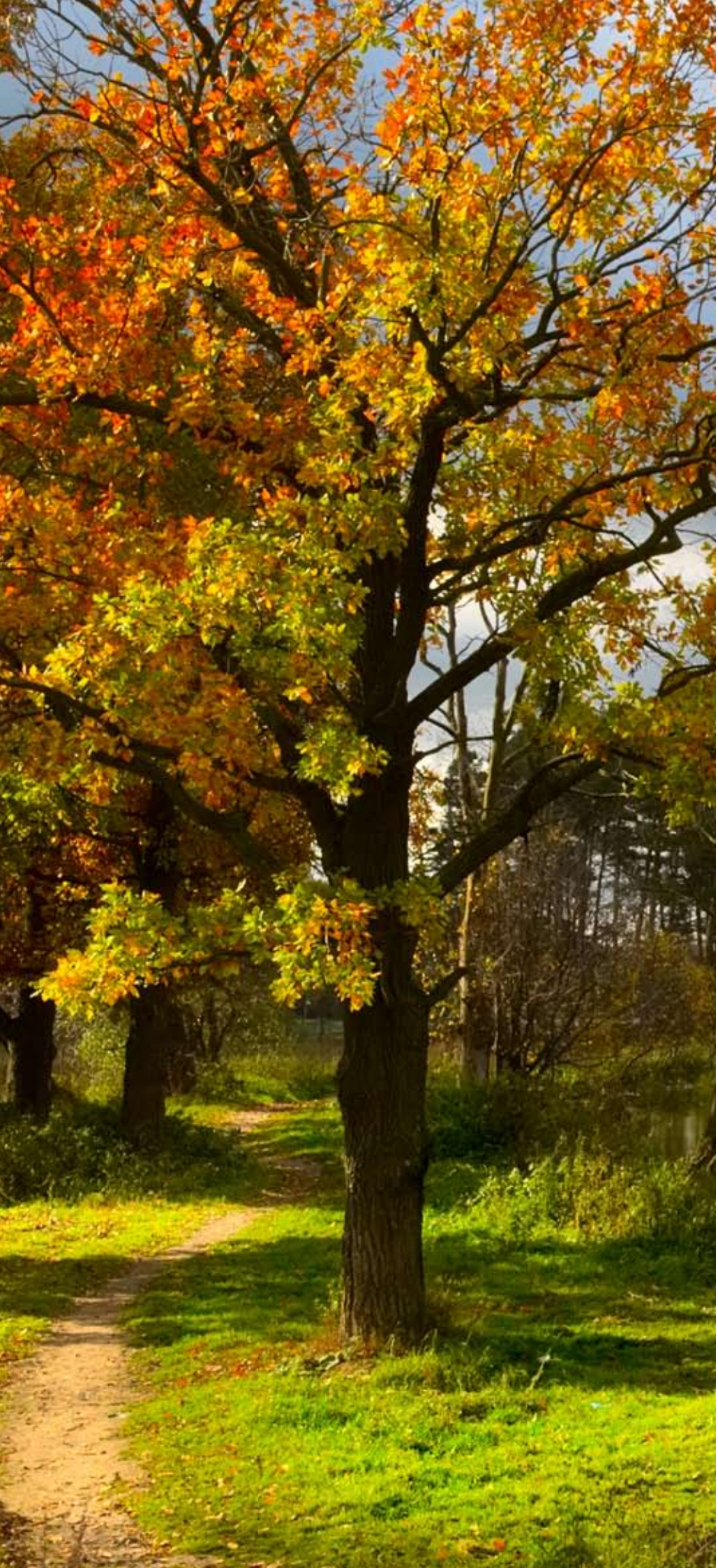
Xerox and Paper: A Sustainability Reference Guide

xerox



"Simply stated, Xerox will demonstrate our active commitment to sustainability leadership through the range of products we offer, our continued innovation, and the partnerships we build with our customers, suppliers and environmental groups."

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Welcome

Welcome to the Xerox and Paper Sustainability Reference Guide, designed for customers, stakeholders, suppliers, and employees. Our reference guide will help you understand what steps you can take to reduce the environmental impacts of paper.

The first part of this document covers Xerox's environmental position, policies, and products and acts as a reference guide in relation to Xerox's proactive environmental strategy. The second part of this document acts as a useful tool for all who wish to understand what steps they can take to reduce their environmental impacts and support the development of a sustainable paper cycle.

As one of the world's largest distributors of cut-sheet paper, Xerox acknowledges our responsibility to foster sustainable development by using paper wisely and protecting forest resources.

To Our Stakeholders:

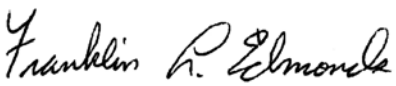
We all face one fundamental question: how do we leave a better world for our children and for their children?

That is the driving force behind the whole topic of sustainability. We cannot avoid it or put it off for another day. Everyone needs to do their part starting now. Each year, Xerox publishes our Report on Global Citizenship which outlines our progress as a responsible corporate citizen. This document extends that report with a deliberate focus on the paper we sell worldwide.

We want to share our goals and vision for sustainability and inform you of our progress. This is the first sustainability document that we have published—specifically around our paper. It is intended to begin a dialog about how we can jointly meet your needs as a consumer of our products—and how together we can meet your sustainability goals, as well as ours. It is an opportunity to look at our relationship through the lens of corporate responsibility. Quality, performance, value, and sustainability must be the foundation of our offerings.

Whether you are the chief environmental officer, the graphics designer, the art director, or the office printer user, you want to know what effect use of paper has on the Earth. You want to understand how Xerox's commitment to sustainable environmental practices, and the long-term benefits they create, will leave a safer environment for everyone who inhabits this globe.

Your media and consumables decision doesn't have to be complicated by environmental implications. It can be strengthened by a partnership, centered on sustainability that will yield benefits for the generations to come.



Franklin L. Edmonds
Senior Vice President
Xerox Supplies Business Group

Introduction

What's more important? Sustainable forestry? Renewable materials? Recycled content? Certified products? Biodegradability? Biodiversity? What do our customers care about?

Our Planet and Our Industry

Sustainable development is the integration of environmental, social, political, and economic development, underpinned by equity. It meets the needs of the present without compromising the ability of future generations to meet their own needs. However, natural resources and ecosystems, on which human life and quality of life depend, have been strained in recent decades, to—and sometimes beyond—their limits. This has been demonstrated by climate change and the global loss of biodiversity.

Therefore, environmental issues are not a passing fad. Whether driven by pressure groups, consumer concerns, legislation, or a sense of corporate responsibility, sustainable management practices are more important than ever. Indeed, there is a lot of talk about sustainability these days, and it means different things to different people. In print and printing papers, the leading issues are: recycled content, sustainable forestry, forest protection, clean air and water, and energy. In packaging, where paper and plastics both come into play, the range of issues is a bit different. However, most of the time, we are unclear regarding which actions are more relevant, which kind of solution needs to be pushed for a "better sustainable world." What's more important? Sustainable forestry? Renewable materials? Recycled content? Certified products? Biodegradability? Biodiviersity? What do our customers care about?

Increasing numbers of consumers, public, and enterprise procurement policies are seeking evidence for environmentally sound business products and practices. Paper purchasers have more choices than ever, both in the number of environmentally sound papers available and in the types of decisions they can make about what's in the paper and how it was made. Having so much choice in papers also brings responsibility.

Our reference guide will help you understand Xerox's approach, our performance, and what steps you can take to reduce the environmental impacts of paper and the development of a sustainable paper cycle.

Xerox's commitment to sustainability

Our Corporate Sustainability Vision

"To Xerox, sustainable development is a race with no finish line. It requires leadership that sets high expectations and clear direction. It takes employees that embrace Xerox values and **innovation** that constantly pushes the frontier of what is possible."

Anne Mulcahy

What is Sustainability?

Sustainability is meeting the needs of the present without compromising the ability of future generations to meet their own needs. The term takes into account environmental and social performance in addition to financial performance—the "triple bottom line." Sustainability is a term that is gaining popularity and is often used synonymously with the terms green, citizenship and corporate social responsibility.

Our Word—Xerox's Commitment to Sustainability

Sustainability is not just a nice-to-do at Xerox. It's about valuing our employees and communities, preserving our environment, and returning value to our shareholders… now and for the future. Xerox views it not as a cost of doing business, but as a way of doing business.

Our Work—Xerox's Actions in Meeting its Commitment

Social: Our commitment to our employees shows in our actions: valuing diversity and inclusiveness, rewarding good performance, offering excellent opportunities for learning and development, providing a safe and healthy work environment, and achieving the right work/life balance. We strive to take a leadership role in **local communities as well as in the global community**. This work is supported by the volunteer efforts of Xerox employees and support of the Xerox Foundation.

Environmental: **Our responsibility** focuses on four areas where we can have the most impact:

- **Climate Protection**—we reduce our carbon footprint by cutting energy use in our own operations and in the operations of our customers through our energy efficient product and solution offerings.
- **Preserve Biodiversity and the World's Forests**—we responsibly source paper for resale, our technologies enable efficient use of paper, and we partner with The Nature Conservancy and others to promote good forest practices.
- **Preserve Clean Air and Water**—we use chemicals carefully and responsibly. We seek alternatives that are less harmful to the environment.
- **Prevent and Manage Waste**—we strive to reduce waste in our operations and in the use of our products. We responsibly manage the disposition of waste by seeking reuse and recycling options.

Financial: Our culture values Xerox both as a profit-making enterprise that creates value for shareholders and an institution that strives to be a positive force in the world around us.

Our World—Reaching out to Others

Attaining our goals for sustainability means going beyond what we can control directly. We engage our suppliers, our customers, our people, and other important stakeholders to extend our reach and magnify our impact.

Xerox's annual Report on Global Citizenship provides a comprehensive report of our efforts in these areas.

For more information visit:
www.xerox.com/citizenship

Walking the sustainability talk

We strive to raise the bar on our environmental goals around four critical challenges:

Climate Change Carbon-Neutral

Invest in technologies that reduce both the carbon footprint of our operations and the printing solutions offered to our customers. Aim to be a carbon-neutral company.

- Reduce GHGs 10 % from 2002 to 2012—achieved in 2007. New target set for total reduction of 25 % by 2012.
- Obtain the 2007 ENERGY STAR for 90 % or more of new product launches by 2010. Automatic power saver modes available on all products.
- ISO 14001 Environmental Management Certified.

Preserve Biodiversity and the World's Forests

- Continue to maintain strict paper sourcing guidelines.
- Certify Xerox-branded paper to standards for sustainable forest management.
- Improve forest management among Xerox suppliers through our partnerships, such as The Nature Conservancy.
- Continue to invest in technologies to develop papers that use recycled content and less pulp (i.e., high-yield papers).

Preserve Clean Air and Water through Reducing Use of Toxics and Heavy Metals

We strive to eliminate the use of persistent, bioaccumulative and toxic (PBT) materials throughout the supply chain.

- Utilize Life Cycle Analysis to prioritize areas for future technology development.
- Reduce use of PBTs in Xerox supply chain through adherence to Xerox and EICC requirements by 90 % of suppliers (based on spend) by 2012.
- Continue to reduce emissions, which have already been reduced by 94 % since 1991.

Waste Prevention and Management

- Reduce material footprint of Xerox equipment and supplies.
- Continue investment in "cartridge-free" solid-ink technology that produce 90 % less waste than conventional office printers.
- Maintain >90 % reuse or recycling of recovered Xerox equipment and supplies offerings via Green World Alliance, diverting over two billion pounds of potential waste from landfills
- Invest in EA toners and "E-Agent" for conventional toners to reduce energy required to produce printed pages.
- Continued development of energy saving automation software.

There is so much more that we can do together. In the words of one Xerox customer, "The environment as an issue is not going to go away, it's not a fad. Addressing environmental matters is essential in order to exist as a business."

Part 1: Xerox and paper

1.1 Preserving Biodiversity and the World's Forests through a Sustainable Paper Cycle

As one of the largest distributors of paper for office printers and copiers, Xerox recognizes our obligation to support a sustainable paper cycle. We impose strict environmental requirements on our paper suppliers, ensuring that all Xerox papers come from responsibly managed mills and forests. We partner with The Nature Conservancy and others to promote good forest practices, and we innovate to produce papers with reduced environmental impacts.

Paper sourcing—for companies that provide paper to Xerox for resale, we apply stringent requirements that cover all aspects of papermaking, from forest management to production of finished goods. On an annual basis, Xerox suppliers submit detailed documentation that verifies compliance.

Efficient use of paper—Xerox equipment and software are designed with features that allow customers to make efficient use of paper. These features include reliable two-sided (duplex) printing and software products such as DocuShare® and FreeFlow® digital workflow products that help Xerox customers reduce paper consumption by facilitating electronic data management, scan-to e-mail, print-on-demand, and distribute-then-print workflows.

Recycled paper offerings—Xerox recycled products are designed for optimal performance in Xerox equipment and are required to meet the same strict performance specifications as original products. Xerox offers multipurpose papers with post consumer content. This includes tabs, colored papers and several premium products designed especially for digital color printing applications.

Xerox High Yield Business Paper™—a mechanical fiber paper developed by Xerox scientists. Ideal for transactional printing, Xerox High Yield Business Paper is made through a "greener" process than standard paper used with digital printers. The sheet is produced by mechanically grinding wood into papermaking pulp instead of using a chemical pulping process traditional for producing digital business papers. The result: 90 % of the tree by weight ends up in the High Yield Business Paper versus only 45 % in creating traditional digital printing paper. In addition, High Yield Business Paper requires less water and chemicals and is produced in a plant using hydroelectricity to partially power the pulping process.

FSC and PEFC certified papers—Xerox has been granted FSC (Forest Stewardship Council) and PEFC (Programme for the Endorsement of Forest Certification) Chain of Custody certification. The achievement of this certification means that Xerox is now positioned to market FSC and PEFC certified papers. The FSC and PEFC product label allows consumers worldwide to recognize products that meet strict standards for sustainable forestry and management of the Chain of Custody, from forest management to final distribution.

1.2 Xerox Paper and Supplies Paper Purchasing Policy

Paper Sourcing Position

As one of the largest distributors of cut-sheet paper, Xerox recognizes our obligation to responsibly source and produce paper. Starting with the source of the fiber used to make the paper, through its manufacture and use, Xerox strives to minimize environmental impact while meeting our customers' specific business needs.

In 2000, Xerox adopted an environmental position on sourcing paper. This position states that our goal is to source paper from companies committed to sound environment, health, and safety practices as well as sound environmental management. In support of this position, Xerox phased in a set of requirements from 2003 to 2005 for all supplying mills. These stringent requirements cover all aspects of papermaking, from forest management to production of finished goods.

The requirements are included in our new supplier qualification process—and existing Xerox paper suppliers worldwide must meet them to continue doing business with us.

Suppliers must also submit detailed documentation on an annual basis, verifying conformance. Since these requirements became fully effective in 2005, more than 75 % of our paper suppliers—representing in excess of 90 % of the paper Xerox supplies to our customers—have committed to meeting them. Xerox is working with our suppliers to increase the rate of compliance to 100 %.

Key Elements Required

- Commitment to comply with all applicable environment, health, and safety regulatory requirements, including forestry codes of practice and regulations governing legal harvesting of wood.
- An effective mill environmental management system and objectives for continual improvement in environmental performance that go above and beyond regulatory compliance.
- An effective procurement process that:
  - Ensures the exclusion of illegally harvested wood raw materials.
  - Ensures the exclusion of wood raw materials derived from forest areas of significant ecological or cultural importance, unless certified to a Xerox-accepted sustainable forest management standard.
  - Encourages all suppliers of wood raw materials to practice sustainable forest management.
- Strict limits on the use of hazardous materials, including exclusion of elemental chlorine, in the processing and content of Xerox papers.

Responsible Forest Management

Being able to demonstrate that they are safeguarding forest areas of significant ecological or cultural importance is one of the most significant challenges paper mills face. Xerox recognizes this—and fully supports multi-stakeholder efforts to develop information sources and tools that will help suppliers identify these areas within their own forestlands and in their procurement of wood raw materials from third-party lands. Xerox encourages and expects our suppliers to take full advantage of these resources as part of their sustainable forestry efforts.

This commitment to preserve biodiversity and the world's forests motivates the formation of a three-year partnership with The Nature Conservancy. Funded by a $1 million (U.S.) grant from the Xerox Foundation, the goals of this partnership are to:

- Provide lasting solutions for environmental sustainablility both for us and our suppliers.
- Demonstrate measurable progress in protecting forests.

Areas of focus:

Information—support the development of the Canadian Boreal Data Centre, launched in 2007.

Standards—improve biodiversity components of international standards.

Tools and Practices—advance conservation planning practices in U.S., Canada, Brazil, and Indonesia.

Education—of our suppliers and other forest product users of the knowledge gained from the research.

Xerox Media and Compatibles Technology Center

The Xerox Media and Compatibles Technology Center (MCTC) team of paper engineers and specialists ensures all Xerox media meet the quality that you expect from Xerox. Our engineers audit our supplying mills, right down to the paper production machine level to ensure conformance to Xerox product certifications and environmental standards such as ISO 14001, EMAS, and others. This expertise also ensures that all Xerox products are developed in concert with our hardware platforms, to be certain that Xerox papers and specialty media are optimized and guaranteed to run flawlessly through our Xerox offerings. In fact, our suppliers tell us that Xerox sets the standard for optimal paper quality.

The MCTC—which is comprised of experts in paper design and xerographic technology who have access to the full range of Xerox devices and selected competitive printers—is unique in the industry. This enables Xerox to provide customers with a total answer—from hardware to guaranteed paper and media. Our engineers balance environmental benefits of a given paper with runability to provide our customers with risk-free choices.

Our integrated hardware and paper launch process, certification testing, and audit programs enable Xerox to offer a 100 % satisfaction guarantee. This gives our customers the peace of mind that comes with running guaranteed and optimized substrates though their digital laser equipment. Whether a product is recycled, certified, or environmentally optimized, we don't offer the paper or media unless it is qualified by our experts for maximum productivity, uptime, image quality, and performance.

Smarter ways to green

Xerox advances seven key actions to sustain a greener office.

1 Conserve paper – make two-sided prints.
2 Recycle the paper you use and use sustainable paper.
3 Reach for the ENERGY STAR.
4 Replace standalone office equipment with multifunction systems.
5 Return print/copy cartridges and supplies for recycling.
6 Seek office equipment designed for remanufacturing or recycling.
7 Scan and send to share documents electronically.

Xerox Paper and Supplies Environmental Ranges

Xerox Paper and Supplies is committed to making available a choice of recycled products, as well as products that originate from certified well-managed sources or sources operating accredited management systems. With a wide and varied range of environmental papers, Xerox is the clear choice to the environmentally aware consumer.

Whatever your concerns, your environmental commitment, or your corporate sustainable direction, Xerox Paper and Supplies offers a wide selection to provide the environmentally responsible solution you are looking for. Thanks to our green practices and processes and our clear, demonstrated environmental commitment, you will find all our products, from our certified range to our standard portfolio, have received recognized accreditations. If you are particularly sensitive to recovery or bleaching issues, our range of recycled products offers a variety of quality levels as well as a varied choice of products.

From our ISO 14001 accreditation to our recent FSC Chain of Custody certification, all Xerox papers come from sustainable practices. If you are looking for an engaged and environmentally friendly supplier whose environmental commitment goes beyond just products, Xerox Paper and Supplies is your green partner.

1.3 Xerox and Climate Change

As you can see, Xerox is not merely committed to sustainability, but we are working daily to make it a core value in all we do from product design to document output and paper. Here are a few other activities which are ongoing efforts to ensure we consider sustainability in all aspects of our corporate life.

Multifunction product savings: In addition, Xerox's digital multifunction systems reduce the amount of energy required to provide customers with copy, print, fax, and scan capabilities by combining the functions of multiple products into one machine.

The annual energy consumption of a Xerox WorkCentre® or WorkCentrePro multifunction system is approximately **50% less** than the combined annual energy consumption of the individual ENERGY STAR-qualified copier, fax, and printers it replaces.

Xerox Solutions—customers become more productive through Xerox's comprehensive document management and production printing solutions. Digital production printing solutions offer an alternative to offset printing to enable reduced use of chemicals and improve indoor air quality. Print-on-demand applications and FreeFlow® digital workflow enable material and waste reduction, contributing to reduced energy use. Electronic document management avoids the need for paper altogether.

Logistics—product transportation also contributes to a product's carbon footprint. For commercial as well as environmental reasons, we encourage customers to place larger orders or group orders together. This initiative enables our everyday business to save on fuel, emissions, and traffic congestion.

The Nature Conservancy Partnership—in 2008, Xerox is in our second year of a three-year, $1 million grant to The Nature Conservancy. This partnership is focusing on forest management in Brazil, Canada, Indonesia, and the U.S. It is identifying and promoting best practices that will enable environmental scientists, forest managers, and paper suppliers to work cooperatively toward sustainable forest management.

Waste-Free Factories—since the early 1990s, Xerox has managed environmental performance in its manufacturing operations to an internal benchmark known as Waste-Free Factory. Our commitment to the goals of this initiative, along with global implementation of an ISO 14001-conforming environmental management system, has driven environmental performance improvements over the last decade, including achievement of a 91 % recycle rate for non-hazardous solid waste.

Xerox's Green World Alliance program provides a collection and reuse/recycling program for spent imaging supplies. The Xerox Green World Alliance reuse/recycle program for imaging supplies is central to our commitment to waste-free products. This partnership with Xerox customers has resulted in more than 2.7 million cartridges and toner containers being returned in 2006. Xerox processed 1.3 million pounds of post consumer waste toner for reuse, and the plastic bottles customers used to return waste toner to Xerox—nearly 100,000 of them—have been recycled. Learn more at www.xerox.com/gwa

Part 2: The life cycle of paper

Paper is a part of everyday life, and with its physical properties and conveniences satisfies a human need not yet filled solely by the digital world. In fact, the use of office paper has increased rather than decreased over the last several decades as a result of the "information revolution."

Paper making is a highly industrialized process and has potential environmental impacts to our world's forests, air, water, and soils. It is therefore important to understand and mitigate the environmental impacts of paper use across its life cycle—from raw material acquisition, manufacture, distribution, use, and disposal. Our goal at Xerox is to support the development of a sustainable paper cycle.

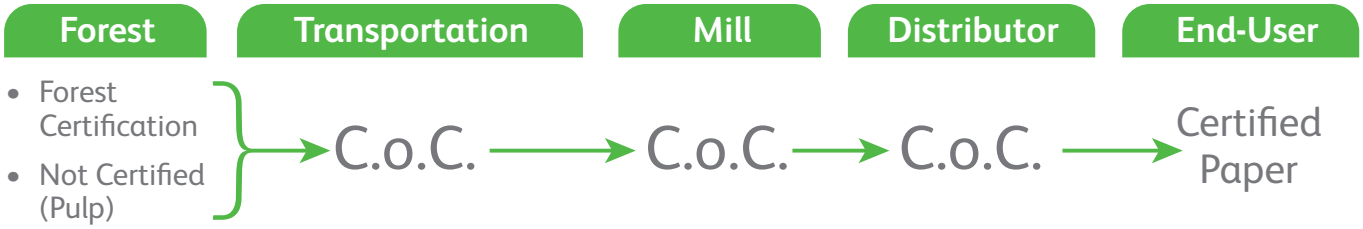
This means ensuring that Xerox paper is derived from sustainably managed sources and manufactured in mills with reduced environmental impacts. It also means providing customers with the means to use paper efficiently and responsibly through our office and production systems offerings.

2.1 Sustainable Forest Management (SFM)

Paper has existed for thousands of years but it was only in the 19th century that paper production methods using wood chips and wood pulp were developed. That change along with increased demand for paper and other wood products has led to growing pressure on the world's forests, Sustainable Forest Management (SFM) is a concept that has developed to ensure that forests are managed properly, meeting both the needs of today and those of future generations and the planet. Sustainable forest management means protecting the health and integrity of forest ecosystems, conserving biological diversity and soil and water resources, safeguarding forest areas of significant ecological or cultural importance, and ensuring sustainable yield, while at the same time maintaining or enhancing the socio-economic, cultural, and spiritual benefits of forests.

In order to support the sustainable management of forests, a number of sets of criteria and indicators have been developed to evaluate the achievement of SFM at both the country and management unit level. These criteria have led to the development and promotion of SFM standards and product labeling schemes. Paper products that are labeled as "certified" to a SFM standard contain a minimum amount of fiber or pulp derived from forests certified to the scheme's approved and independently verified SFM standard. In addition, all parties in the value chain from the forest to the end-consumer must be independently certified to a Chain of Custody standard that assures the presence of the certified fiber in the final product. Several SFM labeling schemes exist today with two international schemes—the Forest Stewardship Council and the Programme for the Endorsement of Forest Certification being the most well known.

Chain of Custody



- Each step of the chain must be certified or the paper loses the right to be considered 'certified'.

2.2. Sustainable Forest Management Certification Schemes

2.2.1. Forest Stewardship Council Certification (FSC)

The Forest Stewardship Council (FSC) is an international network that promotes responsible management of the world's forests. It accredits independent third-party organizations to FSC standards to ensure forest sustainability. Its trademark provides an internationally recognized symbol to organizations that support the growth of responsible forest management. The FSC trademark can be displayed on products containing a mix of uncertified and certified virgin fiber. The total virgin fiber must contain a minimum of 30 % FSC-certified pulp.

For more information, visit www.fsc.org

2.2.2 Programme for the Endorsement of Forest Certification (PEFC)

Founded in 1999, the PEFC Council (Programme for the Endorsement of Forest Certification schemes) is an international, independent, non-profit, non-governmental organization. PEFC promotes sustainably managed forests through independent third-party certification, providing assurance to purchasers of wood and paper products. PEFC is similar to FSC in relation to the end product certification, offering a badge of sustainability as proof of corporate-responsible purchasing policies.

For more information, visit www.pefc.org/internet/html/

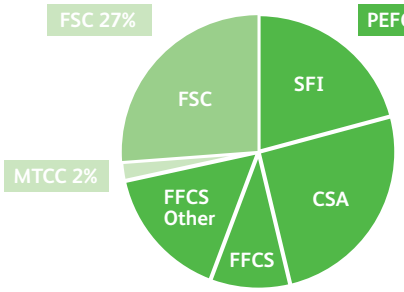
2.2.3 Sustainable Forestry Initiative, Inc. (SFI)

The Sustainable Forestry Initiative, Inc® (SFI) program is a sustainable forest management standard that originated in North America. This program is now endorsed by the international PEFC Council and is overseen by the Sustainable Forestry Board (SFB), an independent organization responsible for maintaining and enhancing the SFI standard and verification procedures. Product labeling schemes are similar to FSC and follow the principles of the PEFC.

For more information, visit www.aboutsfi.org

FSC and PEFC Certifications

- Only 7 % of the world's forests are currently certified
- Currently there is more PEFC certified wood fiber available than FSC certified



SFI: Sustainable Forest Initiative (NA)
CSA: Canada's National Standard for Sustainable Forest Management
FFCS: Finnish Forest Certification System
MTCC: Malaysian Timber Certification Council
FSC Sweden, FSC Maritime, etc. (accepted by FSC)
UKWAS: UK Woodland Assurance Standard (accepted by PEFC and FSC)

2.2.4 SFM Certification: A Small Part of the Total

Today, less than 7 % of the world's forests are certified, representing 51 million acres for FSC and 172 million acres for other certifications (mainly PEFC). Thus, 93 % of world forests are currently not certified. Beyond a debate over the relative merits of FSC certification versus PEFC, it is important to focus on the main issue—which is to obtain certification. At the same time, we must keep in mind that acceptable wood is also procured from non-certified sources where it is often the responsibility of the mills and paper merchants to set up their own traceability systems. These systems can consist of internal verification of compliance with corporate policies and national legislation, or can have third-party verification through EMAS, ISO 14001, Chain of Custody or Controlled Wood certification.

2.3 Environmental Labels and Certification Schemes

Consumers seeking environmentally preferable paper choices will find a number of product label and certification schemes that apply to paper products. To reduce confusion, it is useful to understand the range of environmental attributes covered by the schemes. The criteria for some programs concentrate on one environmental aspect such as sustainable forest management. Others are life cycle based and include a wide range of criteria. For example, paper products carrying the FSC label ensure the purchaser that the product meets the minimum sustainable forest management and Chain of Custody criteria established by the Forest Stewardship Council. By contrast, the Blue Angel criteria consider the product's impact on the environment from the raw material to waste, i.e., throughout the product's life cycle.

The comparison chart provided here is meant to help you understand the range of choices in labels and certifications that may be encountered when making purchasing decisions.

Comparison of Certifications and Labels

	Recycled Fiber Use	Wood Raw Materials	Chemicals	Energy Use	Emissions	Waste Mgmt	Recyclability
Global	x	x					
EU	x	x	x	x	x	x	
Nordic Countries		x	x	x	x	x	x
Germany	x	x	x				
Austria	x	x	x	x	x	x	
Canada	x	x					
SFI North America	x	x					

2.4 The Pulp and Paper Making Process

Trees provide the primary raw material for the paper industry. Wood is made from cellulose fibers that are bound together by a material called lignin. In a pulp mill, the fibers are separated from one another into a mass of individual fibers and after separation, the fibers are washed and screened to remove any remaining fiber bundles. The pulp may then be used directly to make unbleached paper, or be bleached for white paper. Pulp may be fed directly to a paper machine in an "integrated paper mill" or dried and pressed into bales to be used as a raw material by paper mills worldwide. Recovered paper is also a raw material for the paper industry.

2.4.1 Chemical Pulping

In chemical pulp production, used to make the vast majority of printing and copying paper, the wood fibers are separated from the naturally occurring lignin by cooking wood chips in boilers. The separated lignin is then incinerated to produce energy and the chemicals are recovered in a recovery boiler.

2.4.2 Mechanical Pulping

Mechanical pulp is produced by grinding logs or refining wood chips in water. After the washing phases, the pulp is bleached to brighten the pulp. Mechanical pulp is normally used for publishing papers and packaging boards and is sometimes combined with chemical pulp to make them smooth, stiff, and opaque.

2.4.3 Recycled Pulp

Recovered paper is fed into a pulper, then mixed with soap and water. This thick pulp then goes through a series of cleaning and screening stages to remove non-fibrous contaminants such as plastics, staples, adhesives, and paper clips. Washing and de-inking—using a flotation process—removes most of the ink.

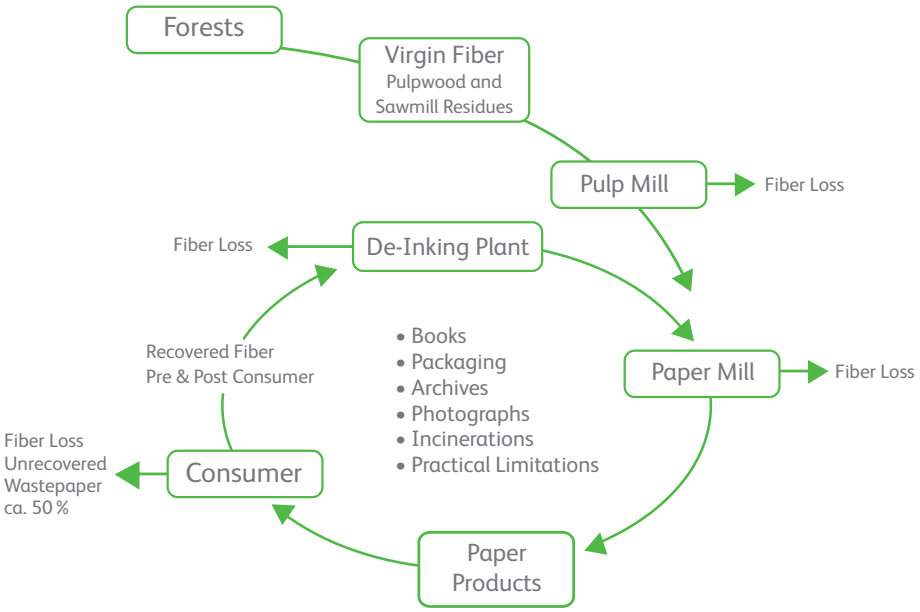
2.4.4 Paper Making

The raw materials used in making paper include wood pulp, a quantity of additives (mainly natural mineral fillers) and dyestuffs that are used together with traces of auxiliary chemicals. A further raw material is water, which is used in large quantities during the papermaking process but is then recovered and reused, or returned to the watercourse from which it is extracted. On the paper machine, the suspended raw materials are formed into sheets, dried and finished.

2.4.5 Bleaching

Bleaching actually refers to two different processes. One is de-lignification used in chemical pulping. Lignin is the "glue" that holds wood together in its natural form (as a tree), and causes paper to turn yellow over time. Chemical pulps undergo a chemical process to remove the lignin from the wood. The other bleaching process is whitening or brightening applied during the paper making process.

The Paper Cycle and Fiber Loss



When chlorine is used to bleach pulp or paper, the process can also result in the formation of harmful chlorinated organic chemicals, such as dioxins and furans in wastewater discharge, which are known to cause cancer in humans.

Elemental Chlorine Free (ECF)—in ECF paper, a chlorine derivative such as chlorine dioxide has been substituted for elemental chlorine gas, substantially reducing the formation of chlorinated organic compounds which are harmful to the environment.

Totally Chlorine Free (TCF)—in TCF papers, no chlorine or chlorine derivatives have been used in bleaching the paper pulp. Only 7 % of pulp is produced using this process, mainly in Northern and Central Europe.

Process Chlorine Free (PCF)—this term is used to refer to the totally chlorine free bleaching process used to bleach recovered fibers in making recycled content papers.

Why Can't All Paper Be Made Using the TCF Process?

In comparison with elemental chlorine-free (ECF) pulps, the environmental benefits of totally chlorine-free processes (TCF) are now minimal. The main advantage of a TCF process is that process waters can continue to be circulated for a longer period of time. Thus, water consumption is usually less than in conventional chlorine bleaching. Because the TCF process does not use chlorine, it does not produce chlorine residuals in wastewaters. However, the replacement of chlorine gas with ECF chlorine dioxide has significantly decreased the amount of harmful chlorine residuals from chlorine bleaching. The result is that the differences between the TCF and ECF processes are now very small from an environmental point of view. The overall quality of the production process and equipment is a far more significant factor in environmental loading than the bleaching sequence.

2.5 Reducing Environmental Impacts of Pulp and Paper Mills

Vast quantities of water and energy are used in making paper. Highly regulated by national governments in most parts of the world, the paper industry has made much progess in conserving water and energy over the last decades. Voluntary programs such as adherence to third-party verified Environmental Management Systems such as ISO 14001 and EMAS serve to ensure stakeholders that pulp and paper mills are controlling and reducing their environmental impacts over time—going beyond what is required by law.

2.6 Paper's Carbon Footprint

With concern about global climate change taking center stage, the concept of a "carbon footprint" has developed. As applied to a product such as paper, a carbon footprint may be defined as the total amount of carbon dioxide (CO^2) and other greenhouse gases emitted over the full life cycle of the product, from forest to disposal. The concept can apply to both direct and indirect emissions, carbon sequestration in forests and in products, the value of bio-energy, transportation and packaging emissions and the concept of avoided emissions. Because of the complexity of developing and interpreting a carbon footprint, it is important that published carbon footprint values are clear as to their scope and meaning. "Carbon neutral" claims should also be carefully evaluated. These are claims that the carbon emissions associated with the full or partial life cycle of a product or service are offset by reductions elsewhere to create a "neutral" effect on global warming.

2.7 Why Recycle?

Wood fiber, the raw material for paper, is one of the few natural resources that can be used again and again, retaining many of its valuable properties for subsequent uses. Therefore, it makes good environmental sense to recover and reuse it. With the increase in the recovery of used paper, the amount of post-consumer recovered fiber has grown dramatically and the market acceptance of recycled content paper is well established. Paper recovery boomed in the 1990s. For example, in Europe the recovering rate increased from 38.8 % to 49.4 %. In order to perpetuate this positive trend, the main players in the European paper chain committed themselves to increasing the recycling rate to 56 % by 2005. They succeeded—and the industry has now committed to a further increase. Similar increases in paper recovery have been experienced in North America as well.

Use of recovered fibers has significant benefits including conservation of a valuable natural resource, reduced pressure on forests, reduced energy consumption, water consumption and wastewater discharges, and avoided landfill space.

2.8 Why Not Only Use Recycled Fibers in Making Papers?

Without fresh wood fibers added to the supply stream, the world would be without paper or board within a relatively short time—with some estimates as short as 6 months. A fresh input of primary fibers is necessary to guarantee the consistency and functionality—technical and visual properties—of paper products. This is because after about 2 to 5 times of reuse, the length, strength, and bonding properties of the wood fibers deteriorate. The best and most economical use for recycled paper and board is, therefore, in the manufacture of new products that are less demanding in relation to functionality and quality, or that also contain some primary fiber. The industry's target is to produce recycled grades for packaging, newspapers, kitchen and toilet papers, etc. with as few processing chemicals and as little energy consumption as possible. Indeed, for "higher quality" publication paper and some packaging applications, only top quality recovered paper—which is not available in large quantities—can be used.

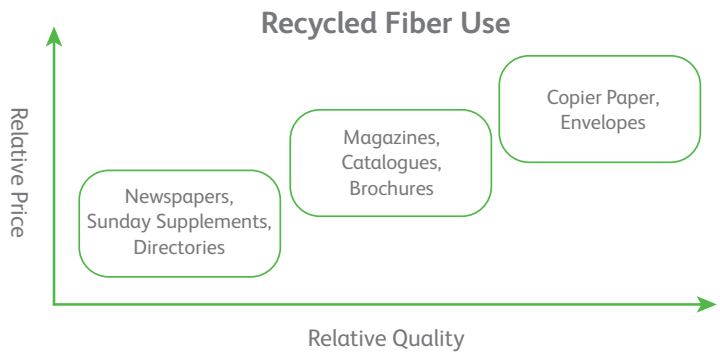
Because paper cannot be recycled endlessly, the recycling system requires a constant flow of virgin fibers to operate. That's why it's important to choose the right fiber for the right purpose. Quality requirements for the end use also determine the fiber choice.

In addition to the need for "fresh" virgin fibers to maintain quality characteristics of paper, another reason virgin fibers are necessary is "loss" of fiber to contamination, archiving—through storage of paper products such as books, and disposal to landfill. Fresh fibers also guarantee cleanliness for products coming into direct contact with food.

2.9 Quality of Recycled Content Papers

Most recycled papers are made from a combination of virgin pulp, broke (mill waste from the papermaking process itself, such as roll trimmings), and post consumer waste.

Paper that has gone to post consumer waste is unpredictable. It may contain adhesives (from window envelopes, stick-on notes, labels, etc.), which are very difficult to remove, or certain types of ink and toner that cannot be readily removed from the fibers. Technology advances in de-inking have improved the quality of recycled fiber. Xerox has long recognized these potential quality issues with recycled paper. To address them, we've established for Xerox recycled papers the same stringent performance and reliability specifications that apply to their virgin counterparts. These specifications are designed to reduce excessive paper dust, curl, paper static, and poor cut quality to ensure optimum runnability. The problems of excessive curl and contamination are quality issues related to the paper manufacturing process. Recycled papers, just like virgin papers, vary from high- to low-quality in terms of print quality and runnability. Producing a quality paper requires papermakers to establish strict performance specifications and to control the variability of the papermaking process to meet these specifications consistently—regardless of the production run, or the paper machine or mill making the paper.



2.10 Efficient Use of Printing and Copying Paper

2.10.1 Use Paper Wisely

- **Use both sides of the paper.** It's called "duplex printing" and it is the single best way to reduce paper use. So choose copiers, digital printers and multifunction devices that can print on both sides of the paper. Add duplex as your "default" mode.
- **Go digital.** Save on postage by sending electronic files and let your recipient decide whether to print them. Replace paper files with electronic ones using the scan-to-file option on multifunction devices.
- **Be selective: print what you need when you need it.** For example, print only the portion of the report you need, not every page. Preview your print to avoid printing pages with boilerplate. Print on demand. Don't stockpile forms, letterhead, or instructions that will go out of date.
- **Reach for the right paper.** A number of options promote sound environmental practices. For instance, Xerox High Yield Business Paper™ is produced using half the number of trees of conventional paper. Print on papers certified through global organizations, such as the Forest Stewardship Council or the Programme for the Endorsement of Forest Certification, both of which have strict international standards for sustainable forestry. Or use paper with recycled content.
- **Recycle.** Collect used paper so the fiber can be used again. Recycling the fiber saves trees, reduces energy and water use, requires fewer chemicals, and keeps paper out of landfills.

2.10.2 Practical Actions Guide: Recycling in Your Office

Reduce, reuse, and recycle is not only good for the environment; it helps to save money in the office. It is estimated that waste typically costs companies 4.5 percent of their expenditures. Recycling is an easy cost-saving initiative that can involve all employees. It makes good business sense to implement a basic program as soon as possible. The plan below outlines practical tips for setting up and monitoring successful recycling systems and promotes long-term success. Before starting a program, it is useful to complete a waste audit to identify what, where, and how much waste is generated by your company. Then you can compare costs after the program is up and running to see where the financial savings are. The audit should:

- Identify all points at which waste is generated.
- Identify the origin of each type of waste.
- Identify the quantity, type, and its environmental effects.
- Establish the costs of current disposal methods.
- Look at opportunities to reduce, recycle, or reuse the waste.
- Set targets for reducing waste.

Conclusion

Paper is a part of everyday life and the choices we make in selecting papers and using papers are important. Those choices can mitigate the environmental impacts of paper use across its life cycle—from raw material acquisition, manufacture, distribution, use, and disposal. Our goal in developing this reference guide was to provide the reader with an understanding of the environmental impacts of paper, and through informed choices, lead to responsible use of paper and the development of a sustainable paper cycle.

At Xerox, sustainability is a code of conduct that is part of our core values. For us, there is no singular sustainable solution—and this document demonstrates our clear environmental commitment, policies, and initiatives that address your everyday environmental concerns about our business. While we are dedicated to putting the best efforts we can into all our current processes and products, Xerox is equally dedicated to protecting our natural resources and ecosystems well into the future.

Glossary of terms

Bleaching—The majority of pulps and papers are bleached to make their appearance whiter. There are a variety of different bleaching methods, the most common descriptions being either totally chlorine free (TCF) or elemental chlorine free (ECF).

Carbon Footprint—As applied to a product such as paper, a carbon footprint is the total amount of carbon dioxide and other greenhouse gases emitted over the full life cycle of the product, from forest to disposal.

De-Inked Material—Waste paper that has had ink, filler, coatings, etc. removed as a step in the production of recycled paper.

Elemental Chlorine Free (ECF)—In ECF paper, a chlorine derivative such as chlorine dioxide has been substituted for elemental chlorine gas, substantially reducing the formation of chlorinated organic compounds which are harmful to the environment.

Life Cycle Analysis (LCA)—Measures the total environmental effects of paper through its complete lifecycle, including the preparation of the raw materials of a product; the generation of energy required for transport and production; the manufacture of a product; its use and recycling and ultimately the disposal of the product.

Mechanical Paper—Paper produced through a process of reducing trees to a pulp by grinding. In this process, the lignin is not removed and the resultant paper can discolor over time with exposure to daylight.

Mill Broke—Any paper or paperboard scrap generated in a mill prior to completion of the manufacturing process, which is unsuitable for subsequent applications but can be re-used in the paper manufacturing process.

Post-consumer Waste (or Post-consumer Recovered Paper)—The paper recovered from our homes and offices that has served its intended purpose and is ready to be recycled into new paper. This material would otherwise be incinerated or end up as landfill.

Pre-consumer Waste (or Pre-consumer Recovered Paper)—Paper generated after completion of the paper making process but never reaching the consumer. This waste includes mill broke, paper waste returned to the mill as a pulp substitute, converting scrap, newsstand returns and printers' overruns, obsolete inventory from printers and other sources, and also any damaged stock.

Process Chlorine Free (PCF)—This term is used to refer to the totally chlorine free bleaching process used to bleach recovered fibers in making recycled content papers.

Recovered Fiber (or Secondary Fiber)—Waste paper that has been collected for reprocessing and turned back into a product.

Recycled Paper (or Secondary Paper)—Paper that contains those percentages of post-consumer material and/or recovered fiber categories required by specifications and so labelled.

Renewable—A term proposed by the paper industry for virgin paper made from "renewable resources" such as managed tree plantations. Does not ensure environmentally sound paper.

Totally Chlorine Free (TCF)—In TCF papers, no chlorine or chlorine derivatives have been used in bleaching the paper pulp. Only 7 % of pulp is produced using this process, mainly in Northern and Central Europe.

Wood-free Paper—Contrary to its suggested description, wood-free paper is made from tree fibers. It describes the process of producing pulp from trees through chemical reduction and removal of lignin.

As always, please feel free to contact your Xerox Paper and Supplies sales representative or local Xerox reseller for any questions you have on this document, or any questions related to our products.