMPACTS ON THE CLIMATE

In addition to the major areas of emissions from the paper industry outlined above, the following impacts are often not considered in analyses and further research will be required to estimate the full impacts:

- Forest management that leads to permanent or long-term losses in carbon storage and sequestration potential.
- Chemical and fertilizer application from forest management.
- Fossil fuel emissions from purchased fossil fuels (also known as 'embedded' or 'indirect' emissions).[6]
- Release of particulates (which have recently been shown to have a strong greenhouse effect and which the paper industry is a major contributor of).
- Energy used in printing and converting of paper products.
- Distribution of pulp to paper manufacturers.
- Distribution of paper products through to markets.
- Retail emissions from marketing paper products (e.g., heating and lighting in stores for paper products).

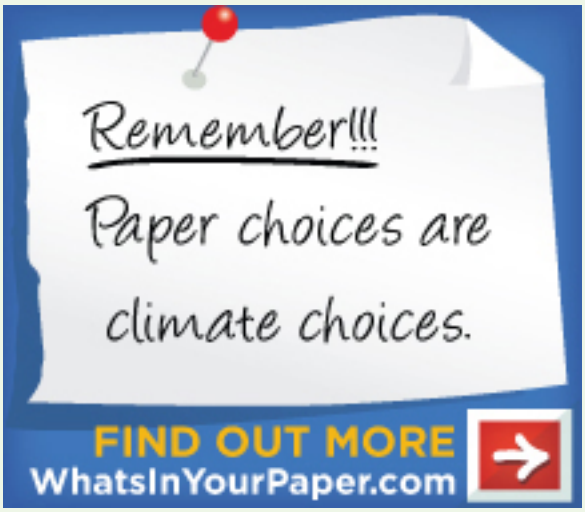
Further, the following impacts of paper production have been estimated and detailed in various studies and reports and are real emissions of greenhouse gases. These impacts further erode the notion of 'carbon neutral paper:'

- Forest harvest and transport
- Pulp & paper manufacturing emissions (fossil fuel)
- Landfill emissions

DO MORE BY USING LESS PAPER

The average North American uses 680 pounds of paper in a year – the highest rate of personal consumption in the world. The typical office worker uses 10,000 sheets of paper every year, or 4 million tons of paper in total.[xxxiii] That's approximately 91,000,000 trees, assuming the average 5% recycled content for printing and writing papers.[xxxiv]

If the United States cut its office paper use by roughly 10 percent, or 400,000 tons, greenhouse gas emissions would fall by at nearly 3,000,000 tons, carbon dioxide equivalent. This is the equivalent of taking 495,000 cars off the road for a year.



RESPONSIBLE PAPER CHOICES REDUCE YOUR CARBON FOOTPRINT

As this report demonstrates, changing our paper habits is critical to stopping global warming. Fortunately, solutions exist and we know what needs to be done. By being more efficient in our use of paper and by making smart choices such as those identified below, we can greatly reduce our carbon footprint. To be a part of the solution, paper purchasers and the industry should embrace the roadmap put forth through the Environmental Paper Network's Common Vision for the Transformation of the Pulp and Paper Industry at www.environmentalpaper.org.

6 - Indirect emissions are those emissions incurred when fossil fuels themselves are produced.

VII. CONCLUSION

Many paper products are an important element of society, literacy, entertainment and hygiene. We must, however, fully understand the greenhouse gas emissions from these products to assess their full impact and how to manage this impact in the age of climate change. Paper production, distribution and disposal have an enormous impact on the climate and are one of the most greenhouse gas intensive products in society. Carbon neutral claims for paper should be dismissed due to the very large emissions of greenhouse gases associated with paper production and disposal.

RECOMMENDATIONS:

- Do not accept claims of carbon neutrality by paper companies.
- Do not pass on claims of carbon neutrality to your consumers.
- Use the guidance on Improving the Estimation of Carbon Footprints for Paper found in this report.
- Reduce your carbon footprint by reducing the amount of paper you use and using more recycled paper.
- Reduce your carbon footprint by using recycled paper and ensuring waste paper does not go to landfills.

APPENDIX. ACCOUNTING OF FOREST BIOMASS FROM THE HARVEST OF FORESTS AND PLANTATIONS

The Intergovernmental Panel on Climate Change sets the rules by which countries report their Greenhouse Gas Emissions. The IPCC is empowered to make these rules according to the United Nations Framework Convention on Climate Change. Nearly every country, including the United States, is a signatory. The IPCC produced a Good Practice Guidance that laid out the rules for accounting for the carbon lost from the harvest of forest products.

Equation 3.2.7 from the Good Practice Guidance defines the rules by which the most important input into the industry, tree fiber, is accounted for in terms of carbon emissions. The equation is entitled "Annual Carbon Loss Due to Commercial Fellings." The loss due to logging, or harvest, is calculated as:

[losses from commercial fellings] = [the volume of wood extracted] x [wood density] x [biomass extraction factor] x [carbon left to decay] x [carbon content of the wood harvested]

Most simply put, wood harvested is an emission of carbon and that calculation should include the wood that is left in the forest that will decay. When accounting for inputs into products or the use of biomass for energy, harvested wood must be counted as an emission.

The U.S. Environmental Protection Agency and Environment Canada explain the same issue in different ways in national greenhouse gas reports:

The net change in forest C is not equivalent to the net flux between forests and the atmosphere because timber harvests do not cause an immediate flux of C to the atmosphere. Instead, harvesting transfers C to a "product pool." Once in a product pool, the C is emitted over time as CO_2 when the wood product combusts or decays. The rate of emission varies considerably among different product pools. For example, ***if timber is harvested to produce energy, combustion releases C immediately***. Conversely, if timber is harvested and used as lumber in a house, it may be many decades or even centuries before the lumber decays and C is released to the atmosphere.[xxxv] (emphasis added)

In keeping with the current IPCC (2003) default methodology, emissions from forest management activities comprise all the CO_2-C contained in harvested roundwood and harvest residues. ***All carbon transferred out of managed forests as wood products is deemed an immediate emission.***[xxxvi] (emphasis added)

It is useful to present here a simplified model of forest carbon sequestration that will help us to understand how to arrive at the correct accounting method for carbon harvested in forests. Trees grow at different rates in different climes, on different sites and responding to different stimuli such as management activities (e.g., thinning). As shown above, many intermediate aged forest stands grow and sequester carbon more robustly than much younger ones. Carbon accounting for forest products should focus on those forests or plantations that are directly affected by the harvest for the products themselves and not on extraneous forest lands: land ownership may change, subsidies for carbon storage in forests may change the marketplace as well as a myriad of other factors. Accounting for these differences in a Carbon Footprint is probably beyond any carbon accountant's means.

Let us imagine a temperate forest region with ten stands, each of which is harvested every ten years. We will use the default values of the Intergovernmental Panel on Climate Change for temperate forests: above-ground biomass of 96 tons per hectare on average and net primary productivity of 7.0 tons of carbon per hectare per year. The table below illustrates the starting carbon storage and two different scenarios: a harvest scenario and a no-harvest scenario.

The equation for estimating the annual carbon loss due to commercial fellings is provided in Equation 3.2.7:

EQUATION 3.2.7
ANNUAL CARBON LOSS DUE TO COMMERCIAL FELLINGS

$$L_{fellings} = H \bullet D \bullet BEF_2 \bullet (1 - f_{BL}) \bullet CF$$

Where:

$L_{fellings}$ = annual carbon loss due to commercial fellings, tonnes C yr^{-1}

H = annually extracted volume, roundwood, m^3 yr^{-1}

D = basic wood density, tonnes d.m. m^{-3}; Table 3A.1.9

BEF_2 = biomass expansion factor for converting volumes of extracted roundwood to total aboveground biomass (including bark), dimensionless; Table 3A.1.10

f_{BL} = fraction of biomass left to decay in forest (transferred to dead organic matter)

CF = carbon fraction of dry matter (default = 0.5), tonnes C (tonne d.m.)$^{-1}$

In applying this equation there are two choices:

(i) Total biomass associated with the volume of the extracted roundwood is considered as an immediate emission. This is the default assumption and implies that f_{BL} should be set to 0. This assumption should be made unless changes in dead organic matter are being explicitly accounted for, which implies use of higher tiers under Section 3.2.1.2 below.

(ii) A proportion of the biomass is transferred to the dead wood stock. In this case, f_{BL} should be obtained by expert judgment or based on empirical data (Tier 2 or 3). Annex 3.A.11 provides default data on f_{BL} for use at Tier 2.

FOREST STAND	YEAR 1 CARBON - BASELINE	YEAR 2 CARBON - NO HARVEST	YEAR 2 CARBON - HARVEST
–	Tons of carbon / hectare	Tons of carbon / hectare	Tons of carbon / hectare
1	61	68	68
2	68	75	75
3	75	82	82
4	82	89	89
5	89	96	96
6	96	103	103
7	103	110	110
8	110	117	117
9	117	124	124
10	124	131	61
TOTALS	**925**	**995**	**925**

FIGURE 9: CHANGES IN CARBON STORAGE, HARVEST AND NO-HARVEST SCENARIOS

In our model, forest stands 1 – 9 gain 7 tons of carbon through growth, as expected, in both scenarios. Forest Stand 10 is different in the two scenarios. In the no harvest scenario, there is growth as in other stands. However, in the harvest scenario, we remove 70 tons of carbon from Forest Stand 10 for use in paper products. Without accounting for the many complexities that would be involved, as noted, the forest stands in our model would gain 70 tons of carbon without harvest, or remain stagnant in the harvest scenario. This model demonstrates the validity of applying the Intergovernmental Panel on Climate Change accounting method for 'annual carbon loss due to commercial fellings' to harvests of wood for forest products.[xxvii]

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