The State of the Paper Industry

Monitoring the Indicators of Environmental Performance

A collaborative report by the Steering Committee of the Environmental Paper Network

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EXECUTIVE SUMMARY

DESPITE PREDICTIONS THAT THE DIGITAL REVOLUTION WOULD MAKE PAPER AS OBSOLETE AS THE TYPEWRITER, PAPER REMAINS CENTRAL TO OUR LIVES. YET MOST OF US, MOST OF THE TIME, GIVE LITTLE THOUGHT TO HOW MUCH WE DEPEND ON PAPER PRODUCTS. THINK OF THE HUNDREDS OF TIMES A DAY WE TOUCH PAPER—NEWSPAPERS, CEREAL BOXES, TOILET PAPER, WATER BOTTLE LABELS, PARKING TICKETS, STREAMS OF CATALOGS AND JUNK MAIL, MONEY, TISSUES, BOOKS, SHOPPING BAGS, RECEIPTS, NAPKINS, PRINTER AND COPIER PAPER AT HOME AND WORK, MAGAZINES, TO-GO FOOD PACKAGING. THE LIST COULD FILL A PAPERBACK.

What's more, few people pay much heed to the ways in which our use of paper affects the environment. Yet the paper industry's activities—and our individual use and disposal of paper in our daily lives—have enormous impacts. These include loss and degradation of forests that moderate climate change, destruction of habitat for countless plant and animal species, pollution of air and water with toxic chemicals such as mercury and dioxin, and production of methane—a potent greenhouse gas—as paper decomposes in landfills, to name just a few.

How can a product that is so interwoven in our lives have such devastating effects? And more to the point, what can we do to avoid, slow, or reverse the harmful consequences of wood harvesting, pulp and paper manufacturing, and paper use and disposal? This report tackles these questions within the framework of *A Common Vision for Transforming the Pulp and Paper Industry,* a call to action first issued in 2002 by the Environmental Paper Network (EPN).

The EPN's members represent a diverse group of non-profit organizations united by their shared interest in supporting socially and environmentally sustainable transformations within the pulp and paper industry. To achieve this transformation, the *Common Vision* defines four key goals: minimize paper consumption, maximize recycled content, source fiber responsibly and employ cleaner production practices.

This report represents the Environmental Paper Network's (EPN) effort to identify the most important indicators to use when evaluating the environmental performance of the pulp and paper industry.

In each of these four categories, this report identifies key indicators to use in evaluating the environmental performance of the pulp and paper industry. Over time, tracking these environmental performance indicators will allow the paper industry, paper users, the EPN and other stakeholders to measure the industry's progress toward sustainability.

This report contains a wealth of data about the paper industry's environmental impacts gathered from business, government and non-governmental sources. While there have been some bright spots in recent years—such as the phasing out in the United States of elemental chlorine to bleach pulp, which reduces the generation of dioxins—in aggregate the environmental performance indicators paint a troubling picture. These indicators help clarify what needs attention, and what role stakeholders might play in moving the industry toward cleaner, healthier, more environmentally responsible production.

PAPER: IT'S CHANGING THE CLIMATE

One of the most significant, and perhaps least understood, impacts of the paper industry is climate change. Every phase of paper's lifecycle contributes to global warming, from harvesting trees to production of pulp and paper to eventual disposal.

It is estimated that 42% of the industrial wood harvest is used to make paper—a sobering fact given that forests store roughly 50 percent of all terrestrial carbon, making them one of our most important safeguards against climate change. Old-growth and mature, second-growth natural forests store much larger amounts of carbon than newly planted stands and once logged, require decades to recover the original amount of carbon they contained.

Whether the tree grew in a mature forest or industrial tree plantation, climate change impacts multiply after it is harvested. The pulp and paper industry is the fourth largest emitter of greenhouse gases among manufacturing industries, and contributes 9 percent of total manufacturing carbon dioxide emissions. The biggest greenhouse gas releases in pulp and paper manufacturing come from the energy production needed to power the pulp and paper mill.

The climate change effects of paper carry all the way through to disposal. If paper is landfilled rather than recycled, it decomposes and produces methane, a greenhouse gas with 23 times the heat-trapping power of carbon dioxide. More than one-third of municipal solid waste is paper, and municipal landfills account for 34 percent of human-related methane emissions to the atmosphere, making landfills the single largest source of such emissions. The U.S. Environmental Protection Agency has identified the decomposition of paper as among the most significant sources of landfill methane.

The climate benefits of reducing paper consumption are significant. If, for example, the United States cut its office paper use by roughly 10 percent, or 540,000 tons, greenhouse gas emissions would fall by 1.6 million tons. This is the equivalent of taking 280,000 cars off the road for a year.

By embracing the four pillars of the *Common Vision*—minimizing paper consumption, maximizing recycled content, sourcing fiber responsibly and employing cleaner production practices—paper manufacturers, suppliers and purchasers can dramatically reduce the climate change impacts of the paper industry.

Benefits of Recycled Paper

Compared to copy paper made from 100% virgin forest fiber, a copy paper made from 100% recycled content reduces:

- total energy consumption by 44%
- net greenhouse gas emissions by 38%
- particulate emissions by 41%
- wastewater by 50%
- solid waste by 49%
- wood use by 100%

Source: Environmental Defense Paper Calculator.

RECYCLED CONTENT: STEPPING UP TO MEET DEMAND

Reducing paper consumption is an important first step in reducing the environmental impacts of the paper industry. The next step is to ensure that all paper is environmentally sustainable—and that starts with recycled content. Replacing virgin tree fibers with recovered fibers reduces demand for wood, which eases pressure to harvest forests and convert natural forests into tree plantations. Making paper from used paper requires less energy and is generally a cleaner manufacturing process than making paper from trees. And because it diverts usable paper from the waste stream, recycling cuts both solid waste and greenhouse gas emissions created when paper decomposes in landfills.

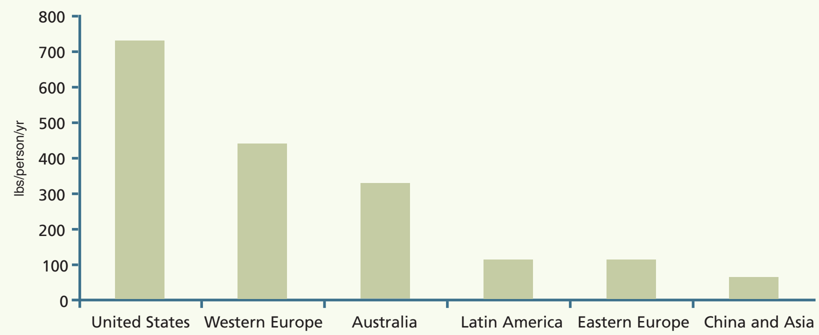
With curbside recycling programs common across the United States, many people assume that the paper recycling industry is thriving. The truth is much more complex.

Currently, 37 percent of U.S. pulp and nearly 25 percent of Canadian pulp is produced from recovered paper. However, the use of recycled content varies widely among grades of paper, from an average of 45 percent recycled content in tissue products and 32 percent in newsprint to a low of 6 percent in printing and writing papers.

Estimates by environmental groups and paper industry pulp producers suggest that as much as 1.5 million additional tons of recycled pulp per year is needed to meet projected new demand for recycled paper in the United States within the next five to ten years. But as demand increases, will there be enough supply? One encouraging trend is that paper recovery has increased every year over the past five years and in 2006 exceeded 53 percent. However, the United States is nowhere close to tapping out the domestic supply of used paper suitable for recycled pulp: in 2003, only 48.3 percent of office paper was recovered for recycling. The key constraints to the availability of recycled paper in the United States are: 1) deinking or recycling capacity, 2) demand for recovered paper from abroad, 3) degradation of recovered paper quality that makes it unsuitable for use in particular grades of recycled papers, and 4) our ability to recover more paper from the waste stream.

Current trends, including an increased reliance on single-stream recycling programs that mix bottles, cans and other material with paper, may ultimately undermine the North American paper recycling system. Unless there is a functional recycling infrastructure, all papers will wind up landfilled or incinerated, wasting their reuse potential. The best way to ensure that the whole recycling system will function optimally is for North American paper purchasers to require recycled content in paper; that demand pulls used paper through the system to be used again.

World paper and paper board consumption, per capita, 2004



Source: RISI 2005.

AS GLOBAL CONSUMPTION AND PRODUCTION BOOM, MUST THE ENVIRONMENT PAY THE PRICE?

Paper is now a global industry, with multinational suppliers managing a complex web of fiber sourcing, pulping, paper production and converting operations all over the world. The United States and Western Europe remain by far the biggest paper consumers per capita, but paper consumption has been growing most rapidly in China and India, in parallel with their expanding economies.

To meet growing demand for paper products, the pulp and paper industry is expanding its production capacity, primarily in developing countries with lower raw material and labor costs and looser environmental regulations. Increasingly, the largest consumers of paper products are exporting the environmental consequences of production, such as damage to forests and discharges of pollutants from paper mills. And while new paper mills making newsprint and packaging in developing countries are incorporating high amounts of recycled fiber, there are virtually no recycled printing and writing mills being built.

SUSTAINABLE FORESTRY: ACTING BEFORE IT'S TOO LATE

Roughly half the world's forests have been burned or cleared and converted to non-forest uses. Human activity has degraded almost 80 percent of what remains of the planet's once vast forests. These forests have lost, to varying degrees, many of their species and much of their ability to function as healthy ecosystems. Yet many of the remaining forests—including old-growth and other ecologically important forests—are still being logged for the paper industry using unsustainable forest management practices.

To prevent further destruction, the paper industry must adopt more environmentally and socially responsible alternatives for sourcing fiber consistent with the *Common Vision's* goals. A necessary first step is to end the use of wood fiber that threatens endangered forests and other high conservation value ecosystems. As this report points out, considerable work needs to be done to map and monitor these regions and to develop long-lasting conservation agreements.

Independent, third-party certification of forestry management operations plays an indispensable role in helping protect endangered and high conservation value forests. Although a number of certification schemes exist worldwide, Forest Stewardship Council (FSC) certification is the most widely recognized as having the most credible standards for responsible forestry management. FSC certification is growing rapidly, and in 2006, FSC's market share of paper products increased globally by 50 percent. Currently, more than 226 million acres of forests are FSC certified globally. As this report explains, strengthening demand for FSC certified content in paper products promises to accrue numerous benefits to the environment, including a decline in conversion of natural forests to plantations and a reduction in use of polluting herbicides and fertilizers on tree plantations.

Indicators Monitored in this Report

Minimizing Paper Consumption

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- Global paper and paperboard consumption, by country and region
- Global paper and paperboard consumption, by grade
- Per capita paper and paperboard consumption
- United States paper consumption by grade
- U.S. printing & writing paper consumption, by end use

Maximizing Recycled Content

—

- Percentage of pulp made from recovered fiber
- North American high grade deinking capacity
- Recycled content in papers and paper products, by sector and grades within sector
- Percentage of recycled content in printing & writing paper
- Consistent minimum content recycled fiber specifications and standards
- Range of recycled paper choices available in each grade
- Volume of paper in the U.S. municipal solid waste stream
- Recovery rates by grade of paper
- Recovery rate for office papers
- Percentage of recovered high grade papers directed to "highest and best use" such as printing & writing paper
- Percentage of mixed paper in recovered paper collections vs. sorted papers
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- Global availability of non-wood plant fiber for pulp and paper
- Leading non-wood fibers in papermaking
- North American pulping capacity for non-wood plant fibers
- World pulping capacities for non-wood fiber

Employing Cleaner Production Practices

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- Wood use
- Water use
- Energy use
- Calcium carbonate use
- Greenhouse gases
- Sulfur dioxide
- Nitrogen oxides
- Particulate matter
- Hazardous air pollutants
- Volatile organic compounds
- Total reduced sulfur
- Mercury
- Biochemical oxygen demand
- Chemical oxygen demand
- Total suspended solids
- Adsorbable organic halogens
- Dioxins and dioxin-like compounds
- Total nitrogen and total phosphorus
- Solid waste
- Effluent flow
- Bleaching processes used for all bleached pulp

WHAT'S NEXT?

This report creates a common vocabulary and set of priorities for EPN's discussions with the paper industry, other nongovernmental organizations (NGOs), corporate purchasers, government agencies and the public. Because the environmental impacts of paper production vary significantly by grade and region, we have not attempted to establish specific performance goals for paper suppliers. Instead, our hope is that people will use the arguments and data put forth here to inform their own campaigns, purchasing decisions and manufacturing practices and to focus on solutions that advance social and environmental sustainability. In doing so, and by monitoring the environmental performance indicators established by this report, genuine progress towards the *Common Vision* can be achieved.

CHAPTER ONE

INTRODUCTION

Purpose and Scope of this Report

In the spring of 2002, a group of leading U.S. environmental organizations worked together to develop *A Common Vision for Transforming the Paper Industry*, a unified statement of goals and recommendations to reduce the environmental impacts of paper production and disposal.

Soon afterward, these groups formed **the Environmental Paper Network** (www.environmentalpaper.org) to share information and coordinate their campaigns to achieve a more sustainable paper industry. As these groups continued to work together, it became evident that a follow-up to writing the Common Vision included being able to answer the questions, **"How will we know if we're getting there?"** and **"What signs should we track along the way?"**

This report represents the Environmental Paper Network's (EPN) effort to identify the most important indicators to use when evaluating the environmental performance of the pulp and paper industry. Consistently tracking these indicators will allow us to measure ongoing progress toward the four goals of the Common Vision, which are minimizing consumption, maximizing recycled content, sourcing fiber responsibly and employing cleaner production methods.

The indicators in this report focus exclusively on the *environmental* performance of the paper industry. Indicators that have been more traditionally used to monitor the state of the paper industry, such as economic performance, are not addressed here. Similarly, the social impacts of the paper industry are beyond the scope of this report. For a discussion of the major social issues related to paper production, visit www.environmentalpaper.org/socialimpactsfactsheet, or see Appendix G.

This report also creates a common vocabulary and set of priorities for EPN's discussions with the paper industry, other nongovernmental organizations (NGOs), corporate purchasers, government agencies and the public. We have not attempted to establish specific performance goals for these and other stakeholders who may benefit from this report. Instead, our hope is that people will use the arguments and data put forth here to inform their own campaigns, purchasing decisions and manufacturing practices.

The most difficult issue the authors wrestled with in writing this report was its geographic scope. On the one hand, paper is now a global industry, with multinational suppliers managing a complex web of fiber sourcing, pulping, paper production and converting operations all over the world. On the other hand, the United States has historically been the world's largest producer and consumer of paper, and much of the available data related to the environmental indicators is from the United States. And because the United States remains such an important market for paper, this report focuses primarily on the United States. However, because decisions made by paper purchasers in the United States have repercussions all over the world, we have also included global information and data whenever available and relevant. We encourage international readers of this report who wish to use the same indicators to find local data sources whenever appropriate.

WHAT IS PAPER?

It's hard to imagine going a day without seeing or touching something made from paper. Paper products are ubiquitous in

SOCIAL RESPONSIBILITY CHALLENGES

THE PULP AND PAPER INDUSTRY has significant impacts on people and communities all around the world. It is responsible for violations of land rights in many places where the fiber for paper is sourced, both in natural forests and by the establishment of plantations on land without the consent of local people. The industry has had devastating impacts on local livelihoods by competing for forests and water and harming markets for natural resources. It also has a bad record for health-threatening pollution. Solving these problems requires industry to adopt principles of corporate social responsibility and paper buyers to share this responsibility by using less paper, choosing recycled whenever possible, encouraging a shift to non-wood fibers and not buying from or investing in companies with poor social records. For a closer look at these issues, see Appendix G.

our society, and include newspapers, magazines, catalogs, office paper, packaging and tissue products. Paper is, as one industry association puts it, "a piece of our lives" (TAPPI).

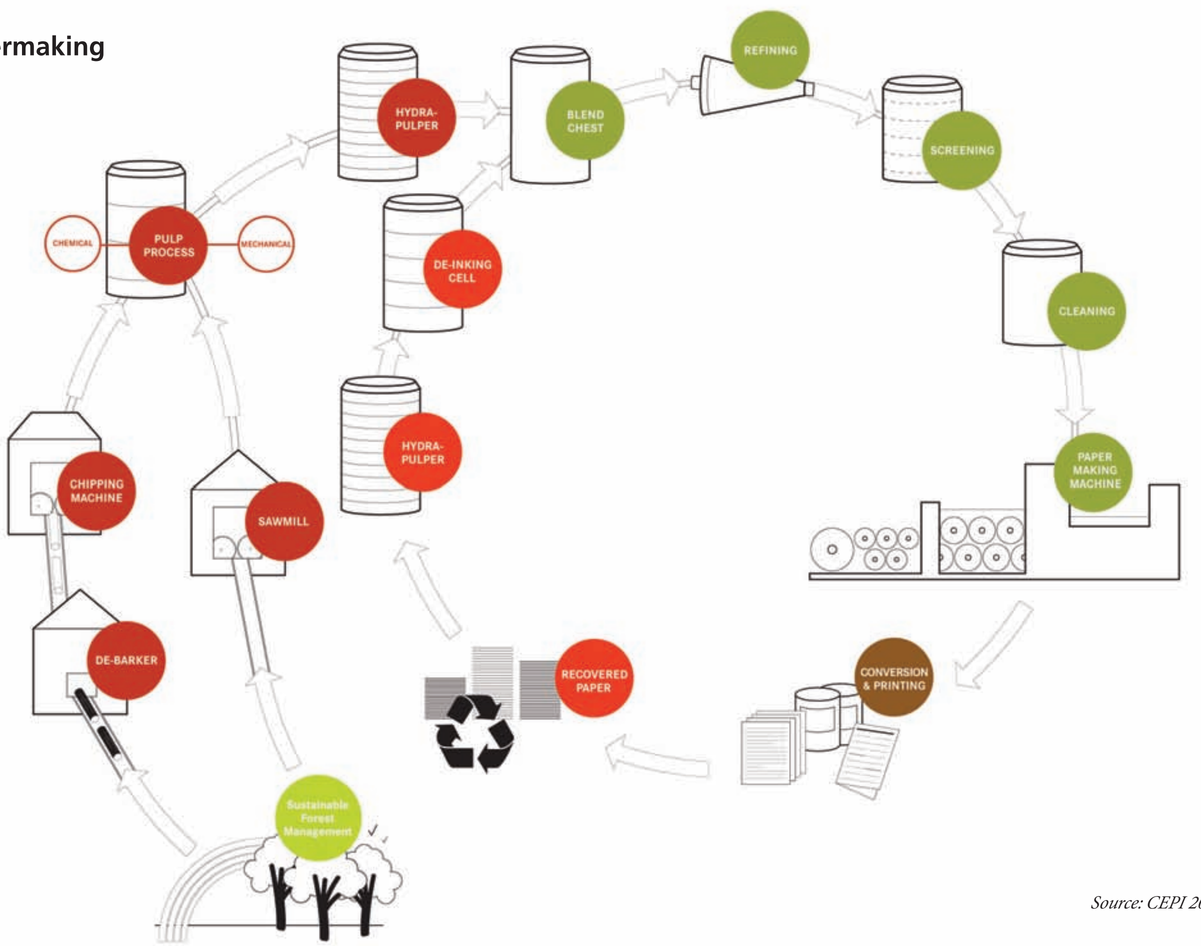
Until about 1800, most paper was made by hand one sheet at a time from recycled cotton and linen. Industrial-scale papermaking began in the mid-1800s after the invention of the Fourdrinier paper machine, and the development of the chemical pulping process that enabled the conversion of trees into paper pulp.

Modern paper production typically involves the following steps:

- Producing and acquiring fiber (for example, from trees, used paper or agricultural residues)
- Chemically or mechanically processing the fiber into pulp
- Running the pulp through a paper machine to create large rolls of paper
- Converting the paper into products such as boxes, office paper or paper towels

Figure 1 illustrates the pulping and papermaking process, which can include both timber and recovered paper as a fiber source.

**Figure 1.
The Papermaking Process**



Source: CEPI 2005.

HOW PAPER STACKS UP: ENVIRONMENTAL IMPACTS THROUGH ITS LIFECYCLE

The pulp and paper industry's impacts on the environment are notable not only for their magnitude but also for their breadth, ranging from damage to forests, pollution of air and water, creation of solid waste and emissions of greenhouse gases. These impacts occur at all phases of the paper lifecycle, from fiber acquisition to manufacturing to disposal.

IMPACTS ON FOREST ECOSYSTEMS

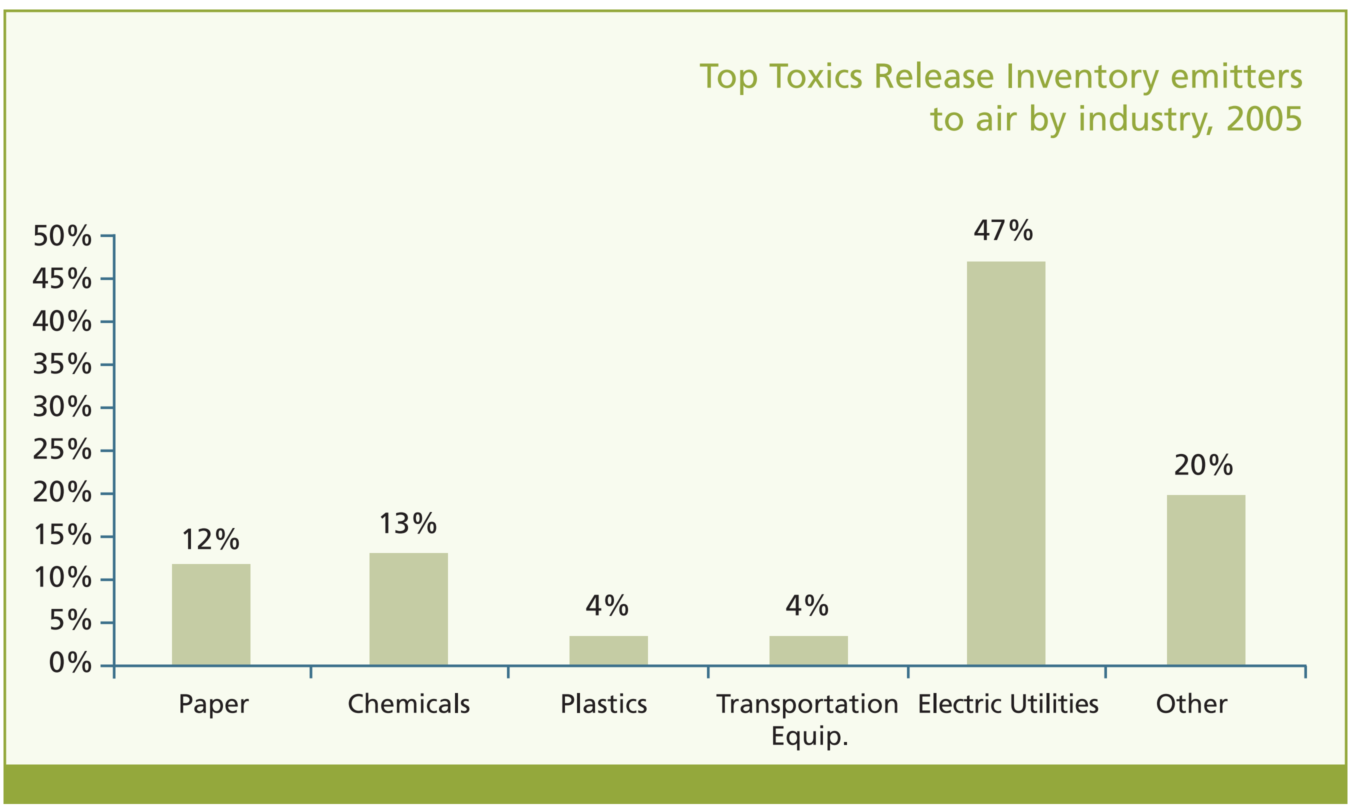
Even with advances in recycling over the past two decades, the primary fiber input into papermaking is still trees. Worldwide, over 40 percent of the industrial wood harvest goes into paper products, and by 2050 it is expected that pulp and paper production will account for over half of the world's industrial wood demand (Abramovitz).

How can an industry that relies on a renewable resource—trees—be so damaging? The answer lies in understanding the full range of values that forests provide. Aside from being a source of timber, forests provide habitat for countless plant and animal species and are essential to the culture and livelihoods of indigenous peoples. They also help maintain water quality, protect against erosion and stabilize the climate by absorbing carbon dioxide from the atmosphere. What's more, people cherish forests for their beauty, spiritual value and recreational opportunities. All of these values can be diminished when forests are unsustainably managed for timber production.

IMPACTS FROM PULP AND PAPER MANUFACTURING

Not surprisingly, pulp and paper production ranks among the most resource-intensive and highly polluting of all manufacturing industries. Besides fiber, the primary inputs into the papermaking process are water, energy and chemicals. In the United States, the paper industry is the largest user per ton of product of industrial process water (U.S. EPA 2002) and the third largest industrial consumer of energy (U.S. DOE). Also, papermaking is a very chemically intensive process. As Figures 2 and 3 show, the pulp and paper industry ranks fourth among industrial sectors in emissions of Toxics Release Inventory (TRI) chemicals to water, and third in such releases to air. The impacts of pulp and paper manufacturing are more fully discussed in the Cleaner Production section of this report.

Figure 2. Top Toxics Release Inventory emitters to air by industry, 2005



Source: U.S. EPA 2007

IMPACTS FROM DISPOSAL

Paper's impact on the environment continues even after it has been thrown away. In the United States, paper and paperboard currently account for the largest portion (34 percent) of the municipal waste stream, and 25 percent of discards after recovery of materials for recycling and composting (Figure 4).

The problem with all this paper being thrown away is not just about landfill space. Once in a landfill, paper decomposes and produces methane, a greenhouse gas with 23 times the heat-trapping power of carbon dioxide (UNEP). According to the U.S. Environmental Protection Agency (EPA), municipal landfills account for 34 percent of human-related methane emissions to the atmosphere, making landfills the single largest source of such emissions. Furthermore, the EPA has identified the decomposition of paper as among the most significant sources of landfill methane (EPA, 2003).

Finally, transportation throughout the system also has significant environmental impacts. Harvested trees or recovered paper are transported to pulp mills, rolls of paper are transported to converters, and finished paper products are transported to wholesale distributors and then on to their retail point of sale. Transportation at each of these stages consumes energy and results in greenhouse gas emissions.[1]

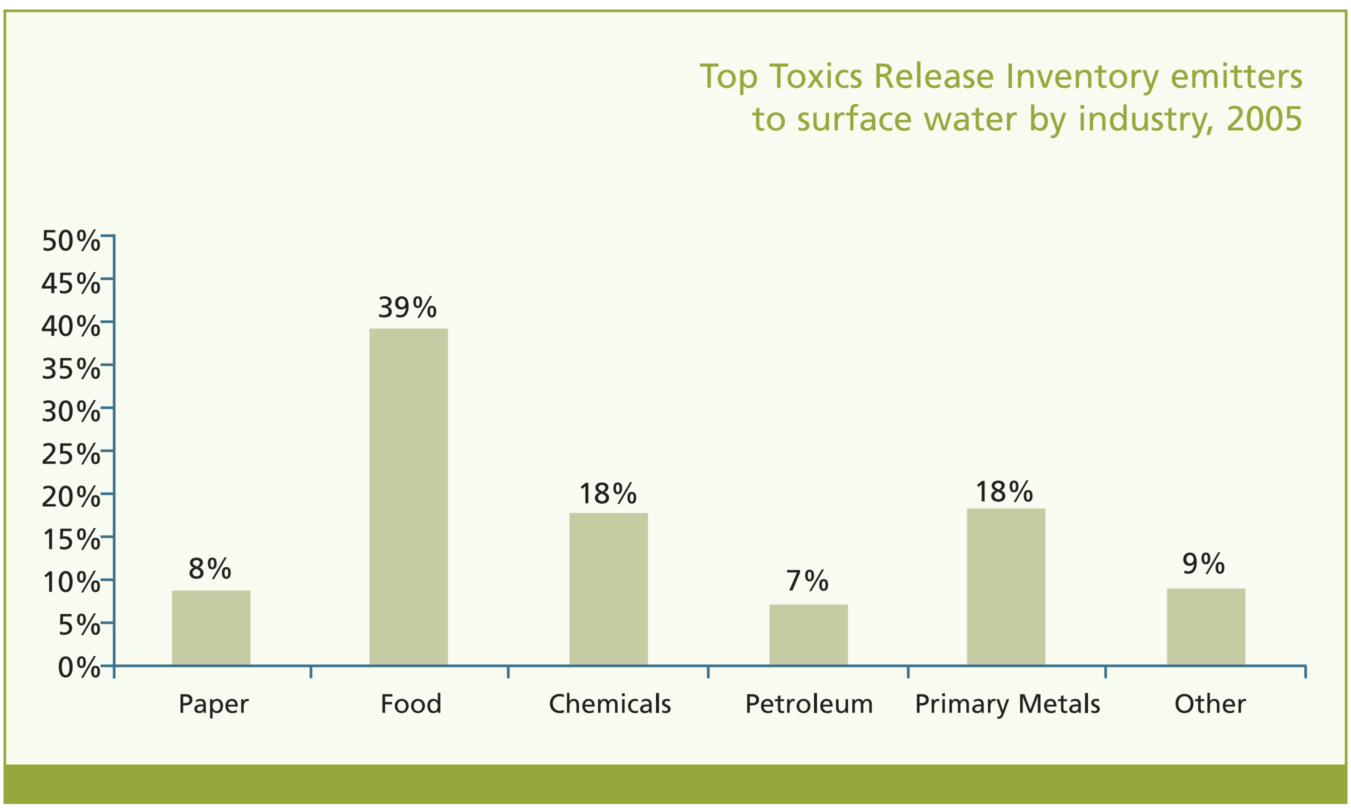
A COMMON VISION FOR TRANSFORMING THE PAPER INDUSTRY

Developed in 2002 and today supported by an Environmental Paper Network of more than 100 environmental organizations worldwide, *A Common Vision for Transforming the Paper Industry* lays out four key goals to achieve an environmentally and socially sustainable paper production and consumption system (Environmental Paper Network).[2] Each of these goals is described briefly here, and explored more thoroughly in subsequent sections of this report.

MINIMIZING PAPER CONSUMPTION

The most effective action one can take to reduce the environmental impacts of paper production is to use less, so that fewer trees are cut down, less energy, water and chemicals are consumed, fewer pollutants are released during manufacturing and less paper is sent to landfills or incinerators. In 2003, the United States consumed almost 5.4 million tons of office paper (uncoated freesheet grade). Reducing that consumption by 10 percent, or 540,000 tons, would have the benefits shown in Table 1.

Figure 3. Top Toxics Release Inventory emitters to surface water by industry, 2005



Source: U.S. EPA 2007

Table 1. Environmental benefits of reducing U.S. office paper use by 540,000 tons

	Environmental Benefit	Annual Equivalent
Total energy	21 trillion British thermal units (Btus)	Enough to provide power to 228,000 homes
Greenhouse gas emissions	1.6 million tons	CO_2 emissions from 279,000 cars
Solid waste	600,000 tons	44,000 fully loaded garbage trucks
Wastewater	11 billion gallons	Enough to fill 16,000 Olympic-sized swimming pools
Wood use	1.9 million tons	13 million typical trees

Source: Environmental Defense Paper Calculator, www.papercalculator.org

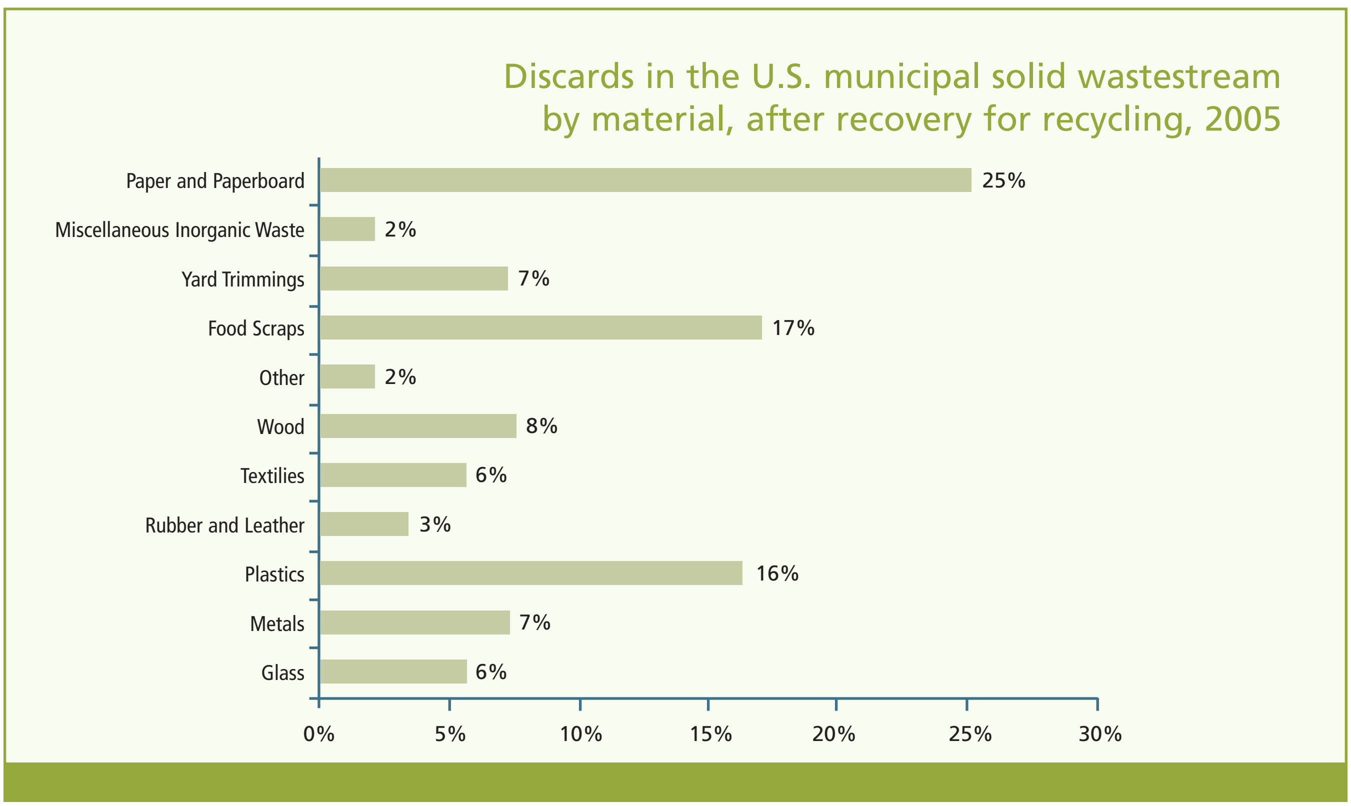
MAXIMIZING RECYCLED CONTENT

Increasing recycled content in paper has benefits throughout paper's lifecycle. It reduces demand for wood, thus reducing environmental impacts of commercial forestry and the pressure to convert natural forests and ecologically sensitive areas into tree plantations. Making paper from used paper is generally a cleaner and more efficient manufacturing process than making paper from trees, since much of the work of extracting and bleaching the fibers has already been done. And because it recovers usable paper from the waste stream, recycling cuts both solid waste and landfill-related greenhouse gas emissions.

SOURCING FIBER RESPONSIBLY

Some virgin fiber will likely always be necessary to produce paper, whether to replace recovered fibers lost in the deinking process, to maintain performance characteristics such as strength and brightness in specific paper grades, or because the distance of many mills from urban areas makes using recovered fiber cost-prohibitive. Therefore, it is important to understand where the virgin fiber originates, to eliminate the

Figure 4. Discards in the U.S. municipal solid wastestream by material, after recovery for recycling, 2005



Source: U.S. EPA 2006.

use of any fiber that threatens endangered and other high conservation value forests and to ensure that forests harvested by the paper industry are managed in a way that protects both their timber and non-timber values.

Environmental groups have had success in recent years working with large paper purchasers to develop procurement policies that address responsible fiber sourcing, and companies such as Bank of America, Dell, Norm Thompson Outfitters, Office Depot, Random House, Staples and others have made public commitments related to forest protection.

EMPLOYING CLEANER PRODUCTION PRACTICES

Paper mills vary widely in their environmental performance, depending on their age, efficiency and how they are run. Minimum-impact mills are those that minimize resource inputs (wood, water, energy and chemicals) and minimize the quantity and maximize the quality of releases to air, water and land (Paper Task Force). Paper mills can optimize their environmental performance by implementing the most advanced manufacturing technologies, the most efficient mill operations, and the most effective environmental management systems.

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1 For a discussion of how transportation in the pulp and paper industry impacts the environment, see International Institute for Environment and Development, ch. 9.

2 The North American Common Vision was followed by a European Common Vision, available at www.environmentalpaper.org.

CHAPTER TWO

MINIMIZING PAPER CONSUMPTION

Common Vision Goal:

- *Eliminate excessive and unnecessary paper consumption*

OVERVIEW

Consistent with the environmental hierarchy of *Reduce, Reuse, Recycle,* the fastest route to environmental improvement is to use less paper from the start. Minimizing paper consumption has multiple benefits: it reduces demand for wood and the environmental impacts of commercial forestry; cuts energy, water and chemical use at the mill; and lowers emissions to the air and water. And it means that less paper needs to be disposed of in landfills, where it breaks down and releases methane, a potent greenhouse gas, or burned in incinerators, where it releases carbon dioxide and other pollutants.

Years ago, it became fashionable to talk about the paperless office and to predict that paper as a means for transmitting and storing information would soon become obsolete. This has not happened. Instead, global paper consumption has increased dramatically over the last decade, and will continue to rise, especially in developing countries. Historically, paper consumption has been largely a function of economic activity, so as a country's gross domestic product (GDP) rises, so does its paper use. But even in developed countries where GDP has risen more slowly, paper use has continued growing.

The United States and Western Europe remain by far the biggest paper consumers per capita, and have a proportionately large responsibility to eliminate wasteful paper consumption. But paper consumption has been growing most rapidly in China and India, in parallel with their expanding economies.

To meet growing demand for paper products, the pulp and paper industry is expanding its production capacity, primarily in developing countries with lower raw material and labor costs and looser environmental regulations. According to RISI (2004), "fast-growing plantations in the Southern Hemisphere and native forests in Eastern Europe and Russia will be the major sources of fiber to underpin the growth in world wood pulp demand that we are forecasting over the next 15 years. Latin America, in particular, is expected to see large investments in wood pulp capacity, which is projected to allow production to expand from 14 million tons now to 36 million tons in 2019."

Increasingly, the largest consumers of paper products are exporting the environmental consequences of production, such as damage to forests (see Responsible Fiber Sourcing section) and discharges of pollutants from paper mills (see Cleaner Production section).

Allowing paper consumption to continue growing at current levels will have disastrous consequences for the environment. In order to meet the world's paper needs equitably and sustainably, we will need to greatly increase the efficiency of our paper use—that is, do more with less—particularly in countries that consume the most paper. The environmental performance indicators and statistics below are intended to demonstrate consumption trends and help monitor progress in reaching this goal.

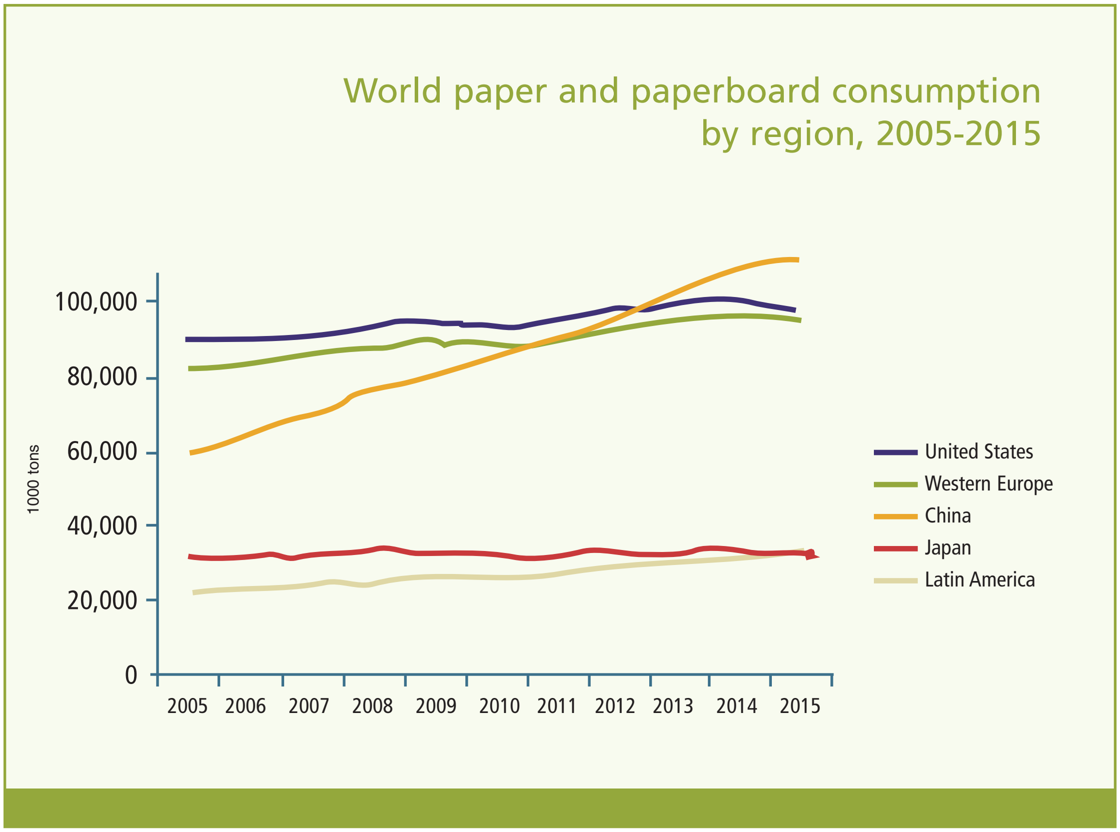
ENVIRONMENTAL PERFORMANCE INDICATORS: PAPER CONSUMPTION

Indicator: Global paper and paperboard consumption, by country or region

Between 2005 and 2021, global demand for paper and paperboard is expected to increase nearly 60 percent, from 368 million tons in 2005 to 579 million tons in 2021(RISI 2007).

Figure 5 shows paper and paperboard consumption by region, from 2005 projected to 2021. The biggest growth in paper consumption over the next decade is predicted to take place in Asia (excluding Japan). This growth, driven largely by India and China's rising populations and expanding markets, is expected to increase dramatically over the next ten years. For example, China's overall paper demand is projected to grow from approximately 60 million tons in 2005 to 143 million in 2021 (RISI 2007).

Figure 5. World paper and paperboard consumption by region, 2005–2015



Source: RISI 2007.

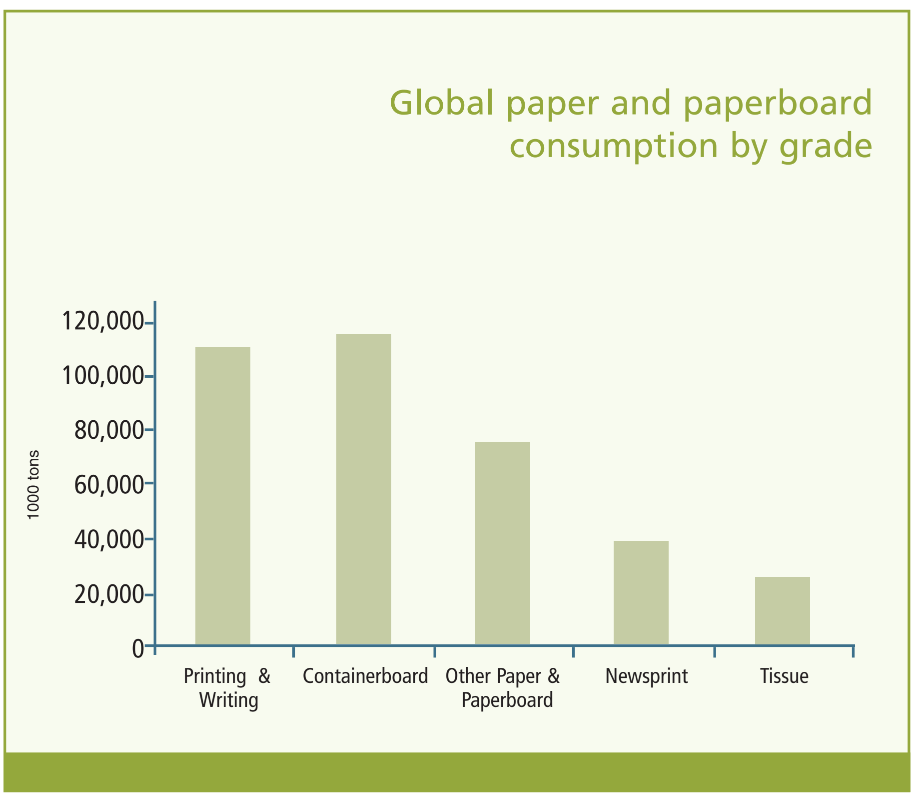


Figure 6. Global paper and paperboard consumption by grade

Source: RISI 2007.

Indicator: Global paper and paperboard consumption, by grade

In 2005, containerboard and printing & writing papers were the biggest segments of the global paper market [1] (See Figure 6).

Containerboard and printing & writing papers are expected to remain the largest segments over time (see Figure 7). Rising demand for containerboard makes sense given the dramatic increase in commodity exports, particularly from Asia. For example, Chinese production of containerboard grew from about 4.8 million tons in 1995 to nearly 20 million in 2005 (RISI 2007). And global demand for printing & writing papers will continue to increase, fueled by paper-based marketing and advertising which the Internet appears to be helping rather than hindering. In the United States, for example, the number of direct mail pieces sent in 2005, including catalogs, credit card solicitations and similar offerings, topped 114 billion pieces—up 15 percent from five years ago (Story 2006).

Best Practices for Reducing Paper Consumption

MANY ORGANIZATIONS have taken steps to reduce their paper consumption, saving money while shrinking their environmental footprint. Both private consultants and environmental organizations can offer solutions tailored to the particular purchaser's needs. For self-starters, an excellent reference is the "Business Guide to Paper Reduction: A Step-by-Step Plan to Save Money by Saving Paper" produced by ForestEthics (www.environmentalpaper.org/documents/REDUCE-BUSINESS-GUIDE.pdf). General best practices for office paper reduction include:

- Filing and transmitting documents electronically rather than on paper
- Changing the default settings on printers and copiers to double-sided
- Switching to electronic billing and financial reporting
- Switching to lighter-weight papers for printing and publishing
- Optimizing the trim size of printed documents to reduce waste

Indicator: Per capita paper and paperboard consumption

Not surprisingly, the United States has the world's highest per capita paper consumption (see Figure 8).

Indicator: United States paper consumption by grade

Looking more closely at the world's largest paper-consuming nation, the largest categories will remain containerboard and printing & writing paper, but the fastest growth will be in the tissue segment, followed by containerboard. Newsprint consumption will actually decrease between 2005 and 2021(see Figure 9).

Indicator: U.S. printing & writing paper consumption, by end use

Figure 10 shows the major end uses of printing & writing papers in the United States, which is the largest global consumer of this category of paper. This chart shows which sectors of the economy are consuming the most paper. What it doesn't show is the breakdown of consumption within each sector; however, this typically correlates to the number and size of companies in the sector, with the largest companies consuming the most paper.

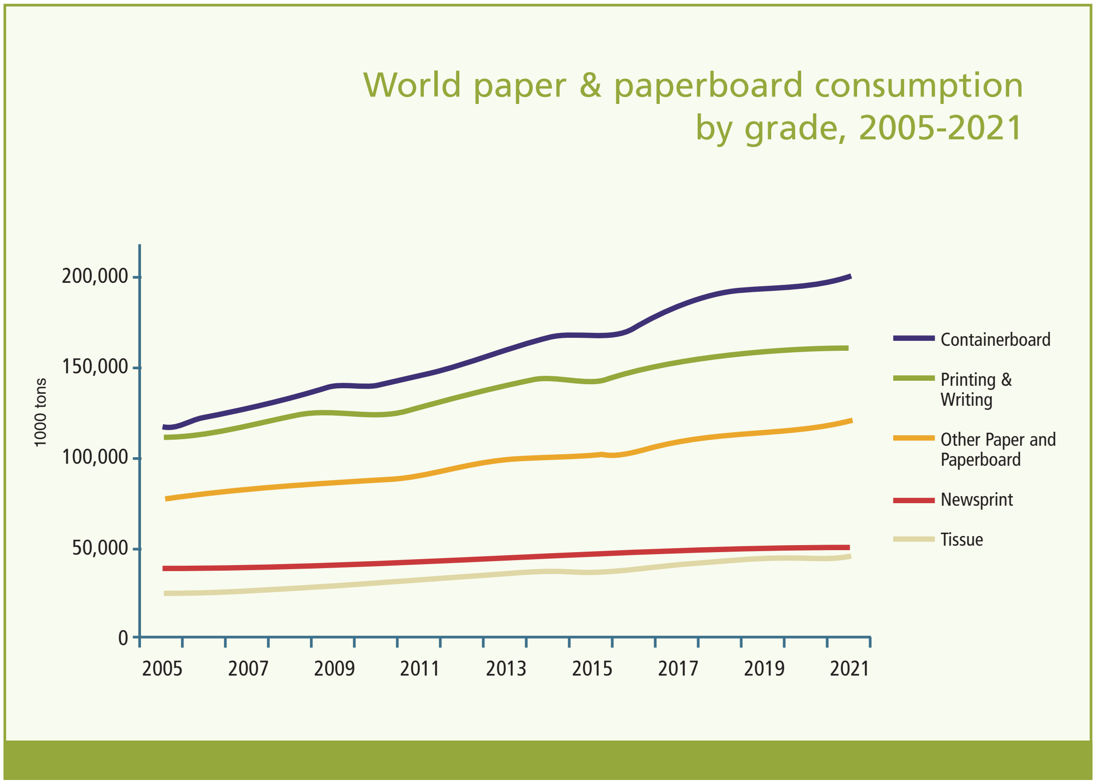
WHAT THESE INDICATORS MEAN

These environmental performance indicators underscore the tremendous challenge facing the global community in managing rising demand for paper and addressing its attendant environmental impacts. In order to determine the best strategies for reducing those impacts, it is helpful to track paper consumption on a number of different levels:

By region or country

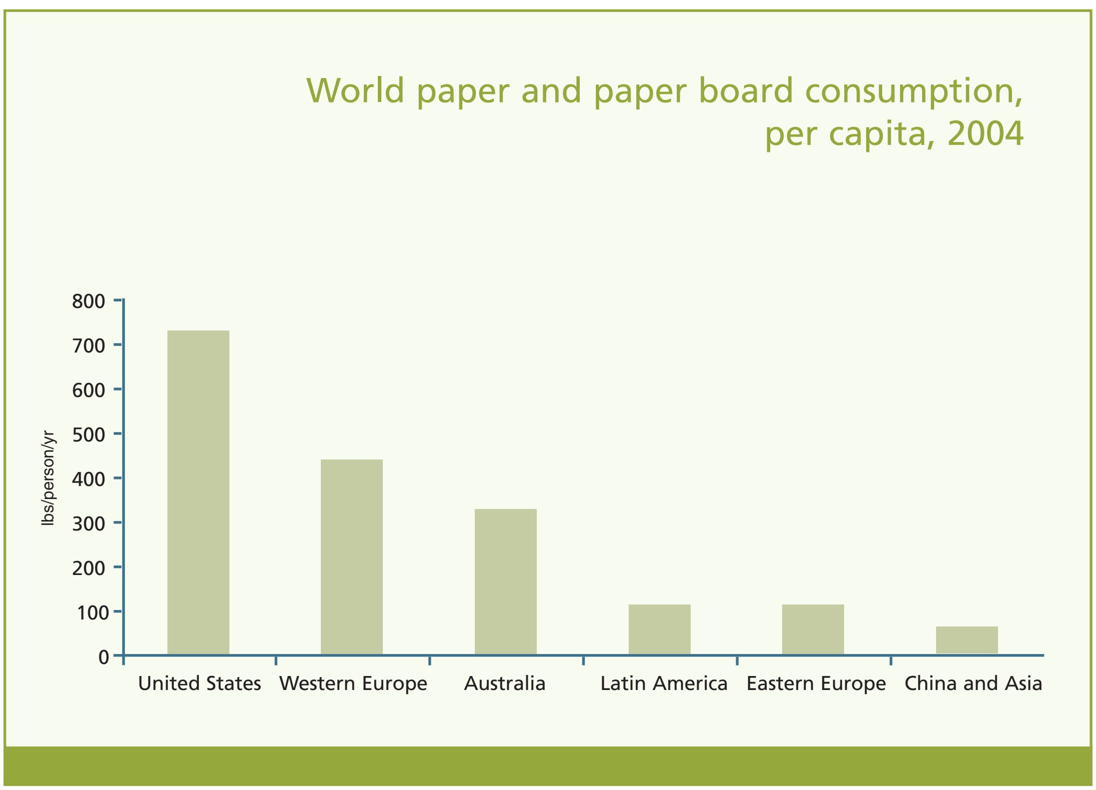
The data demonstrate that the United States and Western Europe remain the largest consumers of paper, but that steep consumption growth in Asia, particularly in China and India, threatens to vastly increase overall demand for paper. To achieve overall sustainability, targeted efforts will

Figure 7. World paper and paperboard consumption by grade, 2005–2021



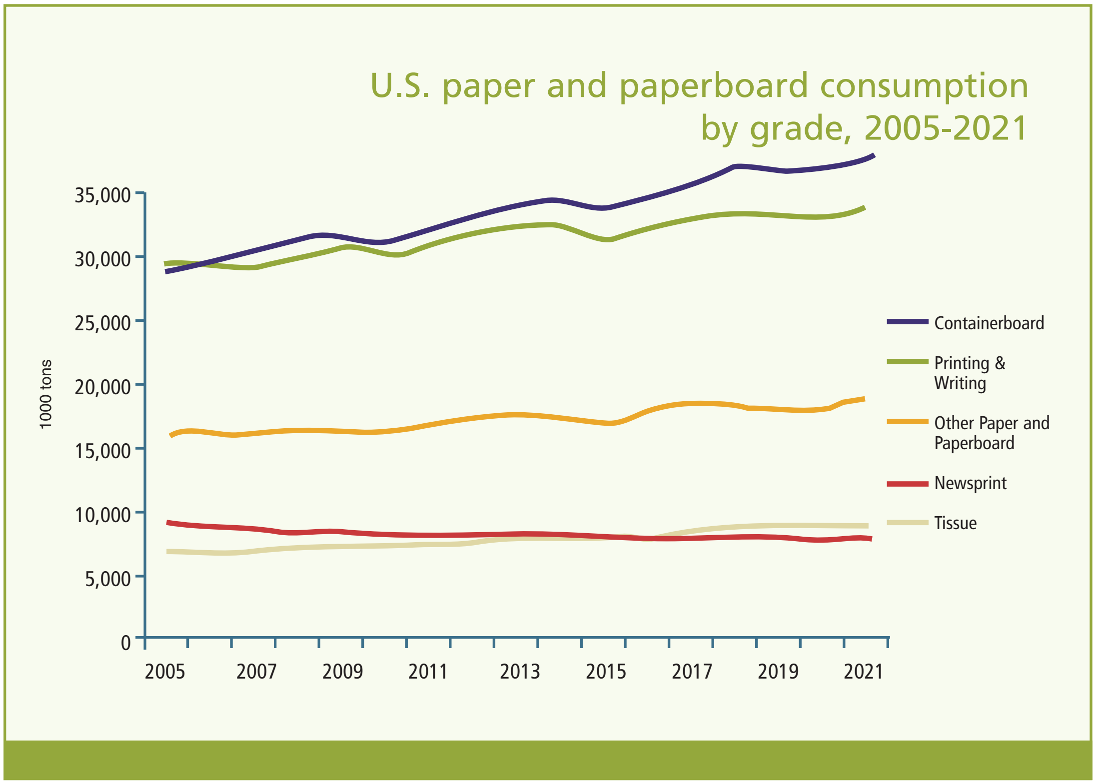
Source: RISI 2007

Figure 8. Per capita paper consumption, 2004



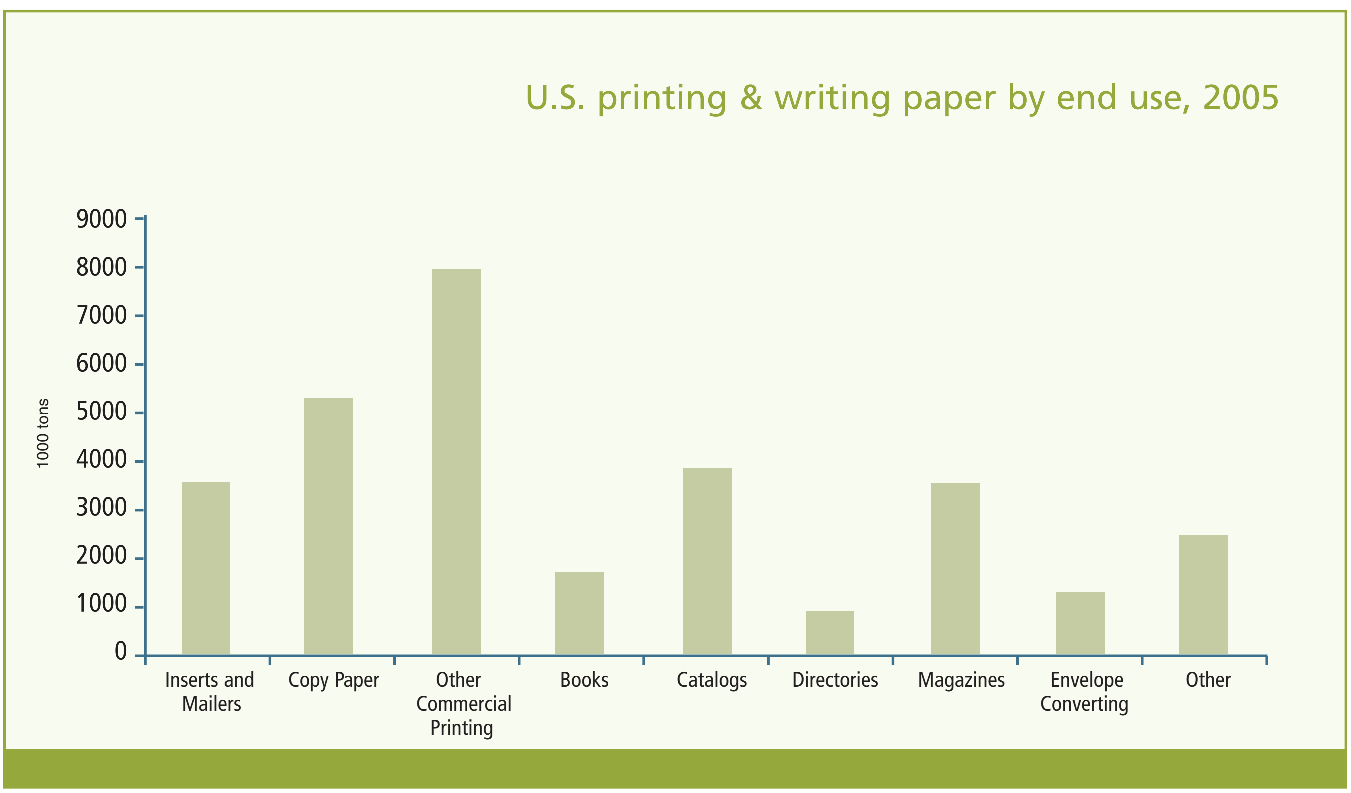
Source: RISI 2005.

Figure 9. U.S. paper and paperboard consumption by grade, 2005-2021



Source: RISI 2007.

Figure 10. U.S. printing & writing paper by end use, 2005



Source: RISI 2007.

be necessary to achieve efficiencies in each of these regions.

By paper grade

The data show that both the largest and the fastest growing segments of the paper market will continue to be containerboard and printing & writing papers. These grades will therefore remain a priority in efforts to curb overall paper consumption.

By end use

Understanding how much paper goes into specific applications can guide advocacy efforts to the uses (and therefore users) with the greatest environmental impact. This report includes data primarily for the United States, so analogous data would need to be obtained for efforts focused on other countries.

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Story, L. 2006. Junk mail is alive and growing. The New York Times, November 2.

[1] The American Forest & Paper Association (AF&PA) defines containerboard as "solid fiber or corrugated and combined board used in the manufacture of shipping containers and related products." Printing & writing paper encompasses a wide diversity of papers, including those for office uses, business forms, books, magazines, catalogs and advertising. For a glossary of paper products terms, visit AF&PA's website, www.afandpa.org.)

CHAPTER THREE

MAXIMIZE RECYCLED CONTENT

Common Vision Goals:

- *Eliminate paper manufactured solely of virgin fiber and fundamentally reduce reliance on virgin tree fibers.*
- *Maximize post-consumer recycled fiber content in all paper and paper products.*
- *Increase the use of other recovered materials (e.g., agricultural residues and pre-consumer recycled) as a fiber source in paper.*

OVERVIEW

Recycled paper is made from fibers recovered from previous paper use or from certain textile or agricultural processes. Almost all recycled fibers in the United States and Canada are recovered from previously manufactured paper, with non-wood fibers playing only a miniscule role. Therefore, this chapter focuses on the state of the paper recycling industry.

The Common Vision goal to eliminate paper manufactured solely of virgin fiber recognizes that recycled fiber is the foundation for environmentally sustainable paper and paper products. No matter what the source of the virgin fiber, environmental benefits are maximized when it can be reused repeatedly rather than requiring new raw resources for every production cycle. Not only does recycling reduce demand for wood fibers, it also generates many other significant environmental benefits as well.

ENVIRONMENTAL BENEFITS OF RECYCLED PAPER

Increasing recycled content has environmental benefits throughout paper's lifecycle:

- It reduces the demand for wood, thus also reducing the pressure to harvest forests and to convert natural forests and ecologically sensitive areas into tree plantations.

In fact, recycling is a far more efficient source of fiber for paper than forests. Kraft pulping (see Glossary sidebar below), for example, requires 4.4 tons of fresh trees to make one ton of virgin pulp but only 1.4 tons of recovered paper to make one ton of recycled pulp, a three-fold increase in efficiency (see Table 2).

Table 2. Tons of fiber input required to make one ton of pulp

Type of Pulp	Volume of Required Material	Efficiency
Virgin kraft (Chemical)	4.4 tons of fresh trees	23%
Virgin mechanical (groundwood)	2.2 tons of fresh trees	45%
Recycled kraft	1.4 tons of recovered paper	71%

Sources: EDF 2002b; Conservatree and Environmental Defense 2001.

When the virgin fiber comes from questionable or endangered forest fiber sources, even partial recycled content at least replaces some of that fiber in what otherwise would be a 100 percent virgin forest fiber paper. Strong support for recycling also sustains an infrastructure that reduces demand for forest fibers. This infrastructure is undermined by paper companies that substitute their paper's recycled content with other environmental attributes, including sustainably harvested virgin fibers. To maximize the environmental benefits of their products, paper companies should instead be *adding* environmentally sustainable attributes such as sustainably harvested fibers to the recycled content, not replacing it. This is especially true because recycled pulp is so much more resource efficient than wood pulp, no matter what its source.

▸ Recycling is generally a cleaner and more efficient manufacturing process than making paper from trees, since much of the work of extracting and bleaching the fibers has already been done.

▸ Recycled paper requires less total energy to manufacture than virgin paper, even when factoring in energy required to collect and transport recovered paper compared to energy used to harvest and transport timber.

▸ Because it diverts usable paper from the waste stream, recycling cuts both solid waste and greenhouse gas emissions created by disposing of paper in landfills. Recycling not only reuses materials that otherwise would have been wasted, it also can provide controlled disposition in industrial landfills for potentially toxic materials such as heavy metals in the inks on discarded papers that would otherwise be landfilled or incinerated.

▸ By reusing paper that would otherwise have been disposed of in landfills, recycling reduces greenhouse gas emissions. The decomposition of paper in landfills produces methane, a greenhouse gas with 23 times the heat trapping power of carbon dioxide (UNEP).

To consider a specific example, making copy paper from 100 percent recycled content results in very significant environmental benefits when compared to copy paper made from 100 percent virgin forest fibers (Figure 11). The recycled paper reduces:

- total energy consumption by 44 percent
- net greenhouse gas emissions by 38 percent
- particulate emissions by 41 percent
- wastewater by 50 percent
- solid waste by 49 percent
- wood use by 100 percent.

GLOSSARY OF TERMS

KRAFT PULP, also known as chemical pulp, freesheet or woodfree, is produced by a chemical process that separates wood fibers into cellulose, which can be used to make paper, and lignin, which is the structural part of wood that deteriorates the paper if not removed. The chemicals include caustic sodas, sodium hydroxide, sodium sulfide and usually chlorine compounds. The resulting pulp is very strong and is most commonly used to make office and printing papers, high-end coated papers, tissue, grocery bags and linerboard (the outer layers of corrugated boxes). Some people mistakenly believe that woodfree indicates that the paper was not produced from wood, timber or trees. In reality, woodfree and freesheet refer to pulp made from fibers from which the lignin portion of the timber structure was removed.

MECHANICAL PULP, also called groundwood, is produced by mechanical grinding, pressure and other physical processes to separate the wood fibers. The separation process may also be enhanced with heat and chemicals. Most of the structure of the timber, including lignin, remains in the fiber, resulting in fiber that is shorter and weaker than kraft pulp, and that deteriorates more rapidly. Mechanical pulp is commonly used to make newsprint, inexpensive printing papers, and less expensive coated papers such as those used for many magazines and catalogs.

OCC is old corrugated cartons recovered for sale to recycling mills.

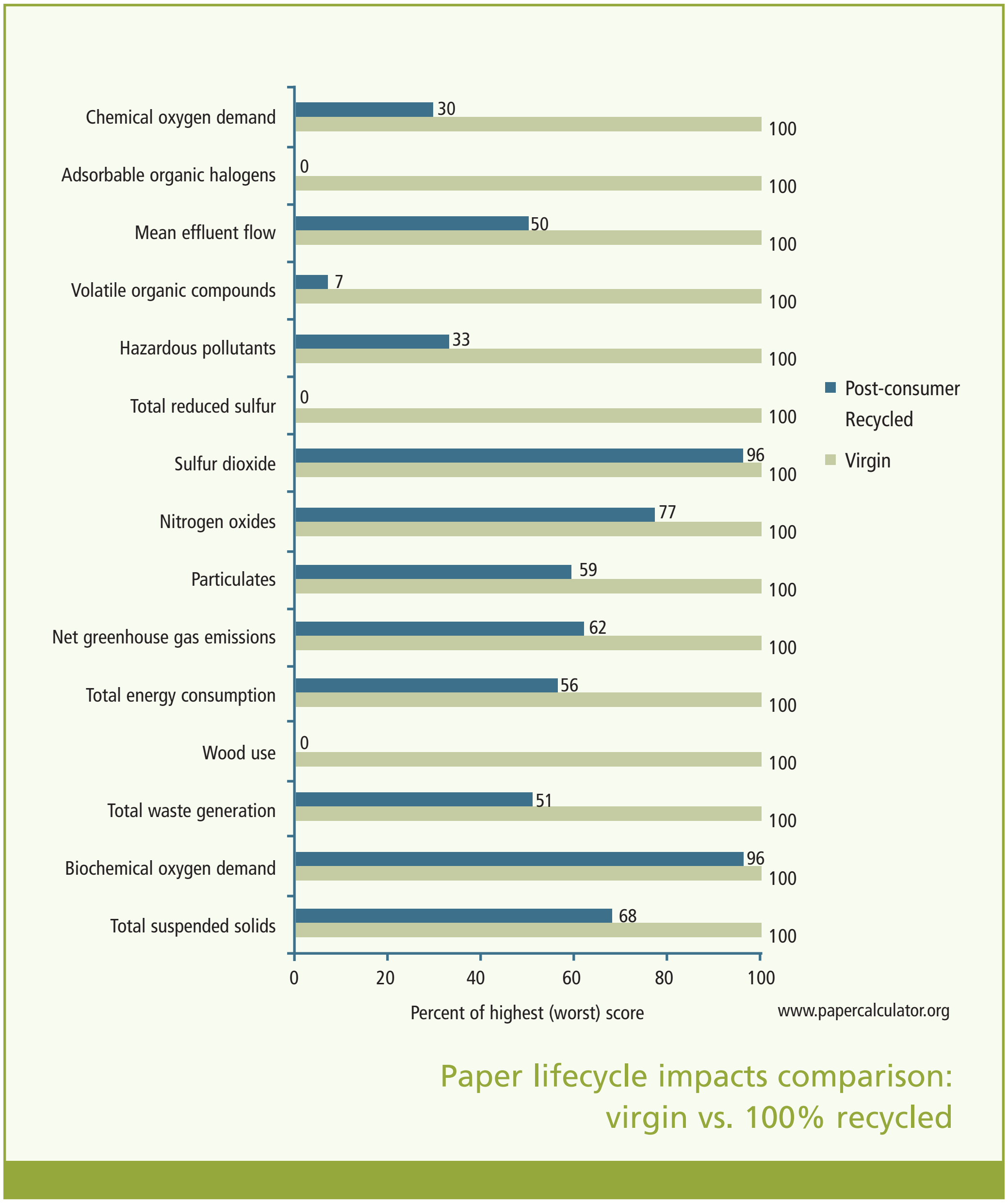
ONP is old newspapers and news inserts recovered for sale to recycling mills.

POST-CONSUMER FIBER has served its intended end use as a consumer item and is then diverted or recovered from the waste stream. Waste paper from people's homes and offices, as well as some finished products used in businesses, are post-consumer, while scraps produced in the process of making those end products are pre-consumer.

PRE-CONSUMER FIBER includes scraps created after the initial papermaking process in a paper mill, as well as those from printers and companies that convert paper into products such as boxes and envelopes. Most of the pre-consumer fiber categories have always been recycled at paper mills; in fact, many are called pulp substitutes.

VIRGIN FIBER is fiber that has never been used before to make paper or other products. Virtually all virgin fiber in U.S. and Canadian papers comes from trees, although there is a very small amount that comes from agricultural crops such as kenaf, hemp and flax.

Figure 11. Paper lifecycle impacts comparison: virgin vs. 100% recycled



Source: Environmental Defense's Paper Calculator

ENVIRONMENTAL PERFORMANCE INDICATORS

Recycling in the United States and Canada is a collaborative system involving thousands of independent businesses and local community programs. State, provincial and federal governments provide some guidance, regulation and assistance, but there is no common coordinating entity. Originally, demand-side market factors regulated recovered fiber quantity and quality. But the advent of wide-scale mandatory municipal government collection programs shifted recycling to a supply-side market, where materials are collected to keep them out of landfills, with little reference to market conditions or the formerly effective price signals.

This lack of system coordination means that recycled paper indicators must be evaluated collectively, not individually. An improvement in one may require related improvements in others, as well, before it truly represents success.

For example, increased recycled content in paper products may indicate only that the available supply was concentrated in a collection of temporary "boutique" products. Far better and more sustainable success is achieved when an increase in the indicator for recycled content in paper products is linked to an increase in the indicator for recycled pulping capacity, which must in turn be linked to an increase in the indicator for clean and uncontaminated recovered fiber. While this section presents individual indicators, they can be better understood as facets of a prism all offering different views that, taken together, illuminate the same point: Is the percentage of recycled pulp increasing in the production of paper and paper products?

NORTH AMERICAN RECYCLED PULP

Indicator: Percent of pulp made from recovered fiber

When considered over all paper production, 34 percent of U.S. pulp and nearly 25 percent of Canadian pulp is produced from recovered fiber.

Of the 114 million tons of paper and paper products produced in the United States and Canada in 2005 (RISI 2006), approximately one-third of the fiber content is produced from recovered paper. However, the use of recycled pulp is not distributed evenly and varies widely between grades.

Indicator: Volume of North American high grade deinking capacity

The U.S. paper industry reported deinked pulp demand as one of their few bright economic spots in 2005, with deinking mills' operating rates currently averaging better than 90 percent. But with deinked fiber contributing less than 6 percent of the whole printing & writing pulp market in the United States and Canada, deinking still requires far greater investments.

The capacity to produce recycled pulp is a critical determinant of the industry's ability to produce recycled paper. In 2001, Conservatree and Environmental Defense assessed available deinking capacity in the United States and Canada for use in printing & writing papers. The study found a potential capacity of 1,348,000 annual tons at deinking pulp mills,[1] with a significantly large unused capacity of 360,000 annual tons (Gleason, Kinsella and Mills). This 73 percent capacity utilization rate was dangerously low in an industry where most mills need to operate over 90 percent capacity to be profitable. The study found 988,000 annual tons of deinked high grade pulp actually available for making printing & writing papers, although a significant portion of that pulp was currently used to make tissue products and paperboard.

Since 2001 several deinking mills that together provided 230,000 annual tons of pulp to recycled printing & writing mills have closed while only 70,000 annual tons have been added.[2] The consolidation of deinking mills, plus environmental groups' markets campaigns that have convinced major purchasers and suppliers to buy recycled papers, have helped to push the remaining deinking mills' operating rates to a much economically healthier average of better than 90 percent.

Currently, production of the nearly 33 million tons of printing & writing paper in the United States and Canada annually require 23 million tons of pulp.[3] Yet the total deinked recycled pulping capacity available is 1.6 million tons (see Table 3), of which 900,000 tons are market pulp that is also shared with tissue and paperboard producers.[4] Clearly, more deinking capacity is needed to support increased market development.

Of equal importance is the type of deinking available. All but two of the existing high grade deinking mills that provide recycled pulp for printing & writing paper are kraft pulp mills. This pulp is particularly appropriate for use in uncoated freesheet papers such as copy, offset and archival book papers and in coated freesheet papers. However, for coated mechanical papers, it is a costlier type of recycled fiber than is necessary. While more infrastructure is needed for all deinking, increasing the capacity for producing recycled mechanical pulp suitable for use in coated publication papers would be singularly effec-

Table 3. North American operating high grade deinking mills, 2007

Mill	Location	Facility Integrated(I) Non-Integrated (N)	Deinking Pulp Kraft (K) Mechanical (M)	Rated Capacity Annual Short Tons (000)
American Eagle Paper	Tyrone, PA	I	K	70
Appleton	West Carrolton, OH	I	K	63
Boise Paper Solutions	Jackson, AL	I	K	85
Cascades Auburn Fiber	Auburn, ME	N	K	75
Desencrage Cascades	Breakeyville, QUE	N	K	60
Flambeau River Paper	Park Falls, WI	I	K	25
Fox River Fiber	DePere, WI	N	K	120
International Paper	Franklin, VA	I	K	115
International Paper	Selma, AL	I	K	120
Madison Paper Co./Myllykoski	Alsip, IL	I	M	70
Manistique Papers	Manistique, MI	I	M	180
Mississippi River Corp	Natchez, MS	N	K	160
Ohio Pulp Mills	Cininnati, OH	N	K	18
SFK Pulp Mills	Fairmont, WV	N	K	220
SFK Pulp Fund	Menominee, MI	N	K	165
Stora Enso NA	Duluth, MN	N	K/M	110
Wausau Paper	Brokaw, WI	I	K	14
TOTAL DEINKED PULP CAPACITY:				1,670

Source: Conservatree compilation from industry data, including Paperloop (RISI) Lockwood-Post Directory, and interviews with deinking mill operators.

tive in creating a more competitive pricing structure for recycled coated groundwood papers such as those used for most magazines and catalogs. At present, one deinking kraft pulp mill has some dual capacity for producing some recycled mechanical pulp and a new deinked mechanical pulp mill has been announced for intended future production (TAPPI 2007).

NORTH AMERICAN PAPER AND PAPER PRODUCTS

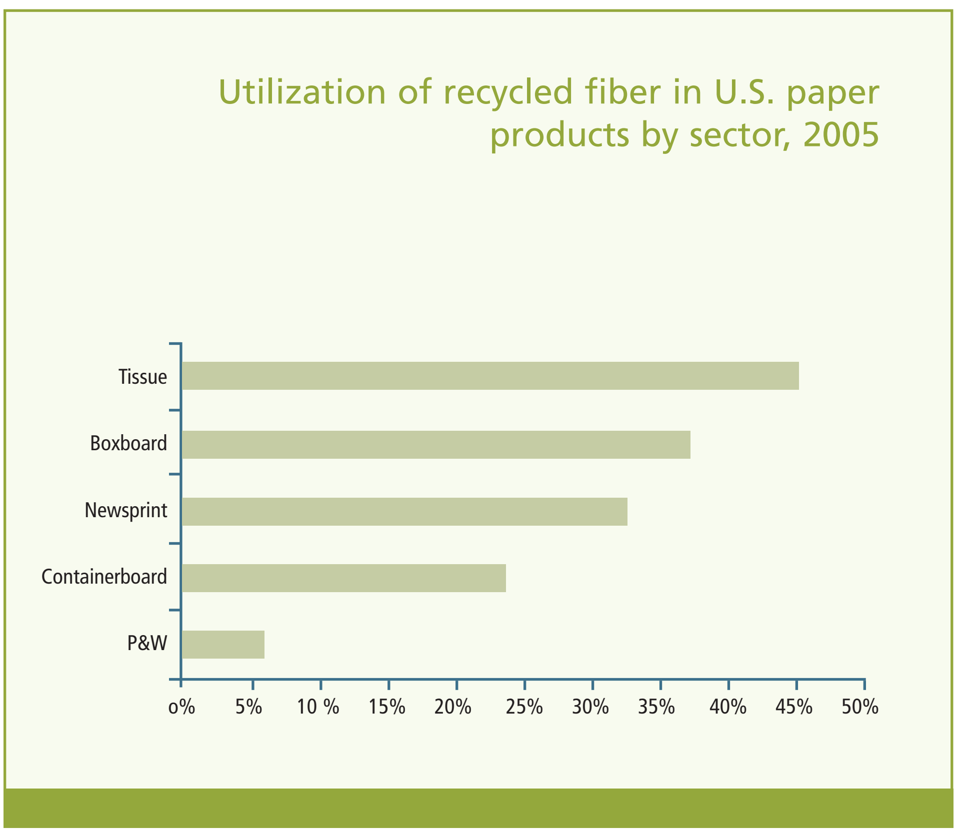
Indicator: Percentage of recycled content in papers and paper products, by sector and grades within sector

The use of recycled pulp varies widely between paper grades, from an average of 45 percent recycled content in tissue products to a low of 6 percent across all printing & writing papers. Percentages also vary widely within grades, with some brands regularly including up to 100 percent recycled content and others never using any at all. The type of pulp and the paper grade's share of industry production can also magnify the environmental benefits of using recycled pulp.

The utilization of recovered fiber varies greatly among types of paper (Figure 12). For example, tissue, which makes up 8 percent of U.S. paper production, averages 45 percent recycled fiber. Newsprint, which accounts for 9 percent of North American paper production (Canada supplies more than half of the U.S. newsprint market), averages 32.5 percent recycled fiber (RISI 2006). But printing & writing paper, which accounts for 27 percent of U.S. paper production, averages only 6 percent recycled fiber across the sector.

Within each papermaking sector, there is wide variation in the use of recycled fiber. For example, within the packaging sector, folding boxboard averages 37 percent recycled content and corrugated containers average 24 percent recycled content, while SBS (solid bleached sulfate), used for food service applications and boxes for pharmaceuticals and many other products, has almost none. Tissue products made for away from home uses (such as hotels and offices) generally include high recycled content levels, while many popular brands of consumer tissue products have none at all.

While there are a number of excellent papers and paper products in all grades with 100 percent recycled content (sometimes 100 percent post-consumer, other times with some pre-consumer), recycled paper in general must continually incorporate some virgin fiber to maintain its strength and continual recyclability. Some products also incorporate varying percentages of virgin fiber to produce specific characteristics. Products with partial recycled content are positive market choices, particularly because they fortify the recycling system, if the virgin fiber meets additional sustainability criteria described in this report, such as FSC certification or non-wood sources.



Sources: RISI 2006 and AF&PA 2005.

Indicator: Percentage of recycled content in printing & writing paper

The printing & writing sector accounts for 27 percent of paper production in the United States yet less than 6 percent of its fiber comes from recycled sources. More than 90 percent of the total quantity of printing & writing papers is still made from 100 percent virgin forest fibers.

Figure 12. Utilization of recycled fiber in U.S. paper products by sector, 2005.

The printing & writing sector uses less than 6 percent recycled fiber overall,[5] yet this sector accounts for 27 percent of U.S. paper production. The Canadian printing & writing sector is much smaller and exhibits similar characteristics. There is no data point that represents the actual recycled printing & writing paper market, but all expert estimates place it below 10 percent of market share, and that is only for copy paper. This leaves more than 90 percent still made entirely from virgin forest fibers. Further, this sector is also a major producer of kraft pulp, which is the most resource-intensive and environmentally taxing method of pulp production.

Indicator: Consistent minimum content recycled fiber specifications and standards

The U.S. EPA comprehensive procurement guidelines have become the de facto consensus minimum recycled content standards for paper purchasers in the United States and Canada. However, in 2006, at least two major North American producers of printing & writing paper reduced the recycled content in their products below national legislative and consensus guidelines.

U.S. federal agencies and contractors are required to purchase recycled paper and paper products, with the most recent directive embodied in Executive Order 13423 (January 2007). The U.S. EPA publishes Comprehensive Procurement Guidelines representing extensive research that provides minimum recycled content specifications for federal purchases. Throughout the 1990s, these guidelines became the de facto consensus minimum recycled content standards in the United States and also often in Canada.

Prior to this unanimity by virtually all public and private major purchasers in North America who specify recycled papers, several U.S. legislatures passed state procurement laws requiring recycled paper purchases, each with different specifications. The paper industry indicated that such diverse requirements undermined recycled paper market development and would result in high cost "boutique" recycled papers. They recommended consistent national standards as the most effective path to increasing recycled paper markets and lowering costs. Once the first federal Executive Order was issued in 1993 that required post-consumer content in federal purchases of printing & writing papers (most other paper grades were already covered under prior federal legislation and implementation guidelines), state and local governments and private sector purchasers rallied to adopt the same criteria, creating de facto national standards that have held for more than a decade. In 2006, however, both Weyerhaeuser[6] and International Paper, which together account for over 40 percent of uncoated freesheet capacity, reduced recycled content in their standard production offset and opaque paper grades from 30 percent post-consumer fiber to 10 percent. The reduction is connected to the significant brightening of office and commercial printing papers, a recent trend driven in part by the demand for contrast in new digital printing methods. The increase in brightness levels was achieved by adding brighteners such as calcium carbonate in all papers and, in the offset and opaque recycled papers, reducing recycled content below consensus minimum recycled content standards. However, apparently recycled fiber is not actually a barrier to higher brightness levels because these same mills increased the brightness for their office paper brands such as copy paper while retaining their previous 30 percent post-consumer content.

Indicator: Range of recycled paper choices available in each grade

New recycled papers continue to be introduced in some grades, while the choices in other grades remain slim and sometimes even shrink.

The number of recycled content options available in each grade gives a fair idea of how well the market for a specific type of recycled paper is developing, although the exact number is not a reliable indicator in itself. For example, Conservatree maintains lists of environmental printing & writing papers available in North America, categorized by grade at http://www.conservatree.org/paper/PaperMasterList.shtml. While the specific brands and characteristics are constantly changing, between 2000 and 2006, the number of papers on the lists remained essentially constant at approximately 500 brands.

Some grades, such as high-end text and cover papers, copy and office papers, and book papers, have seen a great deal of development, producing many different options from which purchasers can choose. In fact, of the current individual brands, 280 are either high-end text and cover papers or office papers. But most other paper grades leave purchasers with only a few choices each and many of those are actually out of reach for many because they require ordering truckload quantities or overcoming other obstacles.

Despite what appears to be a relatively constant number of environmental paper options, there actually has been a significant decline in the number of mills producing recycled content commercial printing papers used for books, magazines, catalogs and direct advertising. Through a series of paper company mergers, mill capacity reductions and bankruptcies, the paper industry as a whole has been consolidating, with some positive aspects, including more efficiency, less market volatility and the closing of older, polluting facilities. However, while both virgin and recycled paper mills have closed, it is recycled paper that has been most negatively affected. Production tonnage for virgin paper brands easily moved to new, more efficient mills. But with no new investments in recycled paper infrastructure, the tonnage from closed recycled mills has simply been lost.

However, pressure from environmental paper campaigns has led some major producers to introduce new environmental papers and innovations. Many of these include recycled content, some have replaced their papers' former recycled content with FSC-certified virgin fiber, and some include only certified forest fibers. The challenge will be to ensure that expansions in environmental paper options represent permanent structural commitments to environmental sustainability and not simply boutique papers or fads that splinter purchasers' environmental interests.

RECOVERED FIBER SOURCES

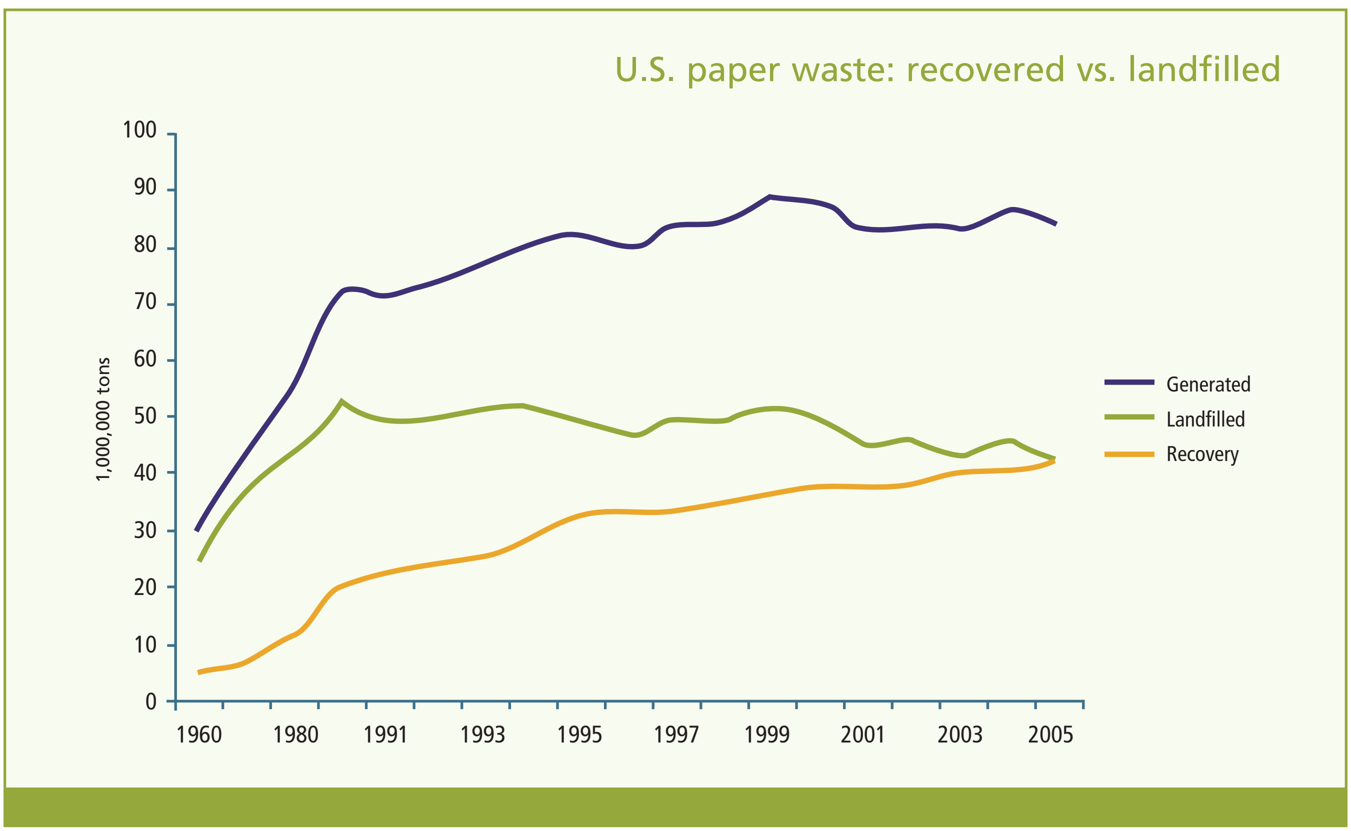
Indicator: Volume of paper in the U.S. municipal solid waste stream

In the United States, 84 million tons of paper were discarded in 2005, resulting in 42 million tons still remaining after materials were recovered for recycling. Paper and paperboard currently account for the largest portion (34 percent) of the municipal waste stream, and 25 percent of materials discarded even after recyclables have been taken out of the waste stream (U.S. EPA 2005).

In 2003 the United States reached a 50 percent recycling rate for all paper; by 2005 it had climbed to a record 51.5 percent, with 51.3 million tons of paper fiber recovered from 99.6 million tons of the total paper and paperboard supply (AF&PA, 2007). In March 2007, AF&PA announced that 53.5 million tons of paper fiber were recovered in 2006, 53.4 percent of the paper consumed in the United States. Canada's recovery rate in 2005 was 46 percent, its highest ever, representing 3.7 million metric tonnes.

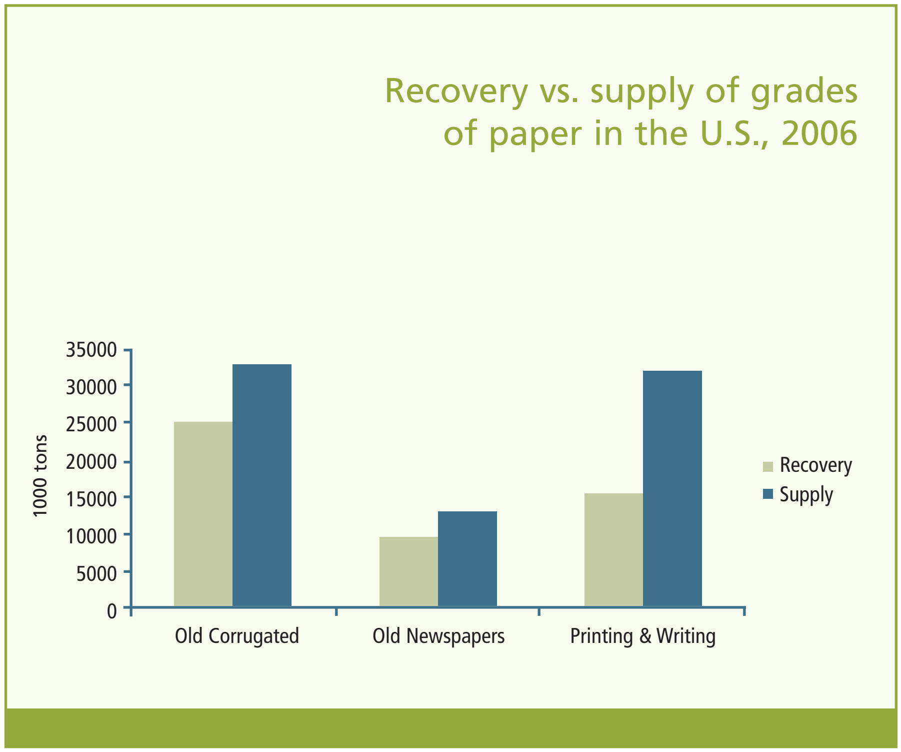
While a positive step, increases in the paper recovery rate can be misleading because the variables are not constant. For example, the 2005 U.S. high occurred because paper and paperboard consumption dropped while recovery of recyclable paper increased. Most significantly, the increasing recycling rate has not appreciably reduced the overall amount of paper landfilled, a figure which correlates with consumption patterns (Figure 13).

Figure 13. U.S. paper waste: recovered vs. landfilled



Source: U.S. EPA 1996, 1998, 2000, 2003, 2005.

Figure 14. Recovery vs. supply (000 tons) of grades of paper in the United States, 2006



Source: AF&PA 2006.

Indicator: Recovery rates by grade of paper

In 2006, the recovery rates for some grades of paper were high. But the rate for printing & writing papers was 49 percent. More than 16 million annual tons of high grade paper suitable for making recycled printing & writing paper could still be recovered from offices, printers and other sources.

In 2006, the U.S. recovery rate for old corrugated containers (OCC) was 76.4 percent (see Figure 14); for old newsprint (ONP) it was 72.3 percent (AF&PA 2006). Together, these categories make up 75 percent of the total recovered paper currently used by U.S. paper mills. However, the recovery of fiber suitable for making recycled printing & writing paper, such as office paper, was considerably lower, at 49 percent (AF&PA 2006).

The recovery rate by grade is a more important indicator than the composite recovery rate because paper mills use different types of recovered paper, depending on the types of products they manufacture. In addition, paper recovery is handled by different collectors depending on the grade, and individual grade rates can point to successes and needs within the system. For example, most old newspapers (ONP) are collected by local community recycling programs in curbside or drop-off programs, while most corrugated cartons (OCC) are collected from retail and grocery stores by paperstock dealers or collection divisions of paper manufacturers. These paper industry collectors also pick up recovered paper from printers, but business offices are generally left to arrange their own paper recycling. This discrepancy most likely accounts for the fact that over half of office paper is still not collected.

When considering the tonnage of fiber available for increased recovery, OCC accounts for just over 7.8 million annual tons and ONP nearly 3.7 million annual tons. High grade fiber such as from offices and printers accounts for the greatest share, over 16 million annual tons that could still be recovered (AF&PA 2006).

Indicator: Recovery rate for office papers

Domestic recovery of high quality used paper will need to expand to meet growing demand for recycled printing & writing paper in the United States and Canada. Recovery of office paper, a subset of recovered printing & writing paper, will be especially important.

Offices generated up to 2.6 million tons of post-consumer high grade deinking in 2003, an estimated 90 percent of the total. Offices also provided approximately 1.8 million tons of comparatively clean, high quality paper to the mixed paper stream,[7] for an office paper recovery rate of 48.3 percent. In 2004, AF&PA reported a recovery rate increase to 49.1 percent. The good news is that we are nowhere close to tapping out the domestic supply of this material.

In 2002, AF&PA announced a goal to increase paper recovery for all grades to 55 percent by 2012, a rather modest advance. Given industry estimates that corrugated cardboard and newspaper recycling are near their maximum practical recovery rates (about 75 percent) in the United States, much of the progress toward this goal will have to come from recovering more paper from offices, the primary—and still significantly untapped—source of clean, high quality recovered fiber.

To illustrate the impact of a relatively small increase in

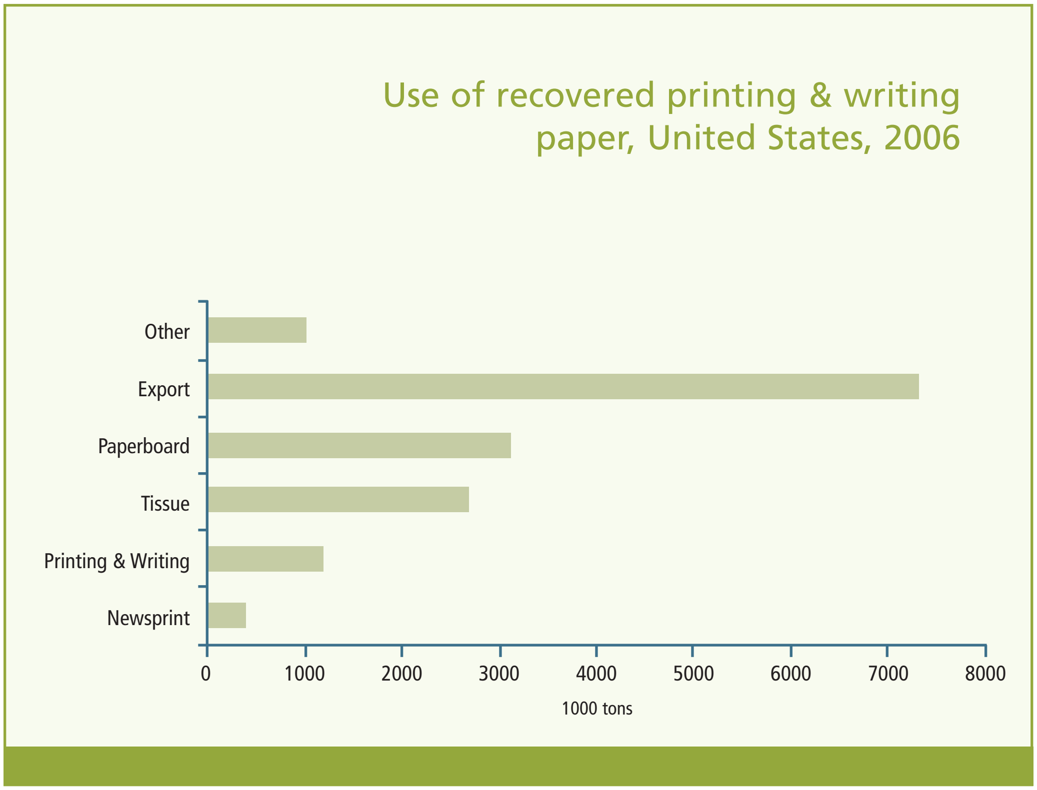


Figure 15. Use of recovered printing & writing paper, United States, 2006

Source: AF&PA 2006.

Nearly 16 million tons of printing & writing paper were recovered in the United States in 2006, almost half of which was then exported (AF&PA 2006). Domestic paper sectors utilizing recovered printing & writing paper include tissue production (17.1 percent) and recycled paperboard (19.9 percent). Only 7.6 percent of recovered printing & writing paper went back into the remanufacturing of new printing and office paper, totaling 1.2 million tons (Figure 15). Probably no more than half of this was post-consumer.

Printing & writing papers can be recycled many times before the fibers become too short for use; industry estimates range from seven to twelve times for printing & writing papers versus three to four times for newsprint. Every recycling multiplies the environmental benefits, which is particularly important for replacing kraft pulp, the most environmentally resource-intensive pulping process. This multiplicity of environmental benefits cannot be matched when high grade fibers are "down-cycled," or mixed into grades such as newsprint, paperboard and corrugated boxes. Once mixed into these other grades, the fibers can never be sorted out again for use in printing & writing papers, thereby losing those substantial environmental benefits.

office paper recovery on recycled paper supply, Environmental Defense examined what would happen if office paper achieved the AF&PA's target recovery rate of 55 percent. At 2003 consumption levels, this would increase the supply of recovered office paper by 616,000 tons.[8] Assuming a 70 percent fiber yield, this would make an additional 431,000 tons of recycled pulp available for paper production. If all this fiber were used to make copy paper, it would enable the production of an additional 1.4 million tons of 30 percent post-consumer recycled paper that year. Even if only half that amount of newly recovered paper were available for use in printing & writing paper, it could produce enough 30 percent post-consumer recycled copy paper, at an average of 27 pounds of copy paper used annually per person (E.O. Lawrence Berkeley National Laboratory), to meet the annual demand of 53.3 million people.

Indicator: Percentage of recovered high grade papers directed to "highest and best use" such as printing & writing paper

In the United States, only 7.6 percent (1.2 million tons) of recovered printing & writing paper goes back into the remanufacturing of printing & writing paper.

Indicator: Percentage of mixed paper in recovered paper collections vs. sorted papers

The declining quality of recovered paper may threaten the continuation or expansion of recycling in North America.

Since 1993, collection of recovered paper and paperboard overall has increased by 45 percent (Figure 16). But recovery of pulp substitutes declined by 30 percent and recovery of deinking grades by 8 percent. Both of these categories supply printing & writing mills. (It is likely that this decline is due to increased production efficiencies rather than missed collection opportunities.) At the same time, recovery of mixed paper has more than doubled. Since mixed paper is not usable at high grade deinking mills, the trend towards unsorted recovered paper collections currently undermines the potential for expanding recycled content in printing & writing paper grades.

Since 2000, several factors have driven down recovered paper quality to levels potentially precarious for continued, let alone expanded, recycling in North America:

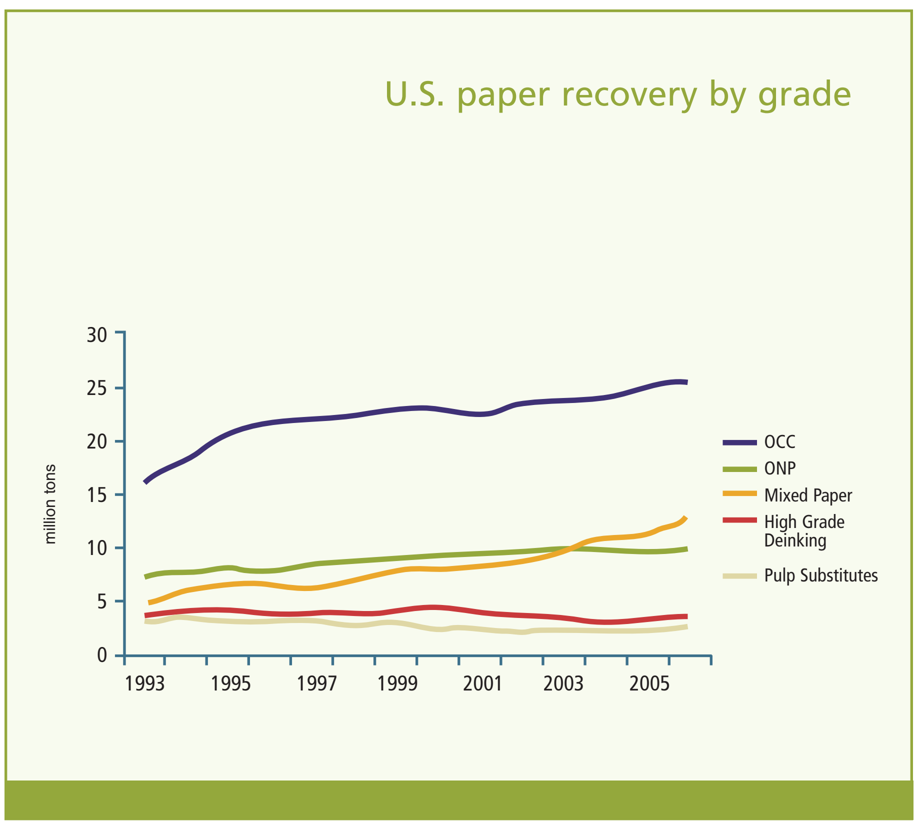
- Garbage collection companies have increasingly introduced single-stream recycling collection programs. Single-stream programs collect all materials in one container, with bottles, cans and other materials often mixed with the paper. Benefits include increased volumes of recyclable materials and the ability to automate collection, which reduces municipal programs' costs. But recycled paper mills' costs are increased by the contamination of recovered paper with glass, plastics, metals and inappropriate mixes of fiber. Materials Recovery Facilities (MRFs), where recovered materials are processed into manufacturing feedstocks, have not yet caught up with collection innovations to properly sort commingled materials to manufacturing requirements (Kinsella and Gertman).
- China has been rapidly building up its paper industry by importing increasing volumes of North American recovered fiber to feed its new recycled newsprint and packaging mills. These new paper mills can handle low grades of recovered fiber, many of the mills reprocess the recovered materials before use for manufacturing, and their labor costs are low enough that they can inexpensively hand-sort the mixed bales of fiber. These pressures result in higher prices for recovered paper at North American mills combined with significantly poorer quality that drives up processing costs, yet ever more stringent quality specifications from customers.
- The increased tendency to collect recovered paper without sorting has led to more processors selling bales of mixed paper rather than sorting them into fiber categories. Even the sorted papers tend to be much poorer quality than in the past. Mills making products such as paperboard, corrugated medium, notepad backings and shingles can make good use of mixed papers. But mills making corrugated linerboard, newsprint, tissue products and printing & writing papers must have sorted bales. The less sorted fiber is available, the less feasible it is for these types of mills to establish or expand recycled content production.

If, however, the mixed paper can be subsequently sorted economically, the increased collection could be a boon for high grade deinking mills. Equipment does exist that can sort mixed paper by use of optical scanners, but the input must be fiber-only and the additional sort is expensive.

WHAT THESE RECOVERED FIBER INDICATORS MEAN

The United States, an intensely consumer-oriented society, is by far the source of the greatest amount of recoverable paper in the world. Given the large amount of paper, particularly in office buildings, that is still available for recovery, there is plenty of capacity for meeting the demand for recovered fiber, especially to increase recycled content across printing & writing papers.

Figure 16. U.S. paper recovery by grade



Source: AF&PA 2006.

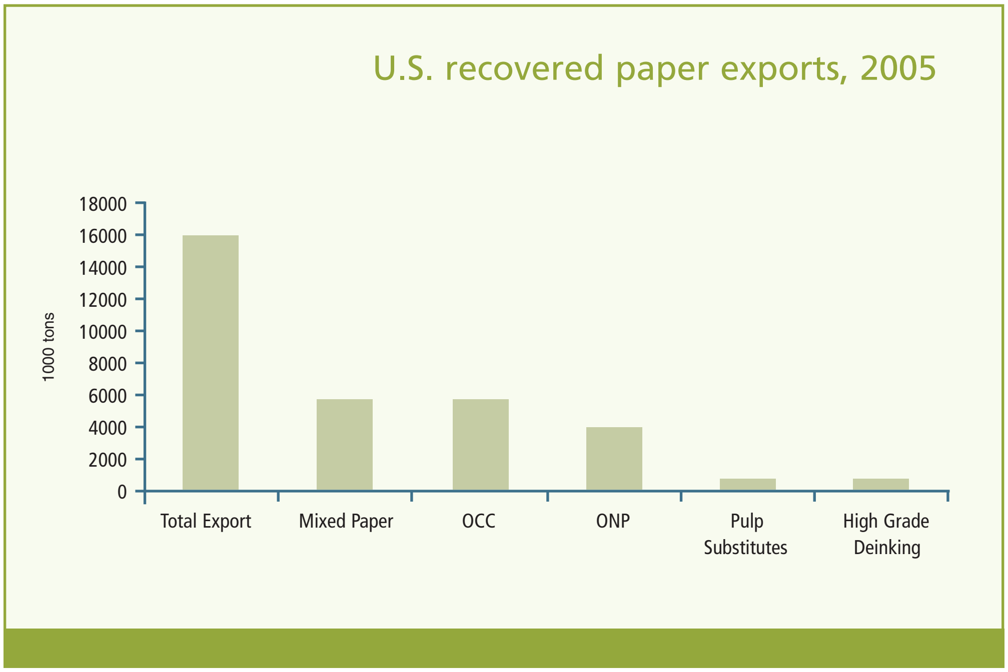


Figure 17. U.S. recovered paper exports, 2005

Source: RISI 2006.

But in meeting demand, community recycling program managers and companies that collect and process recovered fiber must set contract and performance requirements that ensure that the fiber will be processed and distributed in ways that enhance, not undermine, the North American recycling system. Recovered fiber must be processed to meet the needs of domestic manufacturers as well as foreign mills, and fibers must be sorted to support potential recycled content expansions for printing & writing paper mills as well as the other industry sectors that need specific fiber feedstocks.

GLOBAL INFLUENCES: DEMAND FOR U.S. RECOVERED PAPER

Indicator: U.S. exports of recovered paper as a percentage of total recovered volume

Of the 51,310,000 tons of fiber recovered in 2005 in the United States, 15,906,000 tons, or 31 percent, were exported. U.S. exports of recovered paper increased nearly 87 percent between 1999 and 2005(AF&PA 2005).

The rapid build-up in China's paper industry has led the demand for increasing amounts of U.S. recovered paper. Demand from India and other developing nations is also expected to pick up soon. These new paper mills that are making newsprint, containerboard and paperboard grades incorporate high percentages of recycled fiber, resulting in high demand for OCC and ONP. Demand for mixed paper has soared since 1999, with China purchasing 69 percent of exported U.S. mixed paper in 2005, or 3.9 million tons (RISI 2006), for use in making paperboard and corrugated medium.

Exports have been much lower for sorted recovered high grade papers, but a considerable amount of recovered office papers are included in the mixed paper grade. In 2005, 6.36 million tons of recovered printing & writing papers were exported, or 45.5 percent of the total collected (AF&PA 2005). Very little high grade deinking grade paper such as that used to make recycled printing & writing paper or tissue products is currently exported to China, which to date has not included capacity for recycled fibers in its new mills that make printing & writing papers.

Indicator: Recycling capacity in developing nations

While packaging and newsprint often include recycled content in developing nations, printing & writing paper almost always does not.

Packaging paper products in South America and China tend to include high percentages of recycled fiber. Newsprint, too, often includes recycled content. But the new mega-size market pulp mills being developed in South America, China, Indonesia and Tasmania, for example, are all virgin forest fiber pulp mills. New printing & writing papermaking mills are not including deinking pulp mills nor buying recycled pulp, even though they use a significant percentage of kraft pulp, made in the most environmentally resource-intensive process. Two deinking pulp mills, the first in China, are expected to open within the next year for limited recycled printing & writing grades.[9]

Yet North American paper products are increasingly being imported from other nations. Most of the paper exported to the United States and Canada from major supplying countries, including Finland, Germany and Brazil, is virgin paper

(Conservatree). Although some high recycled content papers come from Europe, most printing & writing paper imported by the United States and Canada contains little or no recycled fiber. In emerging economies, major investments have been made in virgin paper production infrastructure, with virgin pulp mills larger than any before in existence being developed in both Asia and South America. In many cases, it is not finished paper that is exported to North America but pulp from fast-growing tree plantations in South America and Indonesia.

Because of lower costs, high quality and increasing globalization of companies, U.S. and Canadian businesses are increasingly turning to South America for printing and to China for books, calendars and converted paper goods such as office and school paper products. Imports of paper from China have soared from $21.5 million in 2004 to $224 million in 2006 (Armstrong).

WHAT THESE GLOBAL INDICATORS MEAN

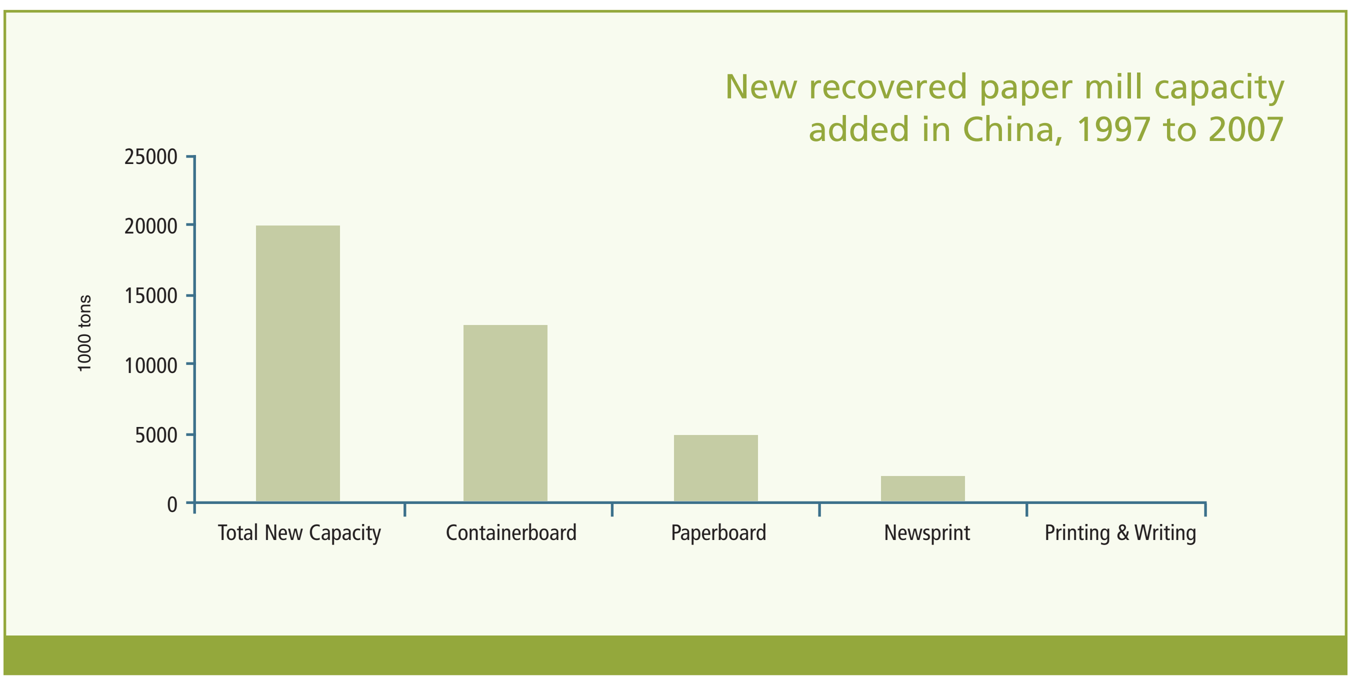
A virtual flood of virgin paper products could be arriving in North America shortly, replacing books, magazines, catalogs, calendars, office paper products, greeting cards and printed materials that might have used recycled paper when produced by North American mills. New paper mills making newsprint and packaging in developing countries are incorporating high amounts of recycled fiber. But the new high grade pulp and paper mills making printing & writing paper grades have ignored essential environmental advances such as recycled fiber, nontoxic production and sustainable forestry. Instead, new mills should be expected to establish the environmental gold standard necessary for producing enough paper to meet the escalating demand from emerging economies that is rapidly being added to the already huge demand from developed nations.

There are virtually no recycled printing & writing mills in Asia other than in Japan. (Taiwan and South Korea have extremely small, limited production.) With none in China or among the other new pulp and paper mills being built, and the decline of recycling infrastructure in North America, only purchasers who insist on papers, whether domestically sourced or imported, that meet high environmental criteria can make sure that all future paper industry investments meet environmental sustainability goals, no matter where they are in the world.

In the United States and Canada, new deinking investments will only be possible if market demand for recycled printing & writing papers expands. At the same time, as long as paper purchasers do not specify papers with recycled content, the growth of low cost virgin pulp and papermaking capacity overseas decreases incentives to build or maintain recycled paper capacity in North America and elsewhere.

Purchaser requirements can make environmental criteria and recycled fiber the nonnegotiable bottom line for all new pulp and paper mills, no matter where they are in the world. This approach changed the North American paper industry in the late 1980s, when newspaper publishers began requiring recycled content in the newsprint they bought—some pushed

Figure 18. New recovered paper mill capacity added in China, 1997 to 2007



Source: RISI 2006, 119.

by legislation, others creating voluntary agreements. Newsprint mills in the United States and Canada made a major technological shift by adding several new deinking mills and advancing the existing technology. Now some of those publisher agreements are no longer intact, but the newsprint deinking infrastructure is still incorporating recovered fiber and enhanced technology.

The Future for Recycled Paper Markets

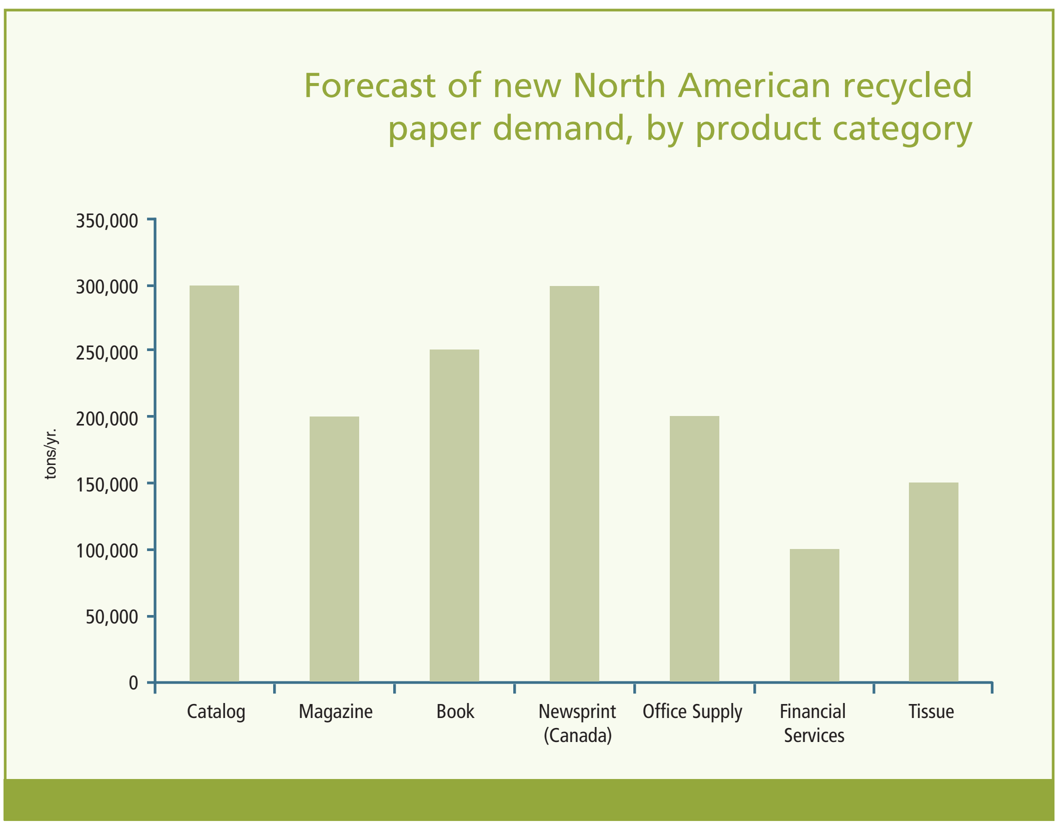
Estimates by both environmental group paper campaigns and paper industry pulp producers suggest that as much as one and a half to two million new tons of recycled pulp per year, split between recycled kraft and mechanical pulp, is needed to meet projected new demand (Figure 19).

We can expect demand for recycled paper products to grow, for a number of reasons. First, high volume and high profile purchasers such as Staples, Kinko's, Norm Thompson, Office Depot, Bank of America, Starbucks, Random House, Dell Computers and many others now have recycled content goals in their purchasing policies. Second, environmental groups will keep pressure on companies that do not yet have recycled content purchasing goals. ForestEthics' and Dogwood Alliance's pressure on Staples, Office Depot and OfficeMax has both strengthened markets for deinked pulp and opened up recycled paper sources for businesses and individuals. Markets Initiative's persuasiveness landed Canada's Harry Potter books on 100 percent recycled paper, and the Green Press Initiative has worked with Random House and hundreds of other publishers to establish goals for increasing the use of recycled fiber—resulting in millions of books on recycled paper.

Environmental Defense's partnerships with UPS, Citigroup and Norm Thompson Outfitters proved the business case for recycled paper use in a variety of applications. Other campaigns focus on magazines, catalogs, tissue products, direct mail and organizing government purchasers. And finally, for a number of grades of paper, such as corrugated boxes, using recycled content is already economically compelling.

As demand increases, will there be enough supply? The first potential constraint on supply is generation of used paper to be recovered. Given that paper consumption in the United States is expected to continue growing (see the Minimizing Paper Consumption chapter) and increasing amounts of paper and finished paper products are being imported from overseas, supply is not a concern. So the question is whether the used paper that goes into the waste stream can make it back into recycled paper. The key constraints to availability of recycled pulp are deinking or recycling capacity (depending on the type of paper product), demand for recovered paper from abroad, degradation of recovered paper quality that makes it unsuitable for use in particular grades of recycled papers, and our ability to recover more suitable paper from the waste stream.

Figure 19. Forecast of new North American recycled paper demand, by product category



Source: Environmental Paper Network Deinking Roundtable, March 27, 2007, New York City

What Paper Buyers Can Do

Recycled content is the foundation for environmentally sustainable papers. Reusing fibers, especially repeatedly and for disposable and high environmental impact products like printing & writing papers, maximizes the use of natural resources. Even if all papers were made from forest fibers from certified sustainable sources, they would require far more trees and other resources than if they incorporated substantial amounts of recycled content instead. To expand the quantity of environmental papers available, other attributes should build on a base of recycled content rather than replace or compete with it.

But the fact is, unless there is a functional recycling infrastructure, all papers are on a one-way trip to the landfill or incinerator, wasting their potential for reuse and all the environmental gains provided by multiple uses. Recycling is a just-in-time system: suitable recovered materials must be regularly delivered to recycling mills. If the system is unreliable, a mill cannot afford to invest in recycling. The best way to ensure that the whole recycling system will function optimally is to require recycled content in paper; that demand pulls used paper through the system to be used again.

North American paper purchasers can make all the difference. If they require the papers they buy and use to have recycled content as well as other environmental attributes (such as environmentally sustainable virgin fibers and cleaner production processes), the paper industry in North America and around the world will respond. If paper buyers also influence the companies they patronize—such as providers of packaging and tissue products, printers and direct mailers, and services and subscription businesses—the increase in recycled paper demand will be dramatic.

If, instead, each paper purchaser chooses different environmental attributes to favor, the environmental paper market will be split into so many types of boutique papers that there will be little financial incentive for companies to make long-term environmental investments. The paper industry is highly capital-intensive and purchasing specifications need to add up to large-scale, long-term requirements to effect change. Following a comprehensive procurement plan such as the Common Vision that is built on a foundation that ensures continuing strength for the recycling system will significantly reduce the production footprint of paper while ensuring environmental sustainability and availability throughout the world.

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Additional Resources
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McEntee Media. Paper recycling online, www.recycle.cc.
RISI. *Annual Review of Global Pulp & Paper Statistics.* www.risiinfo.com.
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TAPPI. *Ahead of the curve.*
———. *Solutions.*

[1] The data set included all deinking pulp mills in the United States and Canada that are integrated with printing & writing mills, as well as all recycled market pulp mills that make at least some of their pulp available for printing & writing paper production. Deinking pulp mills integrated to tissue mills were not included because their pulp is not available to printing & writing mills.
[2] Conservatree research based on industry data, including Paperloop (RISI) Lockwood-Post Directory and interviews with pulp and paper manufacturers.
[3] Conservatree calculations using statistical data for different paper grades' fiber contents derived from Environmental Defense Fund 2002a.
[4] Conservatree calculations based on industry data and interviews with deinking pulp mill managers.
[5] Conservatree calculations based on RISI 2006, AF&PA 2005 and 2006, and deinking capacity research.
[6] As of first quarter 2007, Weyerhaeuser finalized the sale of its fine papers division to Domtar, which creates an even larger concentration of uncoated freesheet capacity.
[7] Derived from 2003 AF&PA recycled and unrecovered tonnages (AF&PA 2004, 27), and Franklin Associates, pp. C-6 and C-7.
[8] 9,200,000 tons recovered from offices in 2003 (AF&PA 2004, p. 27) x 55% = 5,060,000 tons, less 9,200,000 x 48.3% (AF&PA 2004) = 4,443,600 tons, yields an increase of 616,400 tons.
[9] Shandong Chenming Paper Holdings has announced plans to start a deinking pulp mill in January 2008 to provide 180,000 metric tonnes per year of deinked pulp for both tissue and uncoated printing & writing paper. Additionally, Stora Enso is pursuing a joint venture with Shandong Huatai Group to install 200,000 metric tones per year deinking capacity for supercalender mechanical publication grade paper by late 2007.

CHAPTER FOUR

RESPONSIBLE FIBER SOURCING

Common Vision Goals:

- *End the use of wood fiber that threatens endangered forests and other high conservation value ecosystems.*
- *End the clearing of natural ecosystems and their conversion into plantations for paper fiber.*
- *Source any remaining virgin wood fibers for paper from independent, third-party certified forestry operations that employ the most environmentally and socially responsible forest management and restoration practices. Forest Stewardship Council (FSC) is currently the only international certification program that comes close to meeting this goal.*
- *Eliminate widespread use of pesticides, herbicides and fertilizers in plantations and fiber production.*
- *Stop the introduction of paper fiber from genetically modified organisms, particularly transgenic trees and plants with genes inserted from other species of animals and plants.*
- *Use alternative crops for paper if comprehensive and credible analysis indicates that they are environmentally and socially preferable to other virgin fiber sources.*

OVERVIEW

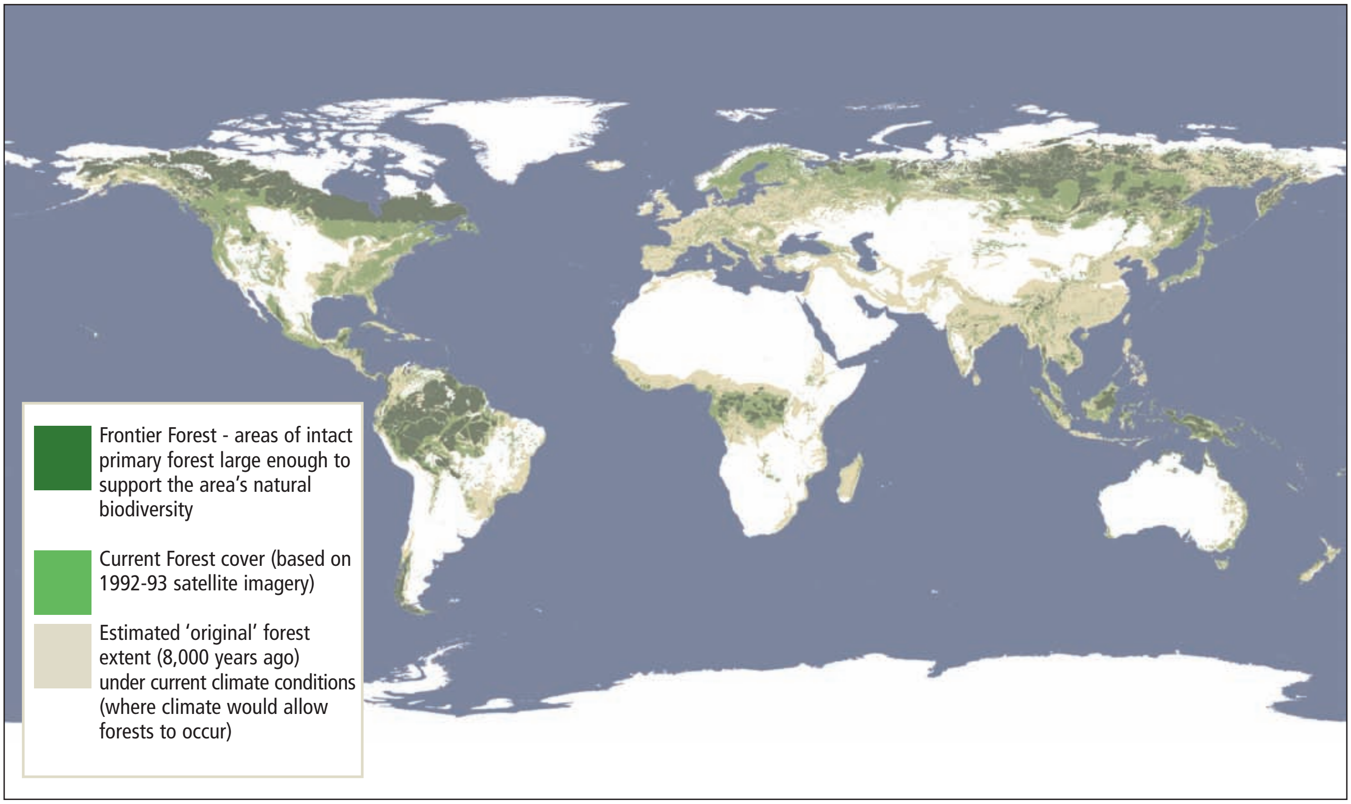
Clean water, habitat for countless species, recreational and economic opportunities for people, the cultural heritage and territory of indigenous peoples—these are just a few of the vital services and benefits that healthy forests provide.

Forests also protect against climate change, storing roughly 50 percent of all terrestrial carbon stocks. At the same time, land-use change and forestry are responsible for approximately 18 percent of carbon emissions into the atmosphere (Baumert, Herzog and Pershing). Old-growth and mature, second-growth natural forests store much larger amounts of carbon than newly planted stands and once logged, require decades to recover the original amount of carbon they contained (German Advisory Council; Harmon, Ferrell, and Franklin). The forest and paper industry, therefore, must move away from the practice of replacing high-carbon forest stands (old-growth, mature second-growth and intact forests ecosystems) with low-carbon second growth. Further, extending harvest rotations—leaving trees to grow for longer periods—can also have a significant impact on carbon storage.

Unfortunately, roughly half the world's forests have been burned or cleared and converted to non-forest uses (see Figure 20). Human activity has degraded almost 80 percent of what remains of the planet's once vast forests (Bryant, Nielsen and Tangley). These forests have lost, to varying degrees, many of their species and much of their ability to function as healthy ecosystems. Yet many of the remaining forests—including old-growth and other ecologically important forests—are still being logged for the paper industry using unsustainable forest management practices.

Threats posed today by the paper industry to forests around the world include the logging of endangered forests, poor management and degradation of forest ecosystems, conversion of forests to tree plantations, the loss of local and

Figure 20. Frontier forests, current forest cover and historic deforestation.



Source: World Resources Institute, 1997.

indigenous peoples' control of their forests, illegal logging and even human rights abuses. Endangered forests occur in every region where the paper industry is active, including regions of intact forests as well as areas where forests have been degraded.

Among the major producers of paper products, the United States, Canada, Scandinavia, Brazil, Russia, Indonesia and southern South America have all come under scrutiny in recent years for unsustainable forestry practices. The issues range from the clearing of natural forests and ecosystems for paper plantations (for example, in Indonesia, Brazil, the United States and Chile), the loss of old-growth forests and other important habitat (for example, in Canada, Russia, the United States, Australia and Finland) and the violation of the rights of indigenous peoples and local communities (for example, in Indonesia, Canada and Finland).

The effect of the paper industry on forests is staggering. Canada alone cuts down five acres (2.02 hectares) of forest every minute, much of that going directly and indirectly to feed pulp and paper mills (ForestEthics 2004). Approximately eighty percent of these logged Canadian forests are old-growth habitat (Natural Resources Canada). Other regions such as Indonesia, Russia, Finland and Chile that export paper, pulp and fiber to major consumer countries like the United States and Western Europe are also losing old-growth habitat.

In many places, indigenous peoples and their cultures are disappearing with the loss of the forests that are their homes. In Chile, for example, local people have struggled against highly polluting mills and fought against the conversion of the Chilean native forests to pulp plantations of exotic species (Neira et al.). The Sámi people of the boreal forests of northern Finland have seen their ancient forests felled by Finnish companies supplying wood for the European paper industry; these forests provide the basis for traditional life of the Sámi reindeer herders, who rely on the area's old-growth forests to feed their herds in the winter; these forests also provide habitat for threatened and declining animal species such as wolverines, golden eagles and the Siberian jay (Greenpeace 2005). In Sumatra, Indonesia, forest-dependent communities and farmers are losing their livelihood and facing violent oppression while the pulp industry chops the last rainforests of the island and converts their ancestral lands to pulp-wood plantations.[1] And in Canada, the Grassy Narrows First Nation has been blocking logging trucks in Northern Ontario from harvesting trees cut for paper and solid wood and Amnesty International has just completed a fact-finding mission related to possible human rights abuses.

To prevent further environmental and social tragedies, the paper industry must adopt more environmentally and socially responsible alternatives for sourcing fiber consistent with the Common Vision. Environmental performance indicators for each of these actions are presented in the following pages, beginning with a discussion of wood fiber sources, followed by non-wood plant fiber sources. For more information on paper and social responsibility see http://www.environmentalpaper.org/socialimpactsfactsheet.

ENVIRONMENTAL PERFORMANCE INDICATORS: WOOD FIBER

Endangered and High Conservation Value Forests

Common Vision goal: End the use of wood fiber that threatens endangered forests. (Some forests are so rare, threatened, or ecologically vulnerable, or are of such global biological or cultural importance that any logging or commercial use could irreparably damage their conservation value.)

Endangered forests include remaining wilderness forests, which are sometimes called frontier forests; core forest habitat of species requiring special attention; representative regions of biological diversity (that is, the full range of different ecosystem types), endemism and high species diversity; and rare ecosystem types. Rare forest ecosystems exist at different spatial scales; some forests, such as temperate rainforests, are rare at the global level, while others are rare at more local levels, such as tropical cloud forests in the Americas (ForestEthics et al.). Some forests, such as the Appalachian and mixed mesophytic forests of the southeastern United States, are being made rare and vulnerable through human activities, including paper industry activities.[2] Industrial development in endangered forests, including harvesting for paper, irreparably damages the forest's ecological values.

Endangered forests occur in most forested regions of the world, though their extent varies widely. For example, one major type of endangered forest, the world's intact—or wilderness—forests, are concentrated in just a few countries. According to Greenpeace, "only fourteen countries, including Canada, Brazil, Russia, Papua New Guinea, Democratic Republic of the Congo, and Indonesia control 92 percent of the world's remaining Intact Forest Landscapes." The World Resources Institute found similar forest regions using different methodology in its groundbreaking study, "The Last Frontier Forests: Ecosystems and Economies on the Edge" (Bryant, Nielsen and Tangley). Greenpeace estimates that less than 8 percent of these forests have formal protection. While both the Greenpeace and World Resources Institute studies were groundbreaking in delineating large areas of endangered forests, neither accounts for other significant regions of endangered forests outside these wilderness regions. There is a great deal of work to do to ensure these forests are protected from industrial development.

High conservation value forests (HCVF)—a designation that is more inclusive than endangered forests—often require less strict conservation regimes than endangered forests, but still require careful management and protection for the exceptional benefits they provide. The High Conservation Value Resource Network (www.hcvf.org) describes high conservation value areas as natural habitats where inherent conservation values, which "could include the presence of rare or endemic species, sacred sites, or resources harvested by local residents...are considered to be of outstanding significance or critical importance."

The paper industry is active in areas that have been defined as endangered and high conservation value forests, and many of its logging activities are threatening the values those forests provide. The industry must work more actively with the full range of stakeholders—and with the companies that supply them with tree fiber—to ensure increased protection of these forests and values.

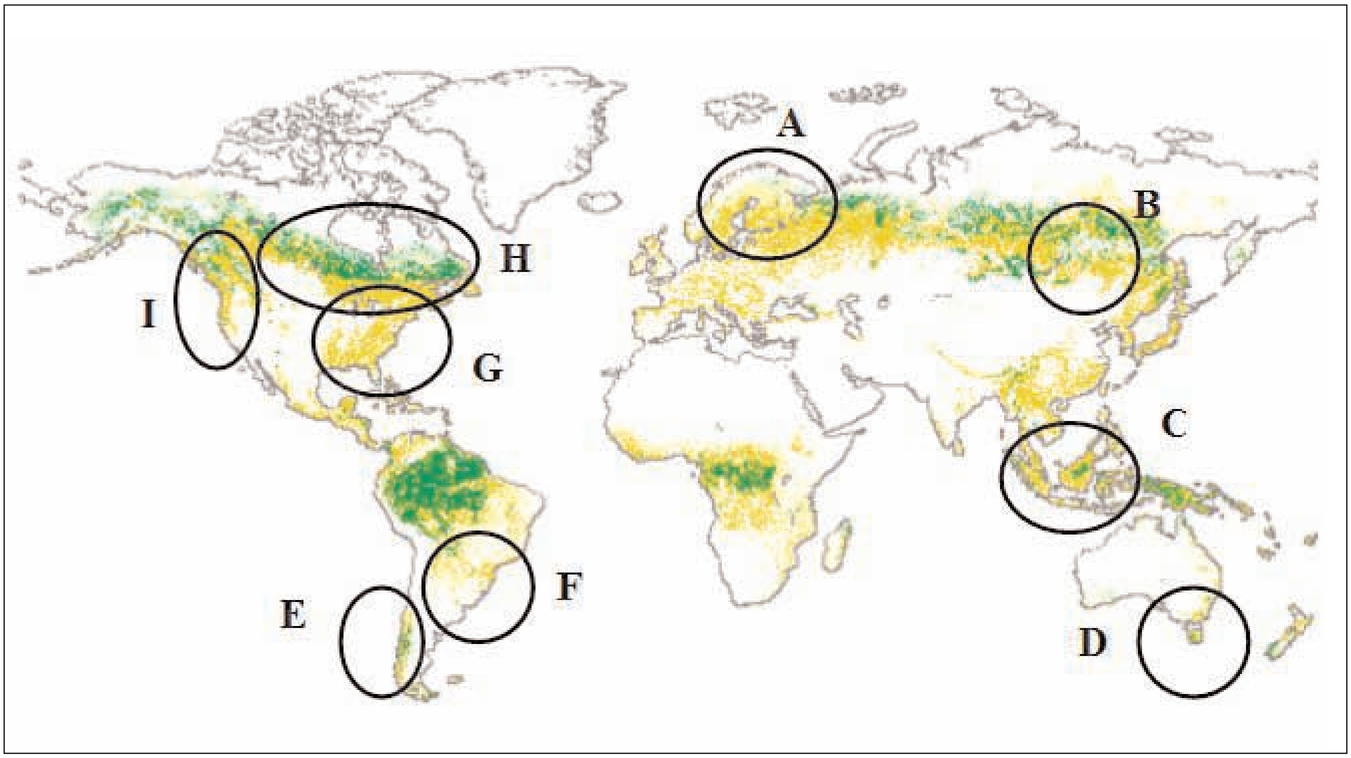
A note on information gaps: Researching this report uncovered significant information gaps that impeded our ability to accurately monitor specific indicators of the health of endangered and high conservation value forests. Better monitoring and increased research into this question are required to improve the accuracy of these indicators.

Indicator: Monitoring endangered and high conservation value forests

A necessary first step in protecting endangered and high conservation value forests where the paper industry sources fiber is the mapping of these regions. Some endangered and high conservation value forests have been mapped and analyzed, but to date there is no single repository of this information.

Mapping and analyzing endangered and high conservation value forests in all the regions where the paper industry sources fiber is a daunting—but critical—task. Without accurate data and analysis, it's difficult to evaluate conditions, set priorities and measure progress toward protecting these forests. The work requires in-depth information about forest intactness, focal conservation species' home ranges and habitat needs,[3] the extent and quality of native forests,[4] rare and vulnerable native ecosystems, and the level and location of any logging operations. Generating extensive satellite imagery is often necessary in order to accurately map the locations of these values and threats.

Figure 21. The Paper Industry and Endangered Forests: Forests of the world where the paper industry threatens endangered forests and high conservation value ecosystems



Green areas are intact forests; yellow areas indicate other forest area that contain endangered forests. A: Finnish and northeast Russian old-growth forests, Sámi people's forests; B: Siberian and Russian Far East; C: Indonesian rainforest; D: Tasmanian temperate rainforest; E: Chilean temperate rainforests; F: Industrial plantations, southern and eastern Brazil, Uruguay and northern Argentina; G: Southern United States native hardwood forests; H: Canadian boreal forest; I: U.S. and Canadian inland temperate rainforest and coastal rainforest.

Many maps have been created that outline these values across extensive landscapes. Some studies apply all endangered forest values across entire landscapes. Other studies focus on one value in a region, such as Mountain Caribou habitat in Western Canada. The global conservation organization WWF has summarized most biodiversity values in its series of studies of the world's ecoregions.[5] The studies designate forests and other ecosystem types with high values of species richness, endemism and other biodiversity values.

Figure 21 shows the world's forests. The circles indicate regions of high paper production from natural forests or controversial plantations (Borealis).

Green areas are intact forests; yellow areas indicate other forest area that contain endangered forests. A: Finnish and northeast Russian old-growth forests, Sámi people's forests; B: Siberian and Russian Far East; C: Indonesian rainforest; D: Tasmanian temperate rainforest; E: Chilean temperate rainforests; F: Industrial plantations, southern and eastern Brazil, Uruguay and northern Argentina; G: Southern United States native hardwood forests; H: Canadian boreal forest; I: U.S. and Canadian inland temperate rainforest and coastal rainforest.

Table 4 outlines existing maps and analysis of endangered forests that comport with the definitions laid out in the paper, "Ecological Components of Endangered Forests" (ForestEthics et al). Other maps and important information exist, but to date there is no single repository of the information; more work on mapping needs to be done in other significant paper-producing regions. The members of the Environmental Paper Network will monitor the regions where endangered forest maps, conservation plans and maps of high conservation values exist to determine what progress has been made to protect these forests and ecosystem values.

However, monitoring and studying these forests is not enough and cannot replace protection of these forests and forest values. This indicator will only help us to arrive at the more critical indicator described below, protection of endangered forests and high conservation value forests.

Table 4. Endangered forests and high conservation value forests—select mapping to date in key regions

Study Name	Region	Source	Ecological Values Identified
Forest Intactness Database	Coterminous U.S. (lower 48 states)	Conservation Biology Institute	Intact forest landscapes
A Science-Based Conservation Assessment for the Klamath-Siskiyou Ecoregion	Klamath-Siskiyou Ecoregion	Conservation Biology Institute	Intact forest landscapes, rare forest types, remnant forest landscapes, high endemism
Alaska Intact Forest Landscapes	Alaska	Conservation Biology Institute	Intact forest landscapes, rare forest types, remnant forest landscapes
Chile's Frontier Forests: Conserving a Global Treasure	Chile	Global Forest Watch	Intact forest landscapes, forests of high endemism, great ecological and evolutionary value, geographic isolation, high degree of threatened species
Forest Conservation Priority Setting for the Lake Region of Central Chile Using a Preliminary Endangered Forests Assessment	Chile	Conservation Biology Institute	Intact forest landscapes, rare forest types, remnant forest landscapes high endemism
The State of the Forest: Indonesia	Indonesia	Global Forest Watch	Intact forest landscapes, rare forest types, forests of high species richness, forests containing high concentrations of rare and endangered species, forests of high endemism
Canada's Large Intact Forest Landscapes	Canada	Global Forest Watch-Canada	Intact forest landscapes,landscape connectivity
Atlas of Russia's Intact Forest Landscapes	Russia	Global Forest Watch	Intact forest landscapes
Low-Access Forests and their Level of Protection in North America	Canada and Continental U.S.	Global Forest Watch—Conservation Biology Institute	Intact forest landscapes landscape connectivity
Second Roadless Area Review and Evaluation	U.S. Federal Public Lands	USDA Forest Service	Intact forest landscapes
Wildlands of the U.S.	Pacific Northwest, U.S.	Pacific Biodiversity Institute	Intact forest landscapes
Canada's Forests at a Crossroads: An Assessment in the Year 2000	Canada	Global Forest Watch-Canada	Intact forest landscapes, landscape connectivity, forests containing high concentrations of endangered species, core habitat for focal species
The Last Intact Forest Landscapes of Northern European Russia	European Russia	Global Forest Watch	Intact forest landscapes
Endangered Forests of the Cumberland Plateau	Cumberland Plateau, U.S. (TN, AL, KY, GA)	Conservation Biology Institute	Remnant forest landscapes, landscape connectivity focal conservation species' habitat, rare forest types, ecological services
Large Landscape-level Forests of the World	Global	Greenpeace International	Intact forest landscapes
Chinchaga Wilderness: The Last Hope for the Creation of a Large Protected Area in the Alberta Foothills	Rocky Mountain Foothills, Alberta, Canada	Canadian Parks and Wilderness Society, Edmonton	Intact forest landscapes, focal conservation species' habitat
Rocky Mountain Foothills and the LIttle Smoky	Rocky Mountain Foothills, Alberta, Canada	Canadian Parks and Wilderness Society, Edmonton	Intact forest landscapes, focal conservation species' habitat, remnant forest landscapes
Mountain Caribou Habitat	British Columbia	Conservation Northwest, Forest Ethics et al.	Focal conservation species habitat (mountain caribou)

Indicator: Stakeholder engagement and agreements

Indicators of progress might include the total number of real engagements with stakeholders by companies and governments on protecting endangered and high conservation value forests, and the total number of stakeholder processes as a proportion of mapped or identified endangered forests and high conservation values. No single repository of this information currently exists.

Stakeholder engagement efforts and forest industry agreements can be effective strategies for protecting endangered forests. In British Columbia, for example, the Great Bear Rainforest conservation plan was the culmination of ten years of campaigning to alter the markets for wood and paper products coming from coastal British Columbia. The final agreement, approved in 2005 by all stakeholders, including local governments, indigenous peoples and the forest industry, sets aside 5 million acres (roughly 2 million hectares) from logging and mandates ecosystem-based management from the remaining 15.5 million acres (6.4 million hectares) in the region. It also requires "comprehensive First Nations involvement in management over their entire traditional territory" and "diversification of the economy based on conservation" (ForestEthics 2006).

Real engagement requires agreement by the stakeholders that the dialogue is open, fair and has a real chance of productive outcomes. Logging in the areas of concern should not proceed while negotiations and dialogue are under way.

Indicator: Protection of endangered forests and high conservation value forests

The paper industry's progress toward protecting endangered and high conservation value forests can be measured by the amount of and increase in protected areas in pulp and paper producing regions compatible with high conservation values and endangered forest definitions. More research is needed to determine the extent of these areas.

While not all values and forests have been mapped, nor detailed conservation plans developed in many cases, members of the Environmental Paper Network will report back and monitor the progress in those areas where maps and conservation plans have been put forward. See Table 4 for a list of detailed conservation plans and maps of endangered forests and high conservation value forests.

WHAT THESE INDICATORS MEAN

Much work remains to be done to map and analyze endangered and high conservation value forests where the paper industry sources fiber. While that work continues, paper buyers and suppliers can take concrete steps now to help protect these vital areas.

Printers and remanufacturers as well as buyers of end products should:

- Conduct full chain of custody certification for paper products from all suppliers (chain of custody is discussed in the Certification of Forest Products section below).
- Work with environmental organizations to determine whether the fiber for these end products comes from endangered forests or high conservation value ecosystems. The Environmental Paper Network and its members are creating tools such as PulpWatch.org that can help buyers identify these forests and the mills that they supply.
- Require suppliers to engage in real dialogue with conservation advocates and other stakeholders to ensure that, as a first step, moratoriums on logging in these areas are put in place, and secondly, that long-lasting conservation agreements include the long-term protection of endangered and high conservation value forests.
- Eliminate any products that come from these areas until full conservation plans are finalized and agreed for the regions by all stakeholders.
- Join with other buyers to support conservation processes in key supply regions where controversial operations are ongoing.

Forestry and primary paper producers should:

- Engage with environmental and social stakeholders in your supply zone to identify endangered and high conservation value forests.
- Work with stakeholders to place the areas under moratorium from industrial development while conservation studies and processes are underway.
- Work with governments and landowners to ensure permanent protection of these endangered and high conservation areas.

CERTIFICATION OF FOREST PRODUCTS

Common Vision goal: Source any remaining virgin wood fibers for paper from independent, third-party certified forest managers that employ the most environmentally and socially responsible forest management and restoration practices. Forest Stewardship Council (FSC) is the only acceptable international certification program that comes close to meeting this goal.

Independent, third-party certification of forestry management operations is a necessary element in protecting forest values. The certification system most widely recognized as having the most credible standards for responsible forestry management was developed by the Forest Stewardship Council, an international nonprofit organization (Ozinga; Tan). FSC certification was created with the input of balanced stakeholder representation, including forest managers and owners, purchasers of wood and paper products, environmental organizations, scientists, indigenous peoples, wood and paper industry unions and others. The FSC system gives buyers the best, most complete and most reliable means of ensuring their wood comes from responsibly managed sources.

FSC's ten principles and criteria form the basis of regional and national standards specific to different forest types, legal systems and stakeholder input. These principles and criteria cover compliance with laws and the FSC principles; tenure and use rights and responsibilities; indigenous peoples' rights; community relations and workers' rights; benefits from the forest; environmental impact; management plan; monitoring and assessment; maintenance of high conservation value forests; and plantations. The FSC system does not allow the certification of forests or the procurement of fiber or wood resulting from the conversion of natural forest ecosystems to plantations after 1994. FSC is currently engaged in a process of revising its plantations standards.

One of FSC's strengths is that it provides chain of custody certification for the FSC certified raw materials in its labeled products. Chain of custody certification tracks each step in the path from the forest to the consumer, including all successive stages of processing, transformation, manufacturing, distribution and retail sales. A product can only carry the FSC label or logo if the raw material for the product derives from a forest that has received an FSC forest management certificate, and if all steps along the supply chain receive a chain of custody certificate.

FSC's chain of custody standards also allow for products that are made from mixed sources of FSC wood, reclaimed material and controlled wood. This standard is very important for paper products, which are almost always made from a wide variety of inputs from a number of sources and suppliers. Adequate controls on any uncertified portion of the product (where certified and uncertified wood are mixed in the production process) must be monitored by the company and the certifiers in order to ensure that no controversial sources (including fiber from threatened high conservation value forests) are included. For details about FSC's chain of custody certification, go to www.fsc.org.

Other certification systems were created subsequent to the development of FSC (Tan), including the Sustainable Forestry Initiative (SFI), the Canadian Standards Association (CSA) forest certification program, and the Programme for the Endorsement of Forest Certification schemes (PEFC). These systems were designed by the timber and paper industries and the boards and controlling bodies of these schemes are dominated by these industries (Ozinga). These systems have served to maintain the status quo of the forest products industry in the marketplace. Unlike FSC, these other systems provide little or no chance for stakeholders to challenge the management of forests systems or for stakeholders who are not directly involved in the forest products industry to have their voices heard. These systems can create confusion among buyers and do not provide the assurances that the FSC system does. Therefore they have not been endorsed by signatories of the Common Vision.

These other systems—whether in North America, Europe or other parts of the world—have given the thumbs up to some egregious logging and business practices. For example:

The Canadian Standards Association certification system allows unrestrained old-growth logging in intact forests throughout Canada. Companies are required to consult with stakeholders, but have the option of ignoring the results of stakeholder consultations. The Hinton Pulp Mill in Alberta, for example, has its fiber supply certified despite the objections to its management by environmental stakeholders and despite the presence of endangered species that their forest management system does not even record (NRDC).

The Sustainable Forestry Initiative, used mostly in the United States, does not track much of the fiber entering the system. The system doesn't take into account the rights of forest-dependent communities and indigenous peoples. Conversion of natural forests to plantations continues apace under SFI rules, even in regions where natural forests have been almost entirely lost.

The Australian Forestry Standard (AFS) was endorsed by Program for the Endorsement of Forest Certification schemes (PEFC) despite the fact that no Australian environmental organizations or stakeholders participated or supported the drafting process for the standard. The AFS currently supports the conversion of old-growth native forest to plantation and the broad scale use of the poison 1080 to kill native browsing marsupials. It continues to support the certification of forest managers found by the Australian courts to be contributing to endangered species extinction.

In short, with the exception of FSC, these certification systems and standards currently cannot provide any guidance to determine whether the paper industry is progressing toward the goals laid out in the Environmental Paper Network's Common Vision.

Indicator: FSC certification

As of May 2007, FSC has certified 226.3 million acres (91.6 million hectares) of forests in 73 countries and issued 5,806 chain of custody certificates globally (FSC 2007).

FSC certification is growing rapidly. Although it is not always possible to determine from published statistics the volume of wood going into solid wood products or paper products, as of December 2006, FSC has certified 208.3 million acres (84.3 million hectares) of forests in 77 countries and issued 5,400 chain of custody certificates globally. In 2006, FSC's market share of paper products globally increased by 50 percent (Malessa).

Indicator: FSC certified paper products reaching consumers

Measuring Chain of Custody certificates will help us to understand how many products are reaching consumers and how the market is responding to the certification of paper products, since chain of custody certification is the means by which the industry assures that FSC products move along the chain of production to consumers. Additional research is needed to obtain data on the market share of FSC certified paper products by volume and value.

FSC fiber and FSC products comprise an increasing share of the chain of custody of the world's paper industry. According to an internal survey of FSC certificate holders, the total sales of FSC products in 2006 was more than 77 billion dollars (FSC 2007b). The FSC certifier Scientific Certification Systems (SCS) reported very strong growth in Chain of Custody certificates from 2005 – 2006:

Dr. Robert J. Hrubes, SCS senior vice president and a founding member of the FSC, announced, "The market demand for FSC certification services continues to increase, particularly for the paper and building products industries. This signals to forest managers that responsible forest management can be good for business. These developments go hand in hand with the increase in value that companies and individual consumers alike attribute to environmental stewardship and responsible purchasing."

Research by the FSC German Working Group found that "the number of FSC certified companies in Europe had grown to 41 as of September 2005. The number of printers certified under FSC Chain of Custody has increased from 20 to over 73 in just two years" (FSC German Working Group).

WHAT THESE INDICATORS MEAN

FSC certification plays an indispensable role in helping ensure that wood fibers in paper products come from environmentally sound sources. Paper buyers can spur demand for FSC fiber by taking the steps described below, and suppliers can meet growing demand by working to obtain FSC certification for their forests and facilities.

Buyers of end products, such as office paper, stationary, printing and book papers, should:

- Specify FSC certified recycled paper products or FSC certified mixed sources paper products with recycled content, or, where market conditions are not ripe or where recycled paper is not available, specify products with FSC certified virgin fiber.
- Where there is inadequate supply of FSC certified fiber and paper products, work with your suppliers at all levels to ensure an increasing supply.
- Set time-bound goals for your suppliers who are working toward achieving FSC certification of paper products.

Printers and paper remanufacturers should:

- Get FSC chain of custody certification so that your own products can carry the FSC logo.
- Educate your customers about options for FSC certified papers.
- Give preference to FSC certified paper products and set time-bound goals for your suppliers who are working toward achieving FSC certification of paper products.
- Where there is inadequate supply of FSC certified fiber and paper products, work with your suppliers at all levels to ensure an increasing supply.

Forestry and primary paper producers should:

- All production facilities should obtain FSC chain of custody certification and immediately address issues of controlled wood, ensuring that controversial sources of fiber do not enter the chain of custody for any paper products.
- Work actively with stakeholders to achieve FSC certification in forests that are under direct control of the company.
- Where there is inadequate supply of FSC certified fiber and paper products, paper producers should work with their suppliers at all levels to ensure an increasing supply.

CONVERSION OF FORESTS TO PLANTATIONS

Common Vision goal: End the clearing of natural forest ecosystems and their conversion into plantations for paper fiber.

The pulp and paper industry relies heavily on industrial tree plantations to meet its virgin fiber demand. Over the last several decades, as demand for wood and paper products has grown, the establishment of industrial tree plantations for intensive forestry management has soared, and trends indicate rapid expansion of this practice in coming years. However, poorly managed industrial tree plantations established through the conversion of natural ecosystems can impose significant environmental and social costs. While there is legitimate debate on the role of industrial tree plantations to meet humanity's needs, there is a strong consensus that further replacement of natural ecosystems with such plantations is contrary to conservation and human rights goals.

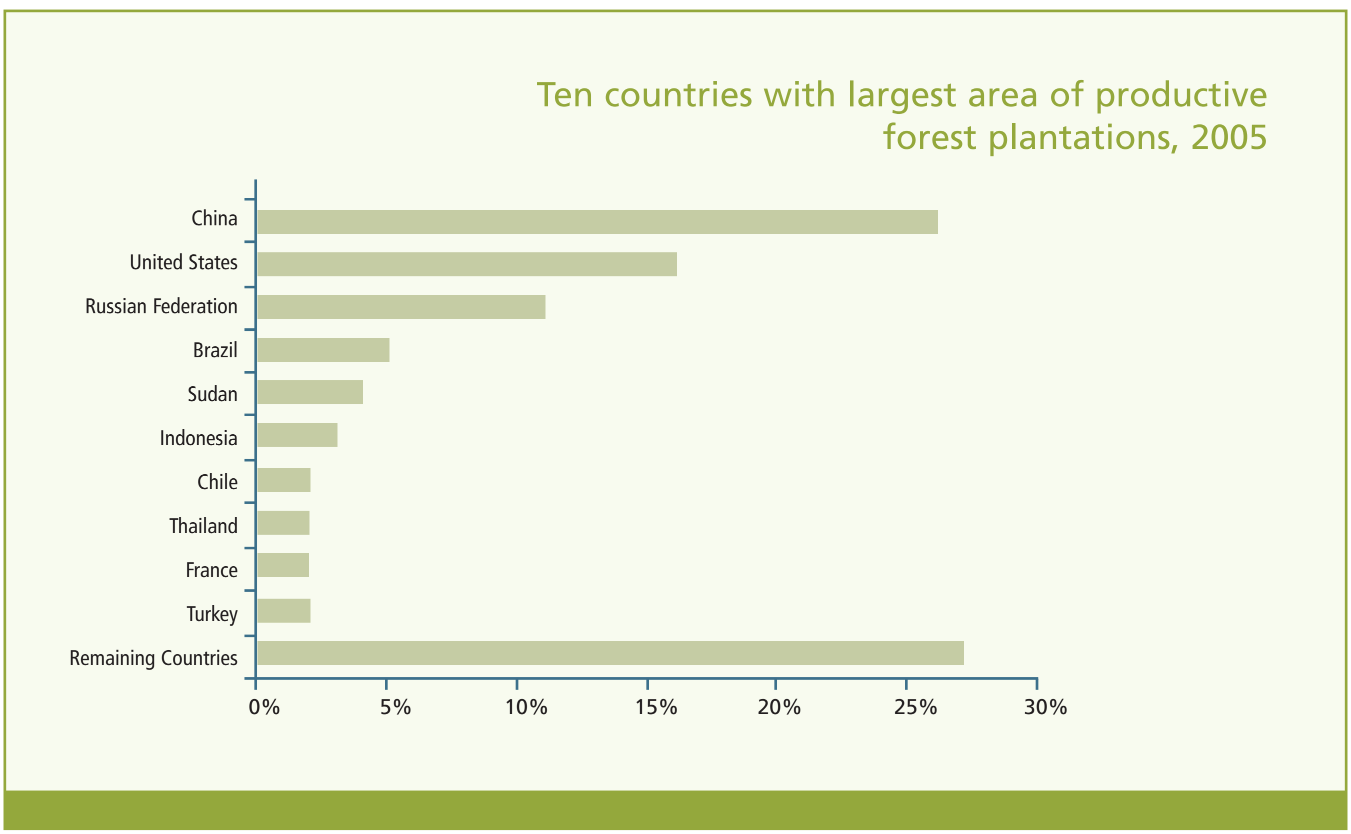
The term "industrial tree plantation" is equivalent to the term "productive forest plantation" used by the Food and Agriculture Organization of the United Nations (FAO). FAO defines these as forests of introduced species, and in some cases native species, established through planting or seeding, with few species, even spacing and/or even-aged stands. The Forest Stewardship Council (2003) defines plantations as "forest areas lacking most of the principal characteristics and key elements of native ecosystems, which result from the human activities of planting, sowing or intensive silvicultural treatments."

When natural forests are clearcut and converted to establish a single-species industrial tree plantation, the diverse natural vegetation and the accompanying wide variety of wildlife habitat it provides, is significantly reduced or lost altogether. World-renowned Harvard biologist E.O. Wilson estimates that compared to a natural forest, the plantation that replaces it contains 90 to 95 percent less diversity (Williams). Industrial tree plantations also require heavy use of synthetic herbicides, pesticides and fertilizers, and their expansion is correlated closely with environmental risks associated with these chemicals (for details, see the section below, Use of Synthetic Chemicals).

The net climate change impacts of plantations are another cause for concern. Globally, forests are among the largest reservoirs of carbon and absorb carbon much faster than oceans (Adams). However, industrial tree plantations established at the expense of natural forests may exacerbate climate change, as demonstrated in recent research by Sohngen and Brown. These researchers found that pine plantations do not retain carbon as efficiently as hardwood or natural pine forests and concluded that the increase in the number of pine plantations in the southern United States will likely contribute to a rise in carbon dioxide, a key greenhouse gas, in the atmosphere.

Globally, 269 million acres (109 million hectares) of land were managed as industrial tree plantations in 2005, according to FAO's Global Forest Resource Assessment. This study found that 197 million acres (79.5 million hectares), or 73 percent of the total global area of industrial tree plantations, are concentrated in just 10 countries (Figure 22). More than half the

Figure 22. Ten countries with largest area of productive forest plantations, 2005



Source: FAO 2005.

world's industrial tree plantations are in China, the United States and the Russian Federation.

Unfortunately, reliable global information specific to land use prior to the establishment of plantations is lacking. Without this monitoring and reporting, exact global numbers on natural forest conversion are difficult to ascertain. However, it is possible to highlight information on the scope and rate of expansion of plantations worldwide, and to report what percentage are being managed by certification standards that will not certify plantations converted from natural forests after 1994. Additionally, case study information can point toward the areas where this issue must be addressed by producers, purchasers and governments. Better national monitoring and increased research into this question are required to improve the accuracy of this indicator.

Indicator: Rate of conversion of forests to plantations

Industrial tree plantations are being established at a growing rate, but there is inadequate data tracking land use prior to the establishment of these plantations.

There is no debate that rapid expansion of industrial tree plantations in the last half-century has led to displacement of biologically diverse natural forests. However, the exact degree to which this displacement is occurring is unknown because inadequate data and research exists about how the land was used before the plantations were established. In lieu of this, we can report on the rate of establishment of plantations, and draw conclusions from existing regional examples and anecdotal evidence.

RATE OF ESTABLISHMENT OF PLANTATIONS

Seventy-one percent of the global annual increase in industrial tree plantations was generated by growth in three countries or areas: China, the Russian Federation and the United States. China represented the largest annual increase in the last five years; plantation area increased from 54 million acres (21.8 million hectares) in 2000 to 70 million acres (28.5 million hectares) in 2005, an annual growth rate of 5.6 percent. In the Russian Federation, industrial tree plantation area increased from 26.5 million acres (10.7 million hectares) in 2000 to 29 million acres (11.9 million hectares) in 2005, an annual increase of 2.1 percent. During the same period in the United States, plantation area increased from 40 million acres (16.3 million hectares) to 42 million acres (17.1 million hectares), an annual growth rate of 0.9 percent. The next seven countries in terms of highest increase in plantation area are Vietnam, Indonesia, Chile, Australia, Portugal, Republic of Korea, and Turkey (FAO 2005).

See Appendix B for a discussion of three examples of areas experiencing rapidly expanding plantations: the United States, Chile and Australia. These examples illustrate the natural forest conversion occurring in areas with endangered and high conservation value forests.

Indicator: Percentage of plantation area certified by Forest Stewardship Council

As of May 2007, FSC had certified 18,780,009 acres (7,600,000 hectares) of plantations, amounting to almost 7 percent of the total plantations worldwide. It had also certified an unknown percentage of the 88,463,727 acres (35,800,000 hectares) included in its "mixed" category (FSC, 2007a).

The Forest Stewardship Council is unable to provide the exact amount of certified plantation area because some of its data is classified as mixed, which includes forestry operations with both plantations and natural forests. FSC's standards for the management of plantations include a provision that prohibits certification of any plantation that was converted from forest after 1994. For a full description of the FSC's plantation standards, go to www.fsc.org/plantations.

Indicator: Number of corporate commitments to avoid conversion of forests

As of May 2007, there were six major U.S. purchasers and one supplier with corporate commitments that advance the Common Vision's goal to eliminate conversion of forests to plantations.

Corporate commitments to examine the chain of custody of forest and paper products to avoid conversion or give preference to suppliers who avoid conversion have recently found growing support. For example, Office Depot states in its paper procurement policy, "Office Depot believes that species conversion and ensuing simplification of natural forests that results from replacing naturally diverse forests with monoculture plantations counters our commitment to environmental stewardship and efforts to conserve natural resources. Office Depot is committed to working with our stakeholders to phase-out the use of wood fiber sourced from such areas."

Other major purchasers with similar specific policies of avoidance, and/or preference for alternatives to conversion include Bank of America, Lanoga Corporation, North Pacific Group, Cascade Wood Products and BMC West. On the supply side, Bowater Inc., the largest newsprint manufacturer in the southern United States, has committed that its southern U.S. operations will eliminate the practice of conversion on its own lands, as well as end the purchase of third-party fiber from converted lands (Bowater).

WHAT THESE INDICATORS MEAN

The pulp and paper industry is increasingly relying on fiber derived from intensively managed tree plantations that are supplanting natural forests on a widespread scale. Achieving sustainability in the pulp and paper industry will require:

- Reducing demand for virgin raw material through manufacturing efficiency, consumer efficiency, recycling and use of non-wood fibers.
- Managing existing plantations according to the highest certification standards.
- Ending the practice of converting natural ecosystems to industrial plantations.

Purchasers and producers of pulp and paper products should:

- Develop institutional policies to avoid the practice of converting natural forests to plantations.
- Examine their paper fiber supply chain to learn about its sources and insist upon the highest certification standards for any fiber from plantation management.
- Work with organizations and companies that can manufacture and use pulp and paper more efficiently and meet their needs from sustainable sources.

This report also reveals:

- A deficiency of data available on land use prior to the establishment of timber plantations.
- A deficiency of current data on the end use of wood and fiber harvested from plantations worldwide.
- A need for more understanding of the social conflicts associated with the establishment of plantations on other land uses in addition to natural forest.

ENVIRONMENTAL PERFORMANCE INDICATORS: USE OF SYNTHETIC CHEMICALS

Common Vision goal: Eliminate widespread industrial use of pesticides, herbicides and fertilizers in plantations and fiber production.

To ensure that a natural forest does not regenerate on an industrial tree plantation, plantation managers typically turn to synthetic herbicides that reduce competition from other species and synthetic fertilizers that promote the growth of plantation trees. On a smaller scale, herbicides are also sometimes used in natural forest management systems to control competing or invasive species. In the context of paper production, herbicide use is primarily associated with plantation management. The application of these chemicals has many negative consequences, including impacts on human health and plant and wildlife habitat.

For these reasons, Environmental Paper Network's Common Vision calls for a reduction or elimination of the use of chemicals in forestry operations. Progress toward this vision can be measured by a reduction in overall chemical use, a reduction of acreage sprayed or a reduction of the overall acreage of plantations in existence, as the intensive use of chemicals is inextricably linked to intensive plantation management.

Indicator: Use of herbicides on tree plantations

No publicly available data exists on the global application of chemicals in forestry operations. Data from the southern United States illustrates the extensive use of chemicals in managing plantations, where the U.S. Forest Service estimates that herbicides are applied to approximately 2 million acres (800,000 hectares) of industrial tree plantations annually (Wear and Greis).

While exact figures on worldwide application of chemicals on plantations are not available, worldwide there are approximately 269 million acres (109 million hectares) of industrial tree plantations (FAO 2005). Chemicals are used in the management of industrial tree plantations around the globe to select for species including loblolly pine, radiata pine and eucalyptus.

Impacts on human health

The most common herbicides used in forestry are glyphosate, hexazinone, triclopyr, sulfmeteron methyl, metsulfuron methyl and imazapyr (Virginia Department of Forestry). Chemicals are applied manually and by aerial application, which has a high chance of unintentionally drifting beyond target areas to neighboring properties.

These are all water-soluble, broad-spectrum herbicides. They are nonselective, and affect everything they come in contact with, sometimes sterilizing the soil. Many of these chemicals pose a human health threat due to irritation, especially of the skin, eyes and respiratory system. Glyphosate is a known carcinogen and has been linked with non-Hodgkin's lymphoma; long-term exposure is associated with kidney damage and reproductive effects (EPA, 2006). Appendix C contains a table with information on the known effects of the common herbicides.

Unfortunately, the data on risks associated with herbicide use on plantations is incomplete and far from comprehensive.

Workers spraying chemicals manually, or people exposed through drift from aerial spraying operations, are at risk. Most of the studies on the human health risks of these chemicals are based on observations, in isolated and controlled settings, of only the active ingredient (for example, glyphosate). But real-life exposure occurs in the environment where interactions between chemicals can occur. Carcinogenic activity and the health effects of multiple herbicides mixed together with surfactants and other chemicals are unknown.

Some ingredients present in chemicals may have risks, even when labeled as inert. According to Cox and Surgan (2006), "Inert ingredients can increase the ability of pesticide formulations to affect significant toxicological endpoints, including developmental neurotoxicity, genotoxicity, and disruption of hormone function. Inert ingredients can increase the phytotoxicity of pesticide formulations, as well as toxicity to fish, amphibians, and microorganisms."

More research needs to be done on the human health effects of real-life exposure to pesticides and herbicides. Until then, the prudent approach for the forestry industry would be to minimize its use of these chemicals and follow the precautionary principle, which states that if the risks of a given activity are uncertain or potentially irreversible, then the burden of proof of the activity's safety should be on those advocating the activity rather than on the public (UNEP). Unfortunately, in the case of synthetic chemicals used in forestry operations, the precautionary principle is typically not followed.

Impacts on plant and wildlife habitat

Herbicides applied on tree plantations have the ability to kill many unintended plants and insects (Carrere and Lohmann). Decreased biodiversity can have numerous adverse ecological effects, including reducing the availability of food and habitat that certain species require to survive (U.S. Department of State).

Some herbicides used on tree plantations are also marketed as soil sterilants. This means that all living organisms, beneficial or not, are eliminated from the soil. This upsets the soil chemistry, and leads to erosion and nutrient leaching. It also eliminates the symbiotic relationship that naturally exists between plants and beneficial soil fungi, which allows nitrogen fixation to occur. The elimination of this natural system of nitrogen generation makes fertilization necessary where it normally would not be.

Indicator: Use of synthetic fertilizers on tree plantations

Nearly 10 million acres (4 million hectares) of plantations in the southern United States were fertilized between 1969 and 1999, which exceeds the sum of acres fertilized in the rest of the world (Wear and Greis).

As the establishment of industrial tree plantations has accelerated in the past decade, so has the use of chemical fertilizers. According to the Southern Forest Resource Assessment, the 34 million acres (13.8 million hectares) of planted pine in the southern United States will likely be fertilized at least twice during a 20 to 30-year rotation (Wear and Greis). This fertilized area is expected to double in the next 40 years, corresponding to the increase in plantation acreage.

To reach their full growth potential, trees need enough essential nutrients. Two vital limiting nutrients are phosphorus and nitrogen. When growing in plantations, trees cannot always obtain the required amount of nutrients from the surrounding area. In some cases, essential nutrients may not be naturally present in the surrounding ecosystem. In other cases, nutrients can become depleted when similar crops are planted year after year in the same soil. This is now being observed not only on cropland, but also on industrial tree plantations (Bowyer et al.; NASA).

To provide essential nutrients, plantation managers often turn to synthetic fertilizers. The two most common fertilizers are dried urea, which provides nitrogen, and diammonium phosphate, which provides both nitrogen and phosphorus. Variable winds make drift from aerial application a significant issue and it is common for aerial spraying to affect areas that were not intended for fertilization. Fertilizer runoff into lakes and streams can also alter the chemical balance of the water, making the habitat unsuitable for its natural inhabitants (Wear and Greis). For more information, see Appendix C.

Further, in most of the states in the southern United States, few or no laws exist to require buffer zones around day care centers, residences or other human communities. While comprehensive reports are not available, community organizations in the southern United States such as Save Our Cumberland Mountains record personal accounts of people living near pine plantations in Tennessee's southeastern counties describing serious health effects after chemical exposure. Symptoms included breathing difficulty, nose bleeds, skin irritation, eye problems and other conditions indicative of toxic chemical exposure. Several people required hospitalization after exposure. Most of the affected people live in rural areas near large-scale clear cutting operations where airplanes apply fertilizers.

WHAT THESE INDICATORS MEAN

- There is a lack of publicly available information about the extent of chemical use in forestry operations and the complete, compounded risks to humans and the environment associated with chemicals used.
- In the short term, plantation owners and managers should immediately establish buffer zones from riparian areas and neighboring landowners. Whenever possible, aerial spraying of chemical pesticides, herbicides and fertilizers should be avoided completely and, when it is necessary, caution should be employed to strictly adhere to no-spray buffer zones and minimize aerial drift. Land owners and managers should also provide information on the chemicals applied to the local community and provide community notification prior to any spraying.
- In the long term, purchasers, suppliers, and plantation owners and managers should work to reduce the total volume of chemical pesticides, herbicides and fertilizers used.
- The Forest Stewardship Council provides guidelines for minimizing chemical use. An increase in the number of companies certified by the FSC will result in a reduction in chemical use.

ENVIRONMENTAL PERFORMANCE INDICATORS: GENETICALLY ENGINEERED TREES

Common Vision goal: Stop the introduction of paper fiber from genetically modified organisms, particularly transgenic trees and plants with genes inserted from other species of animals and plants.

To meet rising global demand for paper products, the pulp and paper industry has teamed up with the biotechnology industry to identify methods of producing more raw materials faster. Research and experimentation with genetically engineered (GE) trees has been conducted over the past two decades as one method of increasing production, despite serious risks posed to the world's remaining natural forests. Environmental concerns are associated primarily with the unpredictable effects of releasing GE pollen or plants into natural ecosystems and the disruption of plant and wildlife habitat. Due to the long lifecycles of trees and the ability of pollen to travel tremendous distances, it is very hard to accurately monitor and predict the long-term implications of utilizing GE trees. It is imperative that the risks of genetic engineering be thoroughly assessed before experimentation with GE trees in North America or other regions proceeds any further.

For the most part, GE forest trees are currently in a research stage, and to date in North America they have only been planted in field trials. China is the sole country where GE forest trees are in commercial application and will likely be used for paper products once the trees reach maturity. The rest of the world has not yet approved commercial use of GE forest trees. For the purpose of this report, we have included only a discussion of GE tree species that could be used in timber production and omitted an analysis of GE fruit trees.

Genetically engineered trees are transgenic organisms, which means they have been altered by inserting genes from another organism into the trees' genetic material. This technology is a radical departure from traditional agricultural breeding programs, when breeders could only cross plants of the same species or of closely related species. Genetic engineering allows scientists to modify trees by inserting genetic material from another tree of the same species, from another tree species, or from another species of plant or animal altogether, in order to create new DNA sequences that express certain traits in the trees. Traits that are the focus of genetic engineering efforts in trees include herbicide resistance, insect resistance, disease resistance, lignin reduction and faster growth.

The introduction of genetically engineered trees poses many serious concerns for natural forests, including these issues:

- Herbicide-resistant genes promote increased herbicide use, which can have negative impacts on nontarget species and human health (see the section above on herbicide use). Insect resistance is engineered by introducing the bacterial pesticide Bacillus thuringiensis (Bt) into tree species. The primary risks are the killing of beneficial insects and microorganisms and the threat that "super pests" will evolve to withstand Bt (Petermann and Tokar). Similarly, introducing disease-resistant traits could eventually cause new and more powerful epidemics while altering soil ecology (Sampson and Lohmann).
- Lignin reduction is a desirable trait for the paper industry because it could allow a cheaper and less chemically intensive pulping process. However, lignin provides structural support to trees, and research has shown reduced-lignin trees to have stunted growth. Sampson and Lohmann report that "because lignin protects trees from feeding insects, low-lignin trees are also likely to be more susceptible to insect damage, leading to pressures to increase pesticide use. Low-lignin trees will also rot more readily—affecting soil structure, fertilizer use, and forest ecology—and will release carbon dioxide more quickly into the atmosphere." These problems threaten native ecology primarily in the event of contamination of natural forests, where structural support is critical to the longevity and composition of a forested ecosystem that needs to withstand storms, insects and other natural factors.
- Faster tree growth means more rapid use of soil nutrients and water resources. Managing plantations more intensively puts a strain on water resources and depletes soil productivity, requiring increased use of fertilizers.

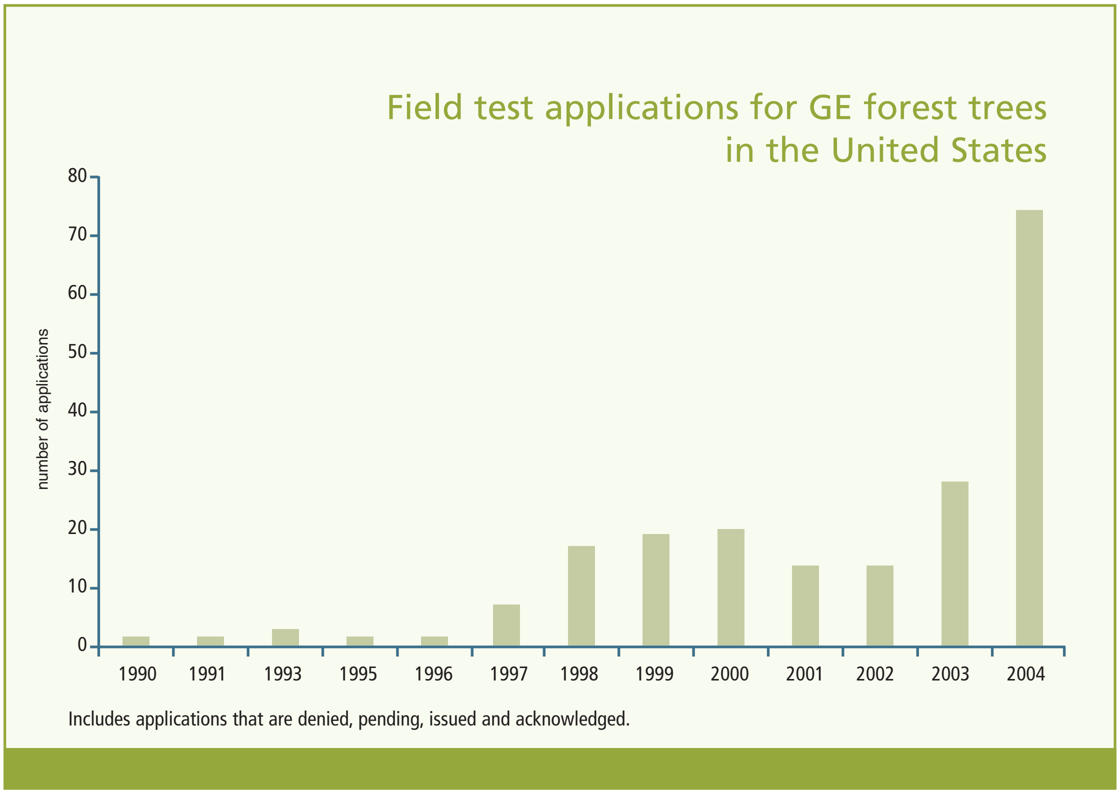


Figure 23. Field test applications for GE forest trees in the United States

Source: FAO 2004.

‣ Concerns about GE trees are inherently linked with the problems of industrial management of plantations and the loss of natural forests for the establishment of plantations. GE trees are being developed with the intent of being used in large-scale, commercial operations and often such plantations come at the expense of natural forests.

‣ Commercial production of GE trees is also expected to exacerbate the negative social and economic impacts associated with industrial forestry. These include monopolization of fiber markets and concentration of production, which makes production cheaper for the large companies and further decreases the competitiveness of small-scale, sustainable forest managers. This causes reduced opportunities for value-added processing, and declining economic benefits to forest workers and forest communities (Bailey, Sinclair and Dubois). Further, contamination of nearby woodlots with the low-lignin trait could devastate small-scale sawtimber operations and lead to property rights disputes because of the patents held by corporations on the engineered genes.

‣ Lastly, but perhaps most importantly, research into sterility technologies in genetically engineered trees is extremely controversial. Sterility technologies include terminator technology, or producing sterile seeds, as well as non-flowering and non-pollinating traits. As Petermann and Tokar state, "engineering trees to be sterile is a lose-lose proposition." If it works, sterile plantations will not have the capacity to support wildlife that depends on fruit, nuts, seeds and pollen for food and should it fail, engineered pollen could affect natural ecosystems with irreversible impacts.

Indicator: Outdoor field trials of genetically engineered trees

At least 225 outdoor field trials of GE trees have been or are being conducted in 16 countries, including 150 in the United States.

FAO reports 225 outdoor field trials, or test plots, of GE trees worldwide in 16 countries (FAO 2004). One hundred fifty are in the United States, with the remainder mostly in Europe, Britain, Canada and Australia. Field tests are also taking place in India, South Africa, Indonesia, Chile and Brazil. China is the only country known to have developed commercial plantations of GE trees, beginning in 2002, with well over one million insect-resistant poplars planted throughout ten provinces. Global Justice Ecology Project reports that "Most of the research is being focused on poplars (47 percent), pines (19 percent) and eucalyptus (7 percent)."

Figure 23 indicates the number of field trials of GE trees that have taken place each year. Currently, the U.S. Department of Agriculture regulates the field trials of GE trees. However, in most cases USDA simply acknowledges field test applications but does not require approval of permits for most GE tree field trials. Before GE trees are allowed into commercial application, USDA would need to undertake a public comment period and environmental review and likely deregulate the planting of GE trees.

WHAT THESE INDICATORS MEAN

Due to the high risk of genetically engineered trees having a negative impact on global forest biological diversity, Environmental Paper Network's Common Vision adopts the precautionary approach and supports a ban at this time on introducing genetically engineered trees into the environment. EPN encourages paper buyers and NGOs to:

- Advocate to pulp and paper companies that they do not field test or use GE trees.
- Encourage the USDA to invest in a risk assessment analysis to establish the foundation for a credible scientific debate.
- Advocate for a ban on genetically engineered trees by the United Nations Convention on Biological Diversity.

ENVIRONMENTAL PERFORMANCE INDICATORS: NON-WOOD PLANT FIBER

Common Vision goal: Use alternative crops for paper if comprehensive and credible analysis indicates that they are environmentally and socially preferable to other virgin fiber sources.

There is significant untapped market potential in the use of non-wood plant fibers for pulp and paper production. The non-wood plant fiber category is very large. It includes annual crops dedicated to producing fiber (referred to as "on-purpose"), perennial crops such as bamboo and switch grass (on-purpose), and the hundreds of millions of tons of agricultural residues left after harvest (referred to as "residue").

There are two primary external drivers to the potential market shift toward non-wood fibers: market demand for eco-friendly paper options and technological innovation. Global demand for pulp and paper is projected to increase significantly, particularly in Asian markets. Concurrent with rising demand, the pulp and paper industry is at a crossroads in its fiber sourcing: either exploit the world's intact forests to depletion, or in addition to maximizing the use of post-consumer recycled fiber, develop and adopt the technological infrastructure to produce pulp and paper from environmentally preferable non-wood sources.

Replacing wood fiber with non-wood options, such as agricultural residues, delivers numerous advantages for paper production. Compared to wood fiber, the pulping process for non-wood fibers requires less water. It also requires shorter cooking times, which reduces energy consumption. The use of non-wood fibers also alleviates stresses on intact and endangered forest ecosystems, as paper manufacturers can meet their fiber needs while reducing their reliance on wood fiber. It also provides alternative economic options for rural communities by offering a value-added element to byproducts of grain harvests.

Both on-purpose and residue non-wood pulps can be blended with multiple types of fiber including other non-woods, recycled and sustainably managed wood pulp, to develop paper characteristics that suit the grade, cost, environmental and performance requirements. In addition to versatility of application, non-wood fibers are widely available; 262 million metric tons of non-wood plant fibers are theoretically available in North America for papermaking, including nearly 93 million metric tons of straw. Globally the volume of non-wood fiber suitable for the pulp and paper industry is estimated to be 2.5 billion metric tons. Given that less than 10 percent of the currently available non-wood fibers are used for pulp production today, there is a lot of scope for increased utilization.

Currently most of the non-wood paper production in the world is in developing nations. Technological innovation in this field has been happening in Europe and North America, but its application in these production regions has been slow due to a reliance on wood fiber. The historical lack of interest in non-woods in North America and Europe has meant that far less research and development funds have been dedicated to creating efficient and clean pulping processes for non-woods than for wood. And even less has been dedicated to building non-wood mills. It is in Asia and South Asia that non-wood fiber paper technology has primarily been adopted.

China recently built mass-scale production of non-wood paper using both their own and Finnish technologies and India has added energy efficient non-wood pulping into their production. Because there has been comparatively little research and development funds dedicated to environmentally sound, energy—and chemical-efficient non-wood pulping, there are few examples of mills producing commercial-grade papers that have been built that meet the environmental standards of Europe or North America. The performance of these new mills built in India and China that are pioneering environmental technologies deserve to be watched, as will a few other North American and British technologies currently being trialed.

However, the use of non-wood plant fibers presents challenges to the pulp and paper industry. Non-woods are generally bulkier and lighter than wood. Their composition is low in lignin and hemicellulose content, and higher in minerals such as silica that need to be dealt with in the pulping process and/or black liquor. The fibers also are quite different from wood and from each other—providing different length, shear and tensile qualities to the papermaking process. Plants such as flax, abaca, hemp and kenaf contain bast fibers that are upwards of 15 times the length of softwood fibers. Cereal straw fiber lengths are equivalent to eucalyptus. Different plant types require different processing and pulping systems than wood. Once pulped, these fibers can be fed into traditional papermaking streams.

The reports cited in this section precede the growing trend of major commercial paper consumers in North America setting purchasing policies that specify preference for non-wood fiber content in paper for environmental reasons. This trend is gaining traction in Europe as well and could result in environmental markets determining non-wood investment over the coming years. As familiarity with the quality and performance of non-wood papers grows in Europe and North America to match market acceptance of these papers in Asia, major buyers will increasingly ask for commercial grade non-wood content paper. At this time there is insufficient commercial production of non-wood papers to meet that demand in the West. With paper consumption projected to increase, regional wood shortages occurring, and decreasing market tolerance for wood from the world's remaining endangered forests, non-wood plant fibers are destined to become a common commercial paper fiber worldwide.

Indicator: Leading non-wood fibers in papermaking

Straw is the most common non-wood fiber currently used for pulp and paper, accounting for 46 percent of total production.

Table 5. Total global papermaking pulp capacities of leading non-wood fibers

Raw Materials	Total papermaking pulp capacities (thousand metric tons) 1985	1988	1990	1993	2000proj.	2010proj.
Straw	6,166	5,260	7,623	9,566	12,318	17,014
Bagasse	2,339	2,267	2,646	2,984	3,516	4,387
Bamboo	1,545	1,674	1,468	1,316	1,137	807
Miscellaneous (cotton, reeds, sisal, jute, hemp, abaca, kenaf, flax)	3,302	6,366	6,870	6,870	10,168	14,276
Total papermaking non-wood capacity	13,352	15,567	18,607	20,736	25,832	35,624
Total paper and paperboard production	178,558	225,887	238,939	250,359	312,056	397,780
Percentage non-wood	7.4%	6.9%	7.8%	8.3%	8.3%	9.0%

Sources: Atchison 1995; FAO 1997.

Indicator: North American pulping capacity for non-wood plant fibers

U.S. production and use of non-wood plant fibers have declined over the past 30 years and in Canada there are currently no commercial non-wood pulping facilities. During 1991, total production of non-wood plant fiber pulps in the United States accounted for about 240,000 metric tons out of a worldwide pulp production in excess of 57 million metric tons.

According to Atchison (1992), in the United States market, the economics of pulp production have favored wood, and hence the production and use of non-wood plant fiber pulps have declined over the past 30 years, but there is renewed interest in non-wood plant fibers and new capacity is slated to be built in the United States. In Canada, one pulp manufacturer has completed a successful feasibility study, a second is considering non-wood pulping infrastructure, and a third has achieved financing for new mill infrastructure.

In 1998, the United States made up between 0.5 and 1 percent of the world's total non-wood pulping capacity of 17.7 million tons. Non-wood pulping made up less than 10 percent of the United States' total pulping capacity (Conservatree 2005). This U.S. tonnage consisted mainly of pulp for specialty papers that sell at a high price, including cotton fiber for currency and other specialty papers, cotton linters and flax straw for cigarette paper, bagasse for insulating board, and abaca (manila hemp) and other specialty fiber pulps for products such as tea bags, filter papers and sausage casings.

Indicator: World pulping capacities for non-wood fiber

Asia accounts for 86 percent of the world's total non-wood pulping production. North America and Europe combined account for less than 4 percent (Ince).

Total non-wood pulp and paper production globally is approximately 17.7 million tons, 85 percent of which occurs in China; much of the rest takes place in India, Thailand and Pakistan (Ince). Modest targets for increased non-wood pulp production, utilizing existing crops, project that by 2010, non-wood production could be over 80 million tons (Atchison 1995). More ambitious targets, such as Europe, North America and Russia utilizing non-woods for 10 to 20 percent of their pulp production, would make that over 120 million tons. Even replacing 5 to 10 percent of wood pulp with non-wood pulp would have an important impact on the conservation of forests and the environment (Mohta and Roy).

According to Mabee and Pande, China and India lead the use of non-wood fiber for papermaking. Table 6 shows estimated regional non-wood pulping capacities for 1993, and projected capacities for 1998.

Table 6. Regional non-wood pulping capacities

Region	1993		1998 (estimated)	
	Non-wood pulping capacity (000 metric tons)	% of world pulping capacity	Non-wood pulping capacity (000 metric tons)	% of world pulping capacity
Asia-Pacific	17,924	86.4	20,516	87.4
Latin America	1,466	7.1	1,511	6.4
North America	179	0.9	204	0.9
Europe	512	2.5	523	2.2
Africa	226	1.1	226	1.0
World Total	**20,736**	**100**	**23,471**	**100**

WHAT THESE INDICATORS MEAN

There remain substantial barriers to the mass commercialization of non-wood fibers for pulp and paper:

- Non-woods grow high volumes per acre in the same location annually but can be expensive to ship distances because of their bulk. Developing on-purpose and residue non-wood pulping capacity in countries with the fiber but without the infrastructure or tradition, will require a rethinking of the location of mills and ultimately an investment in new pulping technologies.
- The chemical composition of many non-wood plant fibers prevents them from being a simple plug-in to current pulping technology, which has been optimized to handle the chemical composition of wood fibers. New pulping systems will need to be built into existing mills or new facilities built. The non-wood pulp can then feed into conventional papermaking systems.
- Under proper pulping conditions, stalks from grasses and grains yield a strong, high quality fiber that can replace the hardwood pulps used to produce printing & writing papers and corrugated board. Most research efforts are devoted to this type of fiber because of greater economic returns. Little research has been done in North America to date on incorporating this fiber source into the production of cheaper publication papers, such as newsprint.

Strategies for government and industry stakeholders:

- Government policies and corporate business models will be a critical determinant of whether there is a global shortage in paper fiber supply in the not so distant future. Done with alacrity, countries could not only avert a paper fiber shortage, they could also develop non-wood's production capacity ahead of the downward curve, to conserve endangered forests.
- A key first step to the commercialization of agricultural residues in pulp and paper production is for government and industry to increase research into efficient pulping and testing of agricultural fiber pulp qualities. Included in this body of work are technology developments for outstanding processing issues such as de-silication and black liquor treatment.
- Government and industry also need to jointly invest in nationwide strategies for developing non-wood pulping capacity. This includes looking into potentials for new mill infrastructure, add-on infrastructure to existing mills located near agricultural areas and bioregional mill designs. Partnerships with private sector financing will be critical in this stage of project rollout.

Strategies for environmental non-governmental organization (ENGO) stakeholders:

Thorough ecological footprint and lifecycle analyses should be conducted to resolve questions about the environmental benefits of using on-purpose and residue non-wood fibers in pulp and paper. While there is broad support within the environmental community for using agricultural residues in paper, on-purpose non-wood fiber requires further research. Additionally, attention should be paid to ensure that the amount of straw removed from a farm does not contribute to soil degradation. ENGOs should insist on this analysis prior to mills moving forward with the assumption of environmental approval.

ENGOs are in position to direct markets toward non-wood paper content. This can have a positive effect on the investment climate for non-wood pulping infrastructure if it is communicated in a coordinated fashion to the industry.

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1 For more information, see www.eyesontheforest.or.id.
2 For a description of rare and vulnerable ecoregions, see WWF's Ecoregion website at www.panda.org/about_wwf/where_we_work/ecoregions/about/index.cfm.
3 Hannon and McCallum define focal conservation species as "small number of species whose distributions and abundances are well known; used in conservation planning; assumed to reflect the distribution and abundance of the regional biota; subsumes indicators and umbrella species."
4 Native forests are indigenous forest types, or forests where the range of species is natural to the region. These forests can be old-growth forest, primary forest or secondary forest that has already been logged, but retains a natural species range.
5 See www.worldwildlife.org/wildplaces/about.cfm.

CHAPTER FIVE

CLEANER PRODUCTION

Common Vision Goals:

- *Minimize the combined impacts of water, wood and chemical usage, as well as air, water, solid waste, and thermal pollution across the entire paper productios system including: fiber production/sourcing, pulping, production, transportation, use disposal.*
- *Eliminate harmful pulp and paper mill discharges and the use of chlorine compounds for bleaching.*

OVERVIEW

This section presents the major indicators of environmental impact of the manufacturing phase of the paper lifecycle. While the indicators themselves are valid globally, aggregate global data on paper industry emissions are difficult to come by. Therefore, industry-level data reported in this section are from paper mills in the United States.

Thanks to environmental regulations, notably the Clean Air Act, the Clean Water Act, the Endangered Species Act and the Cluster Rules, paper mills in the United States are significantly cleaner than they were a few decades ago. Gone are the days when paper mills routinely dumped untreated effluent into rivers and streams, and when the rotten-egg smell of sulfur compounds hung like a blanket over paper mill towns.

But pollution remains a fact of life for the paper industry, given its resource and chemical intensity, and paper continues to rank at or near the top among manufacturing industries for resource intensity, and releases to air and water.

ENVIRONMENTAL PERFORMANCE INDICATORS: CLEANER PRODUCTION

Resource Inputs

Indicator: Wood use

Paper production is responsible for over forty percent of the world's total wood harvest (Abramovitz and Mattoon).

Even with advances in recycling over the past two decades, the primary fiber input into papermaking is still trees. In the United States, 38 percent of the industrial wood harvest, or 228 million tons, is used to make paper (Paperloop). The impacts of commercial forestry to produce this much wood are discussed in the section on Responsible Fiber Sourcing.

Indicator: Water use

The paper industry is the largest user per ton of product of industrial process water in the United States.

The paper industry is the largest user per ton of product of industrial process water in the United States (U.S. EPA, 2002). A typical mill producing virgin bleached chemical pulp uses between 4,000 to 12,000 gallons of water per ton of pulp produced (U.S. Department of Energy).

Water use is of increasing concern due to problems with freshwater scarcity in many parts of the world, exacerbated by global warming which may cause flooding in some areas, droughts in others, and shifts in the times of year when rain falls. By 2025, roughly 5 billion people may live in water-stressed regions where global warming effects could further reduce groundwater recharge and streamflow (Karas). Depending on where they are located, paper mills' heavy reliance on process water may contribute to water scarcity in those regions. Moreover, the withdrawal and return of large amounts of water from rivers and streams can have major ecological impacts, which are made even worse at drier times of year and during droughts.

Indicator: Energy use

The paper industry accounts for over 12 percent of total manufacturing energy use in the United States.

In addition to water, it takes a tremendous amount of energy to turn a tree into paper. The paper industry accounts for over 12 percent of total manufacturing energy use (Martin et al.). In 1998, the pulp and paper industry accounted for 84 percent of total fuel energy use in the forest products industry at 2.7 quadrillion Btus (U.S. Energy Information Administration 2004).

Paper mills draw energy from a variety of sources, including purchased electricity or fossil fuels, and the burning of wood-derived process waste (sometimes called biomass). Because no energy source is free of environmental impacts, the most important indicator is total energy use, regardless of the source.

Indicator: Calcium carbonate use

Calcium carbonate use in paper quadrupled between 1992 and 2000, and now makes up over 50 percent of all fillers used in paper production.

Calcium carbonate, or crushed marble, is increasingly used as a filler in many kinds of paper. Calcium carbonate use quadrupled between 1992 and 2000, and now makes up over 50 percent of all fillers used in paper production. While it does reduce reliance on virgin tree fiber, it comes with its own environmental impacts, which include land-use and industrial impacts on communities where quarries and processing plants are located, large-scale water extraction, toxic releases and waste disposal (Vermonters for a Clean Environment). For more information, visit www.vce.org/understandingomya.html.

RELEASES TO AIR

Indicator: Greenhouse gas emissions

The pulp and paper industry is the fourth largest emitter of greenhouse gases among manufacturing industries, and contributes 9 percent of total manufacturing carbon dioxide emissions (U.S. Energy Information Administration 2002; Martin et al.).

As one of the biggest industrial consumers of energy, it follows that paper is also one of the biggest emitters of carbon dioxide and other gases that contribute to climate change. Looking just at the manufacturing phase of the lifecycle, the biggest greenhouse gas releases come from energy production needed to power the pulp and paper mill.

Some types of mills—those that produce chemical, or kraft, pulp—are able to recover energy by burning the wood-derived process waste from pulp production. (This reflects the low yield of the chemical pulping process, where only 50 percent of the dry weight of the original wood ends up as usable pulp.)

This energy source, known as biomass, is sometimes characterized as a renewable resource (because trees can be regrown), or described as climate neutral (because the carbon released from burning that wood was originally absorbed by the trees as they grew). Both labels are deceptive, since no energy source is free of environmental impacts. Growing and harvesting trees for energy can deplete a non-renewable resource—natural forests—and can adversely affect water quality, biodiversity, habitat for endangered plants and animals, and the integrity of natural forest ecosystems (see the Responsible Fiber Sourcing section). Note that mechanical and recycled pulp mills do not have access to this energy source, so their purchased energy use and associated greenhouse gas emissions may be higher, on a per ton basis, than those for virgin kraft pulp.

Finally, a significant source of greenhouse gas emissions from the paper lifecycle is the decomposition of paper in landfills, which releases methane, a greenhouse gas with 23 times the heat-trapping power of carbon dioxide (UNEP). As discussed in the Maximize Recycled Content section of this report, switching to recycled paper can significantly reduce the climate impacts of paper production and disposal.

Indicator: Sulfur dioxide

The U.S. pulp and paper industry emitted 488,000 tons of sulfur dioxide in 2001. It ranks third by industry in sulfur dioxide emissions, behind ground transportation and fossil-fuel electric power production (U.S. EPA 2002).

Sulfur dioxide (SO_2) is a chemical compound produced when boilers burn fuel that contains sulfur. Of the fuels used in the paper industry, oil and coal generally contain the highest quantities of sulfur. In addition to being a greenhouse gas, sulfur dioxide can cause haze and acid rain. The environmental effects of acid rain include the acidification of lakes and streams, damage to forests, corrosion of buildings and machinery, and poor air quality, which in turn causes respiratory problems such as asthma and bronchitis.

Sulfur dioxide can also react with other chemicals and form tiny sulfate particles in the air that can lodge in people's lungs. These particles have been associated with increased respiratory disease, difficulty breathing and even premature death (U.S. EPA 2006c).

Indicator: Nitrogen oxides

The U.S. pulp and paper industry emitted 318,000 tons of nitrogen oxides in 2001. Pulp and paper production ranks fifth in industrial nitrogen oxide emissions, behind ground transportation, fossil fuel electric power, the stone, glass, clay and concrete industries, and oil and gas extraction (U.S. EPA 2002).

Nitrogen oxides (NOx, which include NO and NO_2) are products of the combustion of fuels in boilers. Nitrogen oxides contribute to two major pollution problems: smog and acid rain. NOx combine with volatile organic compounds and sunlight in the lower atmosphere to form ozone, a key component of smog. In moist air, nitrogen oxides can also form nitric acid, which is precipitated as a component of acid rain. The environmental and health effects of acid rain are described above, under sulfur dioxide.

Indicator: Particulate matter

In the U.S., pulp and paper production emitted nearly 150,000 tons of total particulate matter in 2001 and ranks fourth in particulate emissions behind ground transportation, fossil fuel electric power production, and the stone, clay, glass and concrete industries (U.S. EPA 2002).

Particulates are small particles that are dispersed into the atmosphere from combustion, either from producing the energy required to power the mill, or from the pulp and paper production process itself. The relevant indicator for pulp and paper mills is particulate matter (PM), which the U.S. EPA has identified as a criteria pollutant, and for which it has established maximum concentrations above which adverse effects on human health may occur. These threshold concentrations are called National Ambient Air Quality Standards (NAAQS) (U.S. EPA 2006a).

Pulp and paper mills are required by law to report releases of both coarse and fine particles (PM–10 and PM–2.5). In general, the smallest particles pose the highest human health risks. Exposure to particulate matter can affect breathing, aggravate existing respiratory and cardiovascular disease, alter the body's defense systems against foreign materials, and damage lung tissue, contributing to cancer and premature death (U.S. EPA 2006c).

Indicator: Hazardous Air Pollutants

The U.S. pulp and paper sector ranks fifth in releases of hazardous air pollutants, behind commodity chemicals, construction, petroleum refining and furniture.

Hazardous air pollutants (HAPs) are any of a group of 188 substances identified in the 1990 Clear Air Act amendments because of their toxicity. HAPs include pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects. The pulp and paper sector ranks fifth in releases of HAPs, behind commodity chemicals, construction, petroleum refining and furniture (Environmental Roadmapping Initiative), and are required by law to report their HAP releases (U.S. EPA 2002).

Indicator: Volatile organic compounds

The U.S. pulp and paper industry emitted 144,373 tons of volatile organic compounds (VOCs) in 2001. It is the fourth largest contributor of VOC emissions to the atmosphere by industry sector.

Volatile organic compounds (VOCs) are a broad class of organic compounds that are gases at room temperature, such as vapors from solvents. VOCs react with nitrogen oxides (NOx) to form ground-level ozone, the major component of smog and a severe lung irritant.

The pulp and paper industry is the fourth highest contributor of VOC emissions to the atmosphere by industry sector (U.S. EPA 2002). Methanol, a VOC that is a byproduct of pulp production, is one of the paper industry's highest-volume chemical releases, as reported on the Toxics Release Inventory for both fugitive air and point air emissions (U.S. EPA 2005). The 1990 Clean Air Act Amendments require pulp and paper mills to report their emissions of VOCs.

Indicator: Total reduced sulfur

Total reduced sulfur compounds cause the distinct odor associated with kraft pulp mills. According to the EPA Sector Notebook for the pulp and paper industry, "humans can detect some TRS compounds in the air as a 'rotten egg' odor at as little as one part per billion" (U.S. EPA 2002).

Exposure to total reduced sulfur emissions has been linked to symptoms including headaches, watery eyes, nasal problems and breathing difficulties. Total reduced sulfur emissions are regulated by new source performance standards (NSPS) under Section III of the Clean Air Act. Reducing the release of these components can improve the quality of life in the local community.

Indicator: Mercury

Some mercury is released when coal is burned by power plants to produce electricity to run paper mills. Another significant source of mercury is from the production of chemicals used in the pulping process. Some older chemical plants release significant amounts of mercury when making caustic soda, or lye, although the majority of caustic-soda manufacturing facilities use mercury-free processes. According to the Natural Resources Defense Council, "The pulp and paper industry is the single largest consumer of caustic soda worldwide, and paper suppliers and manufacturers thus have a large role to play in the marketplace to reduce mercury pollution problems from these sources" (NRDC). Specifically, paper purchasers should avoid suppliers that purchase pulping chemicals from facilities that use a mercury-based process. A list of these facilities is provided in Appendix D.

RELEASES TO WATER

Indicator: Dioxins and dioxin-like compounds

Pulp and paper ranks fourth among U.S. manufacturing industries in the release of dioxin and dioxin-like compounds to the air, and third in releases of these chemicals to surface water.

Dioxins and dioxin-like compounds (including furans) are a group of persistent, toxic substances that are produced when unbleached pulp is exposed to chlorine compounds. The National Toxicology Program has designated dioxins as known human carcinogens. (National Institutes of Health).

While replacing elemental chlorine with chlorine dioxide in bleaching processes (as U.S. mills were required to do in the late 1990s by the Cluster Rule) significantly reduces the generation of dioxins, it does not eliminate them. According to the U.S. EPA's Toxics Release Inventory (TRI), pulp and paper ranks fourth among U.S. manufacturing industries in the release of dioxin and dioxin-like compounds to the air, and third in releases of these chemicals to water (U.S. EPA 2006d). The TRI has included reporting parameters for dioxin and dioxin-like compounds since 2000, and mills are required to report their releases.

LOCAL INDICATORS

The next set of indicators measure pollutants released to a paper mill's receiving waters—typically, rivers or streams. The resulting environmental impact depends on local factors such as the volume and composition of pollutants released, and the volume and flow of the receiving waters. For this reason, aggregate industry data is typically not available, but a general explanation of the indicator is provided. These indicators are useful primarily for tracking a particular mill or company's environmental performance (see "How to use the indicators" at the end of this section).

Indicator: Biochemical oxygen demand (BOD)

Biochemical oxygen demand, or BOD, measures the amount of oxygen consumed by microorganisms in decomposing organic matter in stream water. BOD also measures the chemical oxidation of inorganic matter (that is, the extraction of oxygen from water via chemical reaction).

BOD directly affects the amount of dissolved oxygen in rivers and streams. The greater the BOD, the more rapidly oxygen is depleted in the stream. This means less oxygen is available to higher forms of aquatic life. The consequences of high BOD are the same as those for low dissolved oxygen: aquatic organisms become stressed, suffocate and die (U.S. EPA 2006b).

Indicator: Chemical oxygen demand (COD)

Chemical oxygen demand (COD) measures the amount of oxidizable compounds (composed of carbon and hydrogen) present in the water. Since an effluent-treatment system removes most of the organic material that would be degraded naturally in the receiving waters, the COD of the final effluent provides information about the quantity of more persistent substances discharged into the receiving water.

Indicator: Total suspended solids (TSS)

Total suspended solids (TSS) measure solid material suspended in mill effluent, which can adversely affect bottom-living organisms upon settling in receiving waters and can carry toxic heavy metals and organic compounds into the environment.

Indicator: Adsorbable organic halogens (AOX)

Adsorbable organic halogens (AOX) are an indirect measure of the quantity of chlorinated organic compounds in chemical pulp mill effluent, many of which are toxic and may persist in the environment. AOX is mainly an issue for bleached kraft pulp mills, which use chlorine compounds to brighten pulp.

Indicator: Total nitrogen and total phosphorus

Nitrogen compounds (such as nitrates, nitrites and ammonia) and phosphorus are nutrients that are added to the wastewater treatment process to aid in removal of dissolved organic material from the effluent. When present in excess amounts, nitrogen and phosphorus can have significant adverse effects on the quality of receiving waters, by causing dramatic increases in aquatic plant growth (known as blooms) and changes in the types of plants and animals that live in the waterway. Changes in algal communities can lead to blooms of toxic algae. The excessive algal growth can result in very low dissolved oxygen levels which can kill fish and other aquatic organisms.

Nutrient loading and its related impacts—including algae blooms and fish kills—are an increasing environmental problem in both inland and coastal waters. It is important to note that the problem of nutrient loading is different from the release of specific water pollutants, and therefore, the impacts of nitrogen releases are not fully captured by other indicators of releases to water such as BOD and COD.

Many paper suppliers routinely report both nitrogen and phosphorus releases; some are required to by law because of the impact of such releases both on local water quality and on water quality at distances downstream where loadings can accumulate, such as estuaries. Nitrogen is a problem in marine areas, while phosphorus is more of a problem with inland (fresh) water bodies.

Indicator: Effluent flow

Wastewater volume is a meaningful environmental measure, as it indicates both the amount of fresh water needed in production and the potential impact of wastewater discharges—that's why it's often regulated. The withdrawal and return of large amounts of water from rivers and streams can have major ecological impacts, which are made even worse at drier times of year and during droughts. And even treated wastewater carries with it various process-related pollutants (see BOD, COD, AOX, TRS above).

OTHER INDICATORS

Indicator: Bleaching processes used for all bleached pulp

The lion's share of environmental impacts from producing bleached kraft (chemical) pulp comes from the bleaching process itself. And the choice of bleaching process is a major factor in a mill's environmental performance. Thus, the bleaching process is not a specific environmental measure, but an indirect measure of mill efficiency and as such can be a useful proxy for a range of different environmental impacts. Advanced bleaching

Table 7. Common bleaching processes used by the paper industry

Process	How It Works	Environmental Advantage
Totally chlorine free (TCF) or processed chlorine free (PCF)	Completely substitutes oxygen-based for chlorine compounds.	Further improves quality of wastewater. Enables virtually complete recovery and reuse of wastewater.
Enhanced elemental chlorine-free (ECF) with ozone	Uses ozone as brightening agent in initial stages of bleaching process (final stage uses chlorine dioxide).	Further improves quality of wastewater. Reduces quantity of mill wastewater by 70% to 90% compared with traditional ECF. Enables recovery of most wastewater.
ECF with extended or oxygen delignification ("enhanced ECF")	Removes more of the lignin before bleaching, thus reducing energy and chemical use during bleaching.	Compared with traditional ECF, reduces energy consumption by 30%, improves quality of mill wastewater, and reduces quantity of mill wastewater by nearly 50%.
Elemental chlorine-free ("traditional ECF")	Replaces elemental chlorine with chlorine dioxide.	Improves quality of wastewater compared to elemental chlorine. Uses elemental chlorine to bleach pulp.
Elemental chlorine	Uses elemental chlorine to bleach pulp.	Phased out in the United States as of April 2001 per EPA's Cluster Rule.

Source: Environmental Defense 2001.

processes reduce the quantity and improve the quality of all environmental releases from pulp and paper mills. They also can reduce water use, by allowing more of the process water to be recirculated and reused prior to treatment and discharge.

While the environmental benefits of advanced bleaching processes would also show up under other indicators, identifying the bleaching process separately allows purchasers and others to recognize more easily which mills have installed pollution prevention technologies than a line-by-line comparison of individual impacts would allow.

Table 7 lists the most common bleaching processes used. Shaded rows represent environmentally preferable technologies.

While elemental chlorine bleaching has been phased out in the United States, it still accounts for 20 percent of the bleached kraft pulp production worldwide. About 75 percent of world bleached kraft pulp production is elemental chlorine-free (ECF), but significant variations in environmental performance exist within the ECF pulping processes. Only about 5 to 7 percent of world virgin pulp production is totally chlorine free, mainly because this technology requires a higher capital investment and is therefore found where environmental regulations are strongest and water scarcity is an issue (Reach for Unbleached Foundation). Deinked pulp used to make recycled paper is almost always brightened with hydrogen peroxide, so the environmental impacts of chlorine-based bleaching are not an issue.

Indicator: Solid waste

Solid waste from pulp and paper production may include noncombustible process waste, sludge from wastewater treatment, or in the case of recycled paper production, deinking mill sludge. (It is worth noting that the same inks, coatings and fillers present in recycling mill sludge would go into the ground anyway if the paper were landfilled instead of recycled.) Solid waste from pulp and paper manufacturing is dwarfed by the lifecycle contribution of paper to solid waste, when paper is disposed of in landfills and incinerators instead of being recycled.

How to use the indicators

There are a number of levels on which these environmental performance indicators may be tracked, depending on how the information is to be used.

Industry level

For policy and advocacy purposes on a national or global scale, it is most useful to track environmental performance indicators on an industry level. This also helps purchasers, NGOs and policymakers place the environmental performance of the paper industry in context, by allowing comparisons with other industry sectors on key indicators such as greenhouse gas emissions, energy and water use, and chemical releases.

Company level

Many of these environmental performance indicators are reported at the company level, often in paper companies' annual environmental reports, which roll up all of the individual impacts of the mills that the company owns. Tracking these indicators at the company level helps purchasers differentiate among suppliers on their environmental performance, and helps inform advocacy efforts to influence individual suppliers.

Mill level

These same indicators can be used by purchasers, advocacy groups and others to evaluate and compare the environmental performance of individual paper mills. Indeed, understanding a mill's environmental footprint requires ongoing tracking of the comprehensive set of indicators listed above. Paper purchasers can make environmental performance a key criterion in their choice of suppliers, and use an annual review of progress as a way to encourage continuous improvement. For this purpose, data for each indicator should be gathered in consistent units (for example, per ton of final product), so as to enable apples-to-apples comparisons across mills and over time. A sample form for evaluating paper mill performance is attached as Appendix E.

Tracking these indicators at the industry, company and mill level can highlight what's working, what needs attention, and what stakeholders can do to move individual paper suppliers, and the paper industry as a whole, toward cleaner, more efficient paper production.

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APPENDICES

APPENDIX A: LIST OF INDICATORS

Minimizing Paper Consumption

- Global Paper and Paperboard Consumption
  - By country or region
  - By paper grade
  - Per capita
- U.S. Paper Consumption
  - By grade
- U.S. Printing & Writing Paper Consumption
  - By end use

Maximizing Recycled Content

- North American Recycled Pulp
  - Percent of pulp made from recovered fiber
  - Volume of North American high grade deinking capacity
- North American Paper and Paper Products
  - Recycled content in papers and paper products, by sector and grades
  - Recycled content in printing & writing paper
  - Minimum content recycled fiber specifications and standards
  - Recycled paper choices available in each grade
- Recovered Fiber Sources
  - Paper in the U.S. municipal solid waste stream
  - Recovery rates by grade of paper
  - Recovery rate for office papers
  - Recovered high grade papers directed to "highest and best use"
  - Mixed paper in recovered paper collections vs. sorted papers
- Demand for U.S. Recovered Paper
  - U.S. exports of recovered paper
  - Recycling capacity in developing nations

Sourcing Fiber Responsibly

- Wood Fiber
  - Monitoring endangered and high conservation value forests
  - Stakeholder engagement and agreements
  - Protection of endangered forests and high conservation value forests
- Certification of Forest Products
  - Forest Stewardship Council (FSC) certification
  - FSC certified paper products reaching consumers
- Conversion of Forests to Plantations
  - Rate of conversion of forests to plantations
  - Percentage of plantation area certified by FSC
  - Number of corporate commitments to avoid conversion of forests
- Use of Synthetic Chemicals
  - Use of herbicides on tree plantations
  - Use of synthetic fertilizers on tree plantations
- Genetically Engineered Trees
  - Outdoor field trials of genetically engineered trees
- Non-wood Plant Fiber
  - Leading non-wood fibers in papermaking
  - North American pulping capacity for non-wood plant fibers
  - World pulping capacities for non-wood fiber

Employing Cleaner Production Practices

- Resource Inputs
  - Wood use
  - Water use
  - Energy use
  - Calcium carbonate use
- Releases to Air
  - Greenhouse gas emissions
  - Sulfur dioxide
  - Nitrogen oxides
  - Particulate matter
  - Hazardous air pollutants
  - Volatile organic compounds
  - Total reduced sulfur
  - Mercury
- Releases to Water
  - Dioxins and dioxin-like compounds
  - Biochemical oxygen demand
  - Chemical oxygen demand
  - Total suspended solids
  - Adsorbable organic halogens
  - Total nitrogen and total phosphorus
  - Effluent flow
- Other Indicators
  - Bleaching processes used for all bleached pulp
  - Solid waste

APPENDIX B: EXAMPLES OF NATURAL FOREST CONVERSION IN THE UNITED STATES, CHILE AND AUSTRALIA

UNITED STATES

In the southern United States, industrial tree plantations expanded 1,600 percent from 1953 to 1999. Monoculture pine plantations currently cover 32 million acres (13 million hectares), comprising 15 percent of all southern U.S. timberland, that is, land covered by trees. Between the 1980s and 1990s, forty-seven percent of pine plantations were established on land that was previously natural hardwood or mixed pine-hardwood forests and 28 percent of pine plantations were established on land that was formerly natural pine forests (U.S. Forest Service 2001).

In addition, experts estimate that by 2030 some 10 million acres (4 million hectares)—roughly the size of New Hampshire and Vermont combined—of mainly natural hardwood and natural pine forests will be chopped down to make way for pine plantations in just three states in the southern U.S. (Sohngen and Brown 2004). These researchers estimate that an area roughly equivalent to the size of Los Angeles, or about 333,600 acres (135,000 hectares), is converted to pine plantations each year in Arkansas, Louisiana and Mississippi.

CHILE

Economic incentives and national forestry policies in Chile have promoted the establishment of large-scale plantations of pine and eucalyptus for the domestic and export markets, often resulting in the clearing of native forest. The consequences have included a dramatic loss of biodiversity, soil erosion and changes in the water level of streams.

From 1985 to 1995, Chile lost 4.5 million acres (1.8 million hectares) of natural forest. These forests were destroyed largely to make way for industrial tree farms. As a result, Chile now has the world's largest expanse of radiata pine tree farms and some of the world's most endangered natural forests. Conservation International (2006) has designated these forests as one of the world's Top 25 Biodiversity Hot Spots. WWF has listed Chile's temperate forests as one of the Southern Hemisphere's top forest eco-region conservation priorities.

These forests will face increasing danger over the next 15 years as Chile's wood products industry pursues its plans to double plantation acreage from more than 5 million acres (2 million hectares) today to more than 10 million acres (4 million hectares) by the year 2020. Substantial additional subsidies for the planned expansion of these plantations are available under the newly extended version of Chile's Public Law 701 that will be in effect for at least 12 more years (Global Forest Watch 2002).

AUSTRALIA

Industrial tree plantations are expanding at the expense of natural forest in Tasmania and the Northern Territory. Tasmania is home to some of the most ancient and unique old-growth forests in the world. This includes Eucalyptus regnans—the tallest hardwood species in the world, in addition to being the planet's tallest flowering plant. Tasmanian forests comprised of these and other high conservation value species are one of the few remaining temperate rainforests in the world. These majestic forests provide a habitat for many animal species, such as the famous Tasmanian Devil, that can be found nowhere else.

A case study analysis of the Meander Valley in Tasmania completed in 2003 for Bushcare, an Australian Government program, found that the establishment of industrial tree plantations was the overwhelming driver of land clearing and loss of natural forest in the area (Cadman 2003). Across Tasmania, an average of approximately 25,000 acres (10,000 hectares) per year have been cleared of natural forests and converted to industrial tree plantations, primarily pine (Forest Practices Authority 2005). Early estimates for 2006 totals expected that conversion would exceed 49,000 acres (20,000 hectares) (Cadman 2006). Approximately 296,000 acres (120,000 hectares) have been cleared and converted to plantations since 1990, primarily to be turned into woodchips for a proposed pulp mill and for export to Asia.

APPENDIX C: SUMMARY OF THE COMMON CHEMICALS USED IN FORESTRY OPERATIONS AND THEIR TOXICITY AND ENVIRONMENTAL FATE

(Compiled by Dogwood Alliance, 2006)

Summary of the Common Chemicals Used in Forestry and Their Toxicity and Environmental Fate

			TOXICITY					ENVIRONMENTAL FATE			
Main active ingredient	**Type of chemical**	**Other hazardous ingredients**	**Inhalation**	**Ingestion**	**Absorption: skin and/or eyes**	**Chronic exposure**	**Carcinogenic activity**	**Soil**	**Half-life**	**Water**	**Nontarget organisms**
Glyphosate	Broad-spectrum herbicide	POEA-surfactant	Moderate toxicity	Generally nontoxic	Skin and eye irritant	Could cause damage to kidney and liver	Class C*	Moderately persistent	47 days in soil 12 days to 10 weeks in water	Risk of ground water contamination	Moderately toxic to fish
Hexazinone	Broad-spectrum herbicide	Ethanol in Velpar-L	Moderate toxicity	Acute toxicity	Moderate toxicity, severe eye irritant	No chronic risk assessment	Class D*	Mobile and persistent	90 days	Health advisory of 200 ppb	Highly toxic to algae
Triclopyr	Broad-spectrum herbicide	Diesel fuel carrier	Corrosive irritant	Corrosive irritant	Corrosive irritant	"No chronic risk assessment is required"[1]	Class D*	Soil sterilant	46 days	Risk of ground water contamination	Some risk to nontarget organisms
Imazapyr	Broad-spectrum herbicide	Surfactant	Corrosive irritant	Ulcers, lesions	Corrosive irritant	Neurotoxin	Some carcinomas observed, brain tumors	Mobile and persistent	Residual activity: 6-12 mo. in humid temperate zone	Risk of ground water contamination	Not enough evidence
Sulfmeturon -Methyl	Broad-spectrum herbicide	Surfactant	Slightly toxic	Slightly toxic	Corrosive irritant	Increased liver weight, anemia	No observed activity	Soil sterilant	20-28 days	No evidence of contamination	Slightly toxic to fish
MetSulfuron -Methyl	Broad-spectrum herbicide	Sodium napthalene	Low acute toxicity	Systemic poisoning if a lot is consumed	Corrosive irritant	Jaundice, anemia	No evidence	Highly mobile	14 to 180 days	Risk of ground water contamination	Practically nontoxic to fish
Diammonium Phosphate	Fertilizer for phosphorus	Ammonia & iron compounds	Results in severe burns to lungs	Burns to throat, mouth	Burns to eyes and skin	Blindness, lung disease, liver cirrhosis, fluorosis	No evidence	Taken up as a nutrient by plants	n/a	Risk of ground water contamination	Slightly toxic to fish and invertebrates
Urea	Fertilizer supplement for nitrogen	n/a	Irritation, severe cough	Irritation, nausea, vomiting	Corrosive irritant	Protein metabolism disruption, emphysema	No evidence	Mobile and persistent	140 days	Risk of ground water contamination	No information found

** Class C; possible human carcinogen; Class D; not classifiable as to human carcinogenicity, (EPA)*

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APPENDIX D:
CURRENTLY OPERATING MERCURY CELL CHLOR-ALKALI PLANTS
(AS OF 9.20.06)

1. ASHTA Chemicals Inc., 3509 Middle Road, Ashtabula, Ohio 44004

2. Occidental Chemical Corp., 1000 N. Wilson Dam Road, Muscle Shoals, Alabama, 35661 (Occidental plans to phase out the use of mercury at this plant.)

3. Olin Corp., 2402 Doug Barnard Parkway, Augusta, Georgia 30906

4. Olin Corp., 1186 Lower River Road, Charleston, Tennessee 37310

5. PPG Industries, State Route 2, New Martinsville, West Virginia 26155

6. PPG Industries, 1300 PPG Drive, Lake Charles, Louisiana 70601, (PPG will phase out mercury use at its Lake Charles plant by 2007.)

7. Pioneer Americas L.L.C., 4205 Highway 75, Saint Gabriel, Louisiana 70776

8. ERCO (formerly Vulcan Materials), State Highway 73 S., Port Edwards, Wisconsin , 54469

List provided by the Natural Resources Defense Council

APPENDIX E:
SAMPLE FORM FOR EVALUATING PAPER MILL PERFORMANCE

Form provided by Environmental Defense

Please complete and return to [insert contact information]. Attach separate pages as necessary. This information is solely for [insert organization] internal use to evaluate and compare suppliers' environmental performance over time.

Part I: Paper Supplier Information

Completed by: ____________________________ Title: ____________________ Date:_______________

Company name: ____

Paper purchased by [insert organization]: ____

Amount purchased by [insert organization]: ____

Location of mill(s) where paper is produced: ____

1. What is the composition of the paper you supply to [insert organization]?

Chemical pulp: _____________% (Hardwood: _____% Softwood: _____%)
Semichemical &
Mechanical pulp: _____________% (Hardwood: _____% Softwood: _____%)
Recycled pulp: _____________% (Postconsumer fiber: _____%)

Coatings/fillers/moisture: _____________%
TOTAL: 100%

2. For the paper you supply to [insert organization], how much of the pulp you use is…

	Produced at your mill	Acquired from another source (please specify sources)	TOTAL
Chemical			100%
Semichemical, Mechanical			100%
Recycled			100%

Part II: Pulp Supplier Information

Please answer the remaining questions for each source of pulp used in [insert organization] paper. Where there are multiple pulp sources, have each source submit a separate response.

Name of pulp mill: ____

Location of pulp mill: ____

Contact name and title: ____

Amount of pulp supplied annually: ____

Type of pulp produced (check):

_______ Chemical
_______ Semichemical or Mechanical
Please specify type, e.g., TMP, CTMP, BCTMP: ______________________________
_______ Recycled

For Chemical Pulp Mills:

1. How many bleach lines are in place at the mill?

2. For each bleach line, what is the pulping and bleaching sequence?

3. At what stage in the bleaching process are the filtrates from the first bleaching and extraction stages recirculated to the chemical recovery system?

For Mechanical, Semichemical or Recycled Pulp Mills:

4. What bleaching or brightening agents are used, if any?

For All Pulp Mills:

5. What technology upgrades to the pulping and/or bleaching lines have been made in the last five years, or are planned in the next five years?

6. What other investments have been made in pollution prevention in the last five years, or are planned in the next five years?

7. What investments have been made in pollution control technologies in the last five years, or are planned in the next five years?

8. Please describe the major features of your environmental management system (EMS). Provide examples of how your EMS has improved environmental performance.

9. (a) Indicators of general environmental performance: please complete for all pulp mills for the last three years.

Values for these indicators reflect manufacturing technology used by mill and effectiveness of pollution-control equipment	20—Supplier Annual Monthly Average	20—Supplier Process Variability (%)	20—Supplier Annual Monthly Average	20—Supplier Process Variability (%)	20—Supplier Annual Monthly Average	20—Supplier Process Variability (%)
Biochemical Oxygen Demand (BOD) (kg/metric ton of final product)						
Color (kg/metric ton of final product)						
Fresh Water Use (gallons/ton of final product)						
Sulfur Dioxide (SO_2) **(pounds/ton of final product)**						
Nitrogen Oxides (NO_x) (pounds/ton of final product)						
Total Reduced Sulfur Compounds (pounds/ton of final product)						
Total Energy Consumption **(millions of BTUs/ton of final product)**						
Purchased Energy Consumption (millions of BTUs/ton of final product)						
Particulates (pounds/ton of final product)						
Carbon Dioxide (CO_2) or equivalent (tons/ton of final product)						
Hazardous Air Pollutants (HAPs) (pounds/ton of final product)						
Volatile Organic Compounds (VOCs) (pounds/ton of final product)						
Total Suspended Solids (TSS) (kg/metric ton of final product)						

(b) Environmental performance indicators for bleached kraft pulp mills: please complete if applicable for the last three years.

Values for these indicators reflect: • Performance of pollution prevention technologies • Progress toward minimum impact mill	20—Supplier Annual Monthly Average	20—Supplier Process Variability (%)	20—Supplier Annual Monthly Average	20—Supplier Process Variability (%)	20—Supplier Annual Monthly Average	20—Supplier Process Variability (%)
Bleach Plant Effluent Flow (gallons/ton of air-dried pulp)						
Adsorbably Organic Halogens (AOX) (kg/metric ton of air-dried pulp)						
Chemical Oxygen Demand (COD) (kg/metric ton of air-dried pulp)						
Dioxins (in bleach plant filtrates) **(picograms/liter of water)**						

Notes: (1) All data should be provided on a per ton of product basis. (2) The monthly average provides information about the mill's level of performance. As mills implement pollution-prevention technologies, the magnitude of the performance indicators should decrease. (3) The variability provides information about the mill's ability to control the manufacturing process. Improved process control, maintenance and housekeeping should reduce the variability of these indicators over time.

10. Please provide details of any non-compliance incidents in the last three years. Summarize the degree of non-compliance, enforcement actions taken (if any), fines paid (if any) and steps taken to correct the problem.

20______: ____

____

20______: ____

____

20______: ____

____

Part III: Forest Management Practices

1. [Insert organization] is encouraging its paper suppliers to know the sources of and forest management practices employed to provide their pulpwood supply, and to ensure that the landowners, loggers and others in their supply chains use the best environmental practices. Do you currently have chain of custody control over some or all of your pulpwood supply? If so, please describe. Additionally, what steps are you taking to ensure that the loggers that harvest wood for your mills are using the best environmental practices?

2. [Insert organization] believes that independent third-party certification helps paper suppliers ensure that environmentally preferred forest management practices are employed at each link in the supply chain. Are the forest management practices that you and/or your suppliers employ currently certified by an independent third-party? If so, please describe.

3. Environmental and social responsibility reports can provide accountability and transparency on a company's environmental and social responsibility record. Do you publish a report describing your forest management practices and efforts to minimize your environmental impacts? If so, please provide your most recent report.

4. "Endangered," "old growth" and "high conservation value" are terms that describe forests that may contain rare, threatened or endangered species, habitats or ecosystems; provide critical watershed protection or erosion control; or be of special cultural or ecological significance. What steps are you taking to ensure that pulpwood procurement does not contribute to the loss of such forests? In addition, what steps are you taking to contribute to the conservation and restoration of these forests (e.g., land donations, easements, increasing endangered species populations)?

APPENDIX F:
FIELD TESTS OF GENETICALLY ENGINEERED TREES

The table below summarizes the field tests currently underway in the United States for GE trees that are being researched primarily for pulp production. Currently there are 120 field tests comprising 79 hectares (195 acres.) The table indicates the primary institutions that are conducting the field tests, the species planted, the genes altered and the states where the field tests are taking place. The leading institution, ArborGen, is a research arm of several major paper companies. Most tests are taking place in South Carolina, and the primary species being tested are pine, poplar and eucalyptus.

CURRENT FIELD TESTS OF GE FOREST TREES IN UNITED STATES

Data is as of March 10, 2006; does not include fruit trees.

Institution	# of tests
ArborGen	86
Oregon State University	14
Westvaco	11
New York State University	4
University of Connecticut	3
Mississippi State University	2
Species	
Loblolly pine	32
Poplar	30
Eucalyptus grandis	19
Pitch x loblolly pine	14
Sweetgum	9
Populus tremula	7
Eucalyptus camald.	3
American elm	3
Populus deltoids	2
Radiata pine	1
Phenotype	
Visual marker	50
Growth rate altered	28
Fertility altered	18
Lignin altered	17
Dwarfed	4
Sterile	3
Disease resistance	3
Phosphinothricin tolerant	2

Institution	# of tests
Phenotype *(continued)*	
Flowering altered	2
Gene expression altered	2
Development altered	2
Lysine level altered	2
Cold tolerant	1
Drought tolerant	1
Herbicide tolerant	1
U.S. State	
South Carolina	86
Florida	22
Oregon	13
New York	4
Connecticut	3
Mississippi	2
Georgia	2
Alabama	1
Washington	1
West Virginia	1

APPENDIX G: SOCIAL IMPACTS OF THE PAPER INDUSTRY

INTRODUCTION

Global paper consumption is currently running at more than 350 million tons per year and fast approaching an unsustainable million tons per day. Some pulp and paper companies already demonstrate leadership and commitment to principles of corporate social and environmental responsibility. It is important that such commitments become the norm for the industry. There are, unfortunately, companies that are less attentive to their social impacts. The grave negative consequences of their activities must be highlighted and responded to by customers and investors. Everyone involved in the production and supply of pulp and paper products needs to be sensitive to the social impacts of their activities.

This factsheet highlights some of the ways in which the pulp and paper industry can cause social impacts, giving both good and bad examples in two areas: land rights and livelihoods. These impacts can be on indigenous peoples and on forest communities in areas where the industry sources fiber, communities neighboring and downstream from pulp and paper mills, and employees and contractors of the industry. It concludes with recommendations for paper buyers/financiers.

WHOSE LAND IS USED TO MAKE PAPER?

The land rights of indigenous peoples and rural communities must be respected, but in some regions they are violated in the course of activities by pulp and paper corporations. When paper companies are granted concessions to log forests and/or establish fiber plantations without gaining the full and informed prior consent of local communities or indigenous peoples with customary rights on that land, this is an abuse of the land rights of those people and communities. Unfortunately these abuses are far too widespread. Indigenous people are struggling for their rights in many paper producing regions, from the Sami in Finland to the Maori in New Zealand, from the Haida in Western Canada to the Udege in the Russian Far East. Only some examples are given here.[1]

Worst practice

1. In Brazil there is bitter conflict in the state of Espírito Santo, Brazil, surrounding the acquisition by Aracruz Cellulose, the world's biggest producer of eucalyptus pulp, of land claimed by indigenous peoples. In Brazil, there is now more than 5 million hectares (11 million acres) of eucalyptus plantation growing in vast monocultures, termed 'green deserts' by their opponents, who complain that the plantations consume vast quantities of water, causing rivers to dry up and leading to erosion, deterioration of water quality and loss of fishing and water resources to local communities. Aracruz has land holdings in Brazil of more than 825,000 acres (375,000 hectares). In Espírito Santo, it uses land which has been the subject of a long-standing land rights dispute and is claimed by indigenous Tupinikins and Guaranis as part of their 40,000 acre (18,000 hectare) traditional lands. In 2005, indigenous activists moved onto land used by Aracruz Cellulose and demarcated their traditional territory, felling eucalyptus trees that they claim to have been planted illegally and in breach of their human rights. In January 2006 the Guaranis and Tupinikins were violently evicted by the company, to international condemnation. There are ongoing protests by a growing movement of Brazilians and supporters around the world, who want the Brazilian state and companies to recognize the land rights of indigenous peoples and ensure non-violent resolution of land disputes. There are similar complaints in other parts of the world, including Uruguay, Thailand, India and South Africa, where eucalyptus is grown for pulp, lowering water tables and causing droughts and water shortages for rural people.[2]

FASE, Espírito Santo, Brazil

Indigenous Guarani people occupy their traditional land, used by Aracruz Cellulose for a pulp plantation.

Grassy Narrows First Nations Youth protest paper industry clear cutting on their traditional lands, Ontario, Canada.

2. Land rights conflicts are not restricted to the tropics. The indigenous Grassy Narrows community is located in the most northerly part of the industrial logging zone in Ontario, Canada. The provincial government has granted forestry permits to paper industry giants Abitibi and Weyerhaeuser on the traditional lands of the people of Asubpeeschoseewagong (Grassy Narrows First Nation), without their consent. Industrial forestry has devastated the First Nation's territory, with more than 50% of the land having been clear cut, destroying the habitats of the plants and animals that form the basis of traditional livelihoods: hunting, trapping, fishing, and gathering of plants for food, fiber and medicine. Replanting by Abitibi has been with tree plantations that are heavily sprayed with chemicals that have negative impacts on berries and other plants. According to an Amnesty International briefing to the United Nations, Grassy Narrows falls within the territory covered by the 1873 treaty between the Canadian state and the Chiefs of the Salteaux Tribe of the Ojibway Indians. This treaty establishes that indigenous peoples have the "right to pursue their avocations of hunting and fishing throughout the tract". The Grassy Narrows First Nation claims that these treaty rights have been violated by the damage caused to their natural resources by forestry. In 2002, the First Nation took direct action, establishing a blockade on logging roads into their land that has successfully halted logging in the area. It is now the longest running forest blockade in Canada. It has drawn international condemnation for the Ontario provincial government, Abitibi and Weyerhaeuser and there are ongoing calls for a moratorium on logging on any First Nation land where there is not free, prior and informed consent of the local community.[3]

3. The paper industry is the biggest industrial water user, consuming 11% of all freshwater in industrial nations. Not surprisingly, this leads to disputes about water resources and its effect on water quality. Plans by Finnish company Botnia to build a new pulp mill in Uruguay, which will take water from and discharge into the Uruguay River, has led to cross-border conflict with Argentina. In June 2006, the Argentina government took the Uruguay government to the International Court of Justice in The Hague, for failure to notify them about potential pollution from the mill. They also accuse Botnia of breaching Organisation for Economic Co-operation and Development guidelines, the 1975 Statute of the River Uruguay and the Equator Principles, a system of guidelines for assessing social and environmental risk based on standards set by the World Bank's private sector lending arm. In addition to the legal conflict there have been massive protests by local people in Uruguay alarmed at the prospect of water pollution and the loss of farm land to eucalyptus plantations to provide the pulp mill with fiber.[4]

Best practice:

In some parts of Canada where First Nations have more secure land rights as a result of treaty arrangements that give them more power, there are some inspiring examples of the paper industry working with the native people to plan how the forest resources can be used to maximize benefits and reduce negative impacts. For example, in Nitassinan, in Eastern Quebec and Labrador, Canada, the Innu First Nation has led a collaborative ecosystem-based planning process that has guaranteed that traditional livelihoods are not threatened by forestry operations. This was achieved after a long history of conflict, when in 2001 the Government of Labrador and Newfoundland reached a Forest Process Agreement with the Innu Nation, empowering them to have full participation in forest planning. The resulting Forest Guardians process involved scientists, Innu elders, local communities and forestry technicians working together to develop a long-term ecosystem-based forest management plan. This kind of process avoids conflict, builds trust and ensures that fiber supplies will be truly sustainable. It demonstrates that collaboration and co-operation between the state, forestry and paper industry and indigenous and forest communities is the best way forward to resolve land use conflicts.[5]

LOCAL ECONOMIC IMPACTS

There are bound to be economic and social impacts to local communities when pulp and paper companies begin operations in their area. There is thus a profound responsibility on these companies to work to ensure that these impacts are beneficial rather than detrimental. Governments can play an important role in ensuring that logging licenses do not conflict with local resource use. Progressive paper companies embrace the opportunity to work with local communities as allies and beneficiaries without making them dependent on the company and supporting economic diversification. The worst companies ride roughshod over local community livelihoods.

Worst practice:

1. In Riau, Sumatra, concessions were granted by the Indonesian government to Asia Pulp and Paper (APP) and Asia Pacific Resources International Holdings Ltd (APRIL) to log and establish fiber plantations on forest land that is inhabited by indigenous communities. The loss of community forest leads to losses in livelihoods including hunting, fishing, honey gathering, medicinal herbs and lumber for housing, furniture, firewood and much more, as well as cash crops such as rubber. For example, in Kuntu village, the community only found out that their traditional lands had been signed away when APRIL's bulldozers and logging equipment arrived. Now they must fight for their land rights in court. Meanwhile their community forest has been logged and replaced by a monoculture of acacia trees. The company offers financial inducements and a profit share in the harvest, but the local community wants their forest land back or a fair rent for the use of that land. Kuntu is just one of many such villages in Riau where there are complaints of heavy-handed and aggressive tactics by the 'security' firms hired by the paper corporations. These have led to violent clashes, in which property has been damaged, protesters have been injured and in which there have even been some fatalities. Activists in Riau say they have suffered intimidation by the security firms and they urge paper buyers to boycott APP and APRIL's products and pressure the Indonesian government to put an end to the conversion of natural forest to fiber plantations.[6]


Credit to come

Innu community members participating in the forest management planning process.

2. China is the second biggest producer of paper in the world after the USA, and a great deal of its paper has agricultural residues as the basic ingredient. All over China, when farmers harvest rice, maize and sugar cane, they sell the straw to pulp mills – an important aspect of rural economies. Unfortunately, many of the thousands of small pulp mills are old and polluting and the Chinese state is closing many of them down, whilst encouraging paper corporations to invest in new modern pulp mills: 40 new pulp mills are predicted to be built in China by 2010. However, modern technology exclusively uses wood as its input, not straw, and a shift on this scale from agricultural waste fiber to wood will remove an important income stream from millions of farmers as well as causing the loss of up to a million jobs. There is an alternative: China could retrofit existing mills with effluent treatment facilities, ensure all new mills can use agricultural residues and exploit its role as the world leader in 'ag fiber', showing paper makers in Europe and North America how to make sustainable papers from the waste products of arable farming, which are mostly burned.[7]

3. Researchers in the south eastern states of the USA have established that the paper industry is threatening local economies. This is because although the paper industry brings some economic benefits to land owners, small land owners tend to be paid less for their wood and the consolidation of forest land holdings has concentrated the economic gain among fewer and fewer people. Research shows a down-turn in the well-being of rural communities where the paper industry is concentrated, which are economically worse off than other rural communities, experiencing higher levels of poverty and unemployment and lower expenditures on public education.[8]

Best practice:

Klabin is the largest forest products and paper producer in Brazil with activities in paper, forestry, and recycling. All of the company's own forests and plantations are FSC certified. The company has recently initiated a program they call 'Legal Woods,' (that has a second meaning in Portuguese of '/excellent/ or /cool/ woods') in collaboration with a local NGO to promote planting and conservation among small farmers and landholders in Parana state, where Klabin has a major mill. Klabin is helping these farmers to diversify their economic activities, increase sales of their products, protect waterways and other ecologically sensitive areas as well as protect and rehabilitate forests for conservation. The program is perhaps unique because Klabin is helping these landowners even when the wood from these projects may go to competing companies, which helps the small landowners compete for better prices for their wood, but ultimately strengthens the community's ability to have a strong economic base, raise wages and rural income and protect ecological values.

IMPACTS ON HEALTH

The use of toxic chemicals for pulping and bleaching paper and dangerous chemical pesticides and herbicides on fiber plantations can lead to pollution that causes negative impacts on the health of paper company workers and communities downstream from mills. The paper industry is responsible for the release of persistent toxic pollutants like chlorine, mercury, lead and phosphorus into the environment, resulting in a legacy of health problems including cancers, nerve disorders and fertility problems. Chlorine bleaching is particularly widespread and although there has been some progress in shifting away from the use of elemental chlorine for bleaching, the use of any chlorine-based chemicals at all can still result in dangerous pollution, because they are the building blocks of organochlorines, which include some of the most toxic compounds on earth, such as dioxins and furans. In the USA, in order to meet Environmental Protection Agency rules, most paper is now 'elemental chlorine free' (ECF), which has led to a 94% reduction in dioxins, however the EPA's own rules state that there is no safe level of dioxin. Dioxin is known to cause reproductive problems, including low sperm counts and endometriosis and is implicated in a range of other health problems including diabetes, hyperactivity, allergies, immune and endocrine system problems. There are alternatives to chlorine for bleaching, such as hydrogen peroxide, which are much safer and are the basis of 'processed chlorine free' (PCF) processes and they should be chosen every time. Recycling paper causes far less air and water pollution than virgin manufacture and thus can help to reduce negative health impacts of the paper industry. For more information related to this topic, go to: http://www.rfu.org.

Credit to come

Indigenous Indonesia villager next to logs being taken from tradional land-use area.

RECOMMENDATIONS To the Paper Industry

- Companies must respect and comply with the following international conventions for the protection of human rights: the International Labor Organization Convention 169 for the Protection of the Rights of Indigenous Peoples, the General Declaration of Human Rights (1948), the United Nations Convention for the Elimination of all Forms of Racial Discrimination (1966), the International Agreement on Economics, Social and Cultural Rights (1966) and the International Agreement on Civil and Political Rights (1966).
- Free and prior-informed consent of local people must be ensured, through meaningful and culturally appropriate consultation methods, in the areas from which raw materials originate and where production takes place. Companies and governments must recognize and respect indigenous peoples' legal and customary rights to control their traditional lands and protect their cultural identity, and also respect local communities' rights to a healthy environment, and their rights to participation as a primary stakeholder in land-use planning.
- Companies must respect the rights of workers, including subcontractors' workers, to beneficial employment and a safe working environment. These include the ILO Fundamental Work Rights: freedom of association, the right to organize and to collective bargaining; the abolition of forced labor; the elimination of child labor; and the prohibition of discrimination in employment and occupation (equality of opportunity and treatment).
- The industry should respect and support local economies and businesses, reversing the trend towards ever-larger industrial units and promoting community-ownership and a diversity of small- and medium-sized enterprises in the paper sector. Production systems must not hinder local food production or jeopardize environmental services or ecosystem assets, such as water quality, and their equitable use.
- The paper industry should use the best available technology to minimize the use of water, energy, chemicals and other raw materials and minimize emissions to air and water, solid waste and thermal pollution, to eliminate toxic waste and mill discharges, reduce brightness of products to reduce levels of bleaching and eliminate the use of chlorine and chlorine compounds for bleaching.
- Any new pulp mill developers must demonstrate environmentally and socially sustainable sources of fiber.
- Companies should recognize that they are part of a larger land use system and should take into account the indirect effects of their land use, such as displacement of pressure for land.

RECOMMENDATIONS To Paper Buyers

- Buyers of paper have powerful leverage over paper companies, and should insist that their source companies are following the recommendations above. If not, take the business elsewhere.
- The most effective way to reduce the negative impacts of the paper industry is to use it more efficiently, thus helping to reduce demand and at the same time reducing waste and saving money. Explore paperless alternatives such as electronic communication and encourage innovation to cut packaging.
- Paper buyers should seek to use as high a level of recycled content wherever possible, because this is the best way to avoid negative social impacts, particularly in forests.
- It is important for buyers to be able to track and analyze where the paper they use comes from and be satisfied that the paper source is sustainable. Where virgin fiber is necessary, seek to ensure that negative social impacts are minimized by sourcing only Forest Stewardship Council (FSC) certified paper and using its chain of custody information to verify that its origins meet the recommendations above. The FSC's principles and criteria include complying with laws and international rights agreements, respecting legal and customary land tenure, managing disputes and conflicts appropriately, respecting indigenous peoples rights, giving opportunities to local communities, ensuring health and safety and taking due account of social impacts of forest management. No other forest certification system comes close to adequately addressing all of these issues.[9]
- Ask paper suppliers for corporate social responsibility reports, but beware that some corporations attempt merely to pay lip-service to social impacts, so it is important to read these reports with a discerning eye and beware of greenwash.

RECOMMENDATIONS To Investors

- Pulp and paper companies should be required to carry out independent social impact assessments of all new developments, including comprehensive assessments of the impacts of their fiber sourcing policies and procedures, and then to take into account the results of these assessments. Ethical investors should withhold support unless this can be demonstrated to have taken place and refuse to subsidize unsustainable developments.[10]
- Pulp and paper companies should meet international standards for corporate social responsibility reporting. They should report against all the criteria recommended by the Global Reporting Initiative. Analysis of paper industry reporting has concluded that across the industry there is 'a lack of detail in independent verification and evidence which leads to a lack of transparency in reporting.'[xi]
- Financers and investors who want to invest ethically in the global pulp and paper industry should not enter into partnerships with companies that have bad social and environmental records and should implement binding social and environmental standards, requiring independent social audits, not only relying on company information.

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[3] www.envirowatch.org/gnfnindex.htm

[4] Chris Lang, *Yes to Life, No to Pulp Mills*, Robin Wood Magazine, August 2006.

[5] www.innu.ca/forest/sec1overview.htm

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