Two Sides Facts

The Myth: Paper has a high carbon footprint.

The Fact: It's not as high as you think!

Carbon footprint is generally defined as the amount of carbon dioxide (CO_2) and other greenhouse gases that a person, organization, event or product causes to be released to the atmosphere, either directly or indirectly, during its life. For paper products, this life includes everything from harvesting trees through the manufacturing process to use and disposal or recycling. A look across this entire life cycle shows that paper's carbon footprint can be divided into three basic elements: greenhouse gas emissions, carbon sequestration and avoided emissions. Each of these elements is influenced by important characteristics that make paper's carbon footprint smaller than might be expected: it's made from a renewable resource that stores carbon, it's manufactured using mostly renewable energy and it's recyclable.

All cited facts are quoted directly from the source unless otherwise noted. Where indicated, Two Sides U.S. has summarized lengthy information, but links to original sources are provided in the footnotes. Information in brackets was added by Two Sides U.S. for clarification purposes.

Since most of the energy used by the U.S. paper industry comes from renewable, carbon-neutral biomass, where do paper's greenhouse gas emissions come from?

- Life cycle studies have determined that most greenhouse gas emissions from the global forest products value chain come from four sources:

  1. fossil fuel combustion at industry facilities – about 260 million tons of carbon dioxide (CO_2) per year;
  2. fossil fuel combustion by the producers of electricity that the industry purchases – about 190 million tons of CO_2 per year;
  3. fossil fuel combustion associated with the transport of the industry's raw materials and products – about 70 million tons of CO_2 per year; and
  4. methane emissions attributable to the anaerobic decomposition of forest products in landfills – about 250 million tons of CO_2 equivalents per year.

  Almost all of the greenhouse gas emissions from forest products industry manufacturing facilities are the result of fossil fuel combustion. The industry also burns large quantities of biomass fuels but the CO_2

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released from biomass combustion is not included in greenhouse gas totals because it contains biogenic carbon [produced from living or recently living sources] that is part of a natural cycle. It is for this reason that biomass-derived CO_2 is called "carbon neutral."[1]

- The print and paper industry accounts for only 1.1% of global carbon dioxide emissions.[2]

- At U.S. pulp and paper mills, the combined direct and indirect emissions intensity rate [rate per ton of production] for 2008 was 14.1 percent lower than in 2000.[3]

What is the difference between biomass and fossil fuels?

- There is a vital difference between energy production from fossil fuels and from biomass. Burning fossil fuels releases carbon dioxide that has been locked up for millions of years [introducing "new" carbon to the atmosphere]. By contrast, burning biomass simply returns to the atmosphere the carbon dioxide that was absorbed as the trees grew and there is no net release of carbon dioxide if the cycle of growth and harvest is sustained. [4]

- It is the new carbon from fossil fuels that is primarily responsible for the increases in atmospheric carbon dioxide that have occurred in the last 100 years.[5]

How heavily does the U.S. pulp and paper industry depend on fossil fuels and purchased electricity?

- The forest products industry far exceeds all other industries in the use of renewable biomass energy and is a leader in cogenerating electricity. In 2005, the forest products industry produced more than four-fifths of the total biomass energy generated by all industrial sectors.[6]

- Some 65% of the energy needed to operate U.S. pulp and paper mills is generated from renewable fuels, primarily biomass. U.S. pulp and paper mills are largely energy self-sufficient, and some mills supply excess energy to the electric utility grid.

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[1] NCASI, 2007.
[2] WRI, 2005.
[3] AF&PA, 2010.
[4] IEA, Bioenergy Task 38
[5] IPCC, 2007
[6] Agenda 20/20 Technology Alliance.

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Since 1990, purchased energy and fossil fuel use per ton of production has been reduced 26% while total energy use per ton of production has been reduced by 8.2 % [7]

- Virtually all U.S. pulp and paper mills that generate electricity on-site do so using combined heat and power technology, sometimes called cogeneration,[8] [which recycles exhaust steam for use as manufacturing process heat or space heating]. CHP systems are highly efficient (up to 75% efficiency compared to 45% for traditional fossil-fuel power plants) and, because they require less fuel to produce the same amount of energy, have lower emissions than separate heat and power generation.[9]

- Because forest products can require little or no fossil fuels for production and store carbon throughout their useful life, they can have inherent climate change advantages over all other materials with which they compete, provided they are produced in a sustainable manner. Indeed, under sustainable practices, the forest products industry is one of the least carbon-intensive manufacturing sectors. [10]

What is carbon sequestration?

- Carbon dioxide is removed from the atmosphere by trees and stored for a period before being returned to the atmosphere. The sequestered carbon is stored not only in trees. It is also stored in forest products [including paper] for periods ranging from days to centuries.[11]

What's the connection between paper, sustainable forestry and carbon sequestration?

- Forests absorb carbon dioxide from the atmosphere as they grow and carbon is stored in the wood produced. Wood products from the managed forest [including paper] continue to store carbon in useful materials outside of the forest. The carbon storage benefits of carbon pools outside of the forest combined with continuous carbon absorption [through photosynthesis] within the forest produces net carbon benefits that continue to accumulate over time (see figure below).[12]

[7] ibid, AF&PA.
[8] ibid, AF&PA.
[9] U.S. EPA, 2008.
[10] WRI, Trees in the Greenhouse.
[11] ibid, NCASI.
[12] Bowyer, J., et al., 2011.

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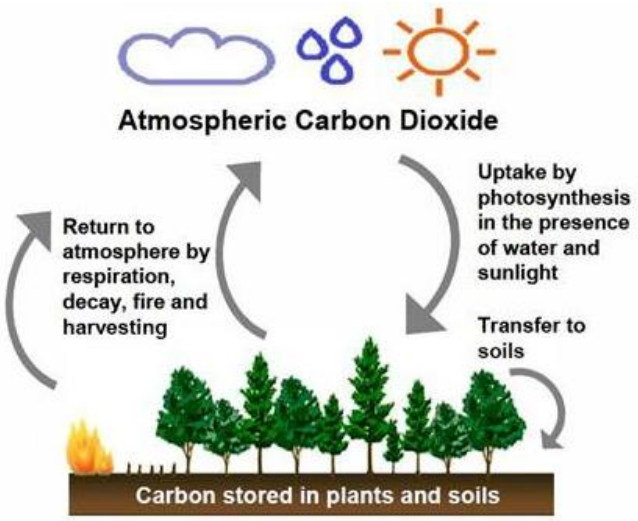

Figure 1. *A sub-cycle within the global carbon cycle. Carbon continuously moves between the atmosphere, plants and soils through photosynthesis, plant respiration, harvesting, fire and decomposition.*

Source: *An Introduction to the Global Carbon Cycle*, University of New Hampshire

- Forests and soils have a large influence on atmospheric levels of carbon dioxide (CO_2)—the most important global warming gas emitted by human activities. Tropical deforestation is responsible for about 20% of the world's annual CO_2 emissions. On a global scale, however, these emissions are more than offset by the uptake of atmospheric CO_2 by forests and agriculture. Therefore, agricultural and forestry activities can both contribute to the accumulation of greenhouse gases in our atmosphere, as well as be used to help prevent climate change, by avoiding further emissions and by sequestering additional carbon. [13]

- Given the requirements of sustainable forestry management programs to employ practices that ensure a continued supply of wood, it is reasonable to assume that carbon stocks in industrial forests managed under sustainable forestry principles are, at worst, stable over time. In fact, it appears likely that an assumption of constant forest carbon stocks understates the carbon benefits of sustainably managed industrial forests. In the United States alone, carbon stocks on private timberland are increasing by more than 240 million tons of CO_2 equivalents per year (Bickel et al. 2004). It appears that about one-quarter of private timberland is

[13] U.S. EPA.

managed to produce wood for the forest products industry, suggesting that 60 million tons of forest carbon sequestration can be directly attributed to the U.S. forest products industry.[14]

- Sustainably managed forests are approximately carbon neutral. They form a mosaic across the landscape in which the growth of trees over a large area will compensate for the carbon lost through annual logging of a much smaller area.[15]

- While carbon is stored in forest products [including paper], it remains out of the atmosphere. Studies indicate that the amounts of carbon stored in forest products are increasing by about 40 million tons per year. Currently, forest products store more than 3 billion tons of carbon globally.[16]

- In the long term, a sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual sustained yield of timber, fiber or energy from the forest, will generate the largest sustained [climate change] mitigation benefit.[17]

What are avoided emissions and what role do they play in paper's carbon footprint?

- (*Two Sides Summary)* Avoided emissions are those that would have occurred in the absence of an activity – or what might have happened if things had been done differently. Avoided emissions for paper products may result from displacing fossil fuels with biomass during manufacturing; from using combined heat and power (CHP) systems that extract far more power from fuels than do traditional systems that produce steam and electricity separately; and from recycling recovered paper. [18]

- In 2010, nearly 51 million tons or 63.5 percent of the paper used in the United States was recovered for recycling, an 89 percent increase in the recovery rate since 1990. That's about 334 pounds for every adult and child in the country. This exceeded the paper industry's 60% goal three years ahead of schedule. The industry's new recovery goal is to exceed 70% by 2020. Every ton of paper recycled saves more than 3.3 cubic yards of landfill space.[19]

[14] Ibid, NCASI.
[15] WRI and WBCSD, 2009.
[16] UNFCCC, 2003.
[17] IPCC, 2007.
[18] ibid, NCASI.
[19] AF&PA paperrecycles.org.

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- In the United States, use of recovered fiber by the paper and forest products industry results in avoided emissions of more than 20 million metric tons of CO_2 equivalents each year.[20]

How much do secondary processes like printing add to paper's carbon footprint?

- In many cases, primary [paper] products are further processed to yield final products. In most cases, however, these operations emit low quantities of greenhouse gases compared to primary manufacturing. Data from the U.S. Department of Energy, for instance, indicate that the "printing and related support industries," which includes some facilities that print on non-paper surfaces, have direct emissions that are only 4% of those from the paper and paperboard industry (USDOE 2005). A life cycle study of magazines in North America found that greenhouse gas emissions attributable to printing were 3% to 7% of those from pulp and paper manufacturing (Gower et al. 2006).[21]

Is there a standard for measuring carbon footprint?

- *(Two Sides Summary)* The most common methods used for greenhouse gas inventories and calculating carbon footprints in the print and paper industry are those of the World Resources Institute[22], the British Standards Institute[23], and CEPI[24].

- The Greenhouse Gas (GHG) Protocol is the most widely used international accounting tool for government and business leaders to understand, quantify and manage greenhouse gas emissions. A decade-long partnership between the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), the GHG Protocol is working with businesses, governments, and environmental groups around the world to build a new generation of credible and effective programs for tackling climate change. It serves as the foundation for nearly every GHG standard and program in the world - from the International Standards Organization to The Climate Registry - as well as hundreds of GHG inventories prepared by individual companies.

- The Carbon Disclosure Project - a non-profit organization that represents investors with assets totaling $41 trillion - regularly surveys the world's largest companies to assess investment-related risks and opportunities

[20] AF&PA, 2009.
[21] ibid NCASI.
[22] The Greenhouse Gas Protocol Initiative.
[23] British Standards Institute, PAS 2050.
[24] Confederation of European Paper Industries, 2007.

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related to climate change using the GHG Protocol as the framework. Last year, 72 percent of Fortune 500 companies responded to the survey.[25]

What do recent life cycle assessments tell us about the carbon footprint of paper?

- *(Two Sides Summary)* The American Forest and Paper Association and the Forest Products Association of Canada initiated a cradle-to-grave life cycle assessment of four North American-average paper products, including office papers, catalogs, magazines and phone books. The study is the most comprehensive ever conducted for North American printing and writing papers. The data was collected from 72 mills in the United States and Canada, which produced 22.4 million short tons of printing and writing papers in 2006-07. This represents approximately 77 percent of all North American production during that time period. The LCA was conducted by the National Council for Air and Stream Improvement, Inc. (NCASI) — an independent, nonprofit research institute recognized as a leading resource for environmental topics of interest to the forest products industry.

  The LCA showed that the most significant carbon emissions for all four products – from 43% to 66% of total emissions – happened during the paper manufacturing process. The researchers concluded that the environmental impacts of paper production are largely driven by the use of fossil fuels during the manufacturing process and that increasing the use of bio-based energy sources at paper mills would further reduce climate change impacts. U.S. pulp and paper mills currently generate 65% of their energy using renewable biomass.

  In addition, the researchers concluded that: increasing the recovery rate of all papers, particularly those products that decompose readily in a landfill would have a significant positive effect on global warming impacts (currently 63.4% of all paper used in the United States is recovered) and that transportation is not very significant in overall life cycle impacts.[26]

- *(Two Sides Summary)* The National Geographic Society (NGS) collaborated with supply chain partners Verso Paper Corp. and Quad/Graphics to measure greenhouse gas (GHG) emissions throughout the life cycle of *National Geographic* magazine. The results of the lifecycle assessment showed that a *National Geographic* magazine weighing an average 12.3 ounces is responsible for emitting 1.82 pounds of carbon dioxide equivalents. The most significant carbon emissions, about 70% of that total (1.28 pounds) resulted from the paper manufacturing process. Twenty-six percent (0.47 pounds) resulted from printing and distribution of the magazine, and 4% (0.07 pounds) results from other activities, including NGS operations, packaging and

[25] The Greenhouse Gas Protocol Initiative.
[26] AF&PA and FPAC, 2010.

landfilling. To put this in perspective, the same amount of CO_2-eq. is emitted when someone drives just under two miles in a car that gets 20 miles per gallon of gas.[27]

- *(Two Sides Summary)* In 2006, a carbon life cycle assessment (LCA) was conducted on two magazines, *Time* and *InStyle,* with support from the H. John HEINZ III Center for Science, Economics and the Environment. The LCA included 2001 data for all major direct and indirect carbon and greenhouse gas emissions from activities including tree harvest, transportation of wood and other raw materials to mills, manufacturing, transportation of finished products to end users, recovery and recycling of products, and disposal of waste. The LCA revealed that 0.32 tons of carbon (or 1.17 tons of carbon dioxide equivalents (CO_2-e)) were emitted per ton of *Time* magazine products and 0.30 tons of carbon (or 1.11 tons of CO_2-e were emitted per ton of *InStyle* magazine produced. This assumed 90% of unrecovered magazines were landfilled and 10% were incinerated. CO_2-e emissions were 5.8 times greater for *InStyle* than *Time* when emissions were expressed on a per magazine basis because the average weight for an *InStyle* magazine was 5.5 times greater than *Time*.

  The relative contributions from the processes generating CO_2-e for *Time* and *InStyle* were: forest management and harvesting , 2% and 2%; transportation of all wood fiber (and clay) to the pulp and paper mills, 8% and 3%; pulp plus paper manufacturing emissions, 61% and 77%; transportation of paper to magazine printers, 1% and 1%; magazine printing, 4% and 2%; transportation and distribution of magazines, 8% and 5%; and final fate of magazines, 16% and 10%. Indirect CO_2-e emissions were 17% and 9% of total GHG emissions for *Time* and *InStyle* magazine chains, respectively. [28]

[27] Boguski, T., 2010.
[28] Gower, S., et al. 2006