GREEN SEAL'S Grease REPORT

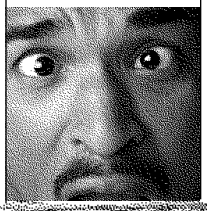
APRIL/MAY 1998

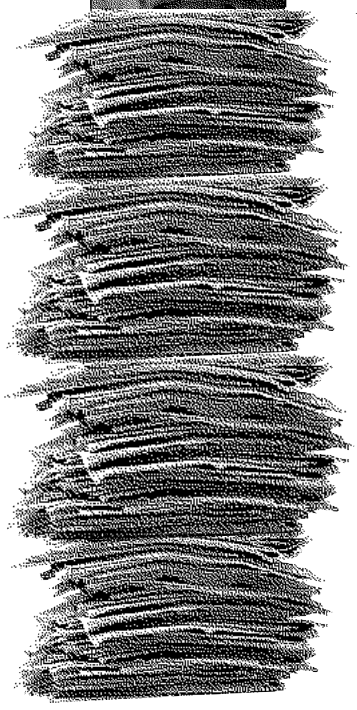
ALTERNATIVE FIBER PAPERS

- US pulp mills consume 12,430 square miles of forests around the world each year, an area almost the size of the states of Massachusetts and Connecticut combined.
- 1.5 billion tons of agricultural by-products are disposed of each year, much of which could be used for papermaking.
- The US uses paper at a phenomenal rate, approximately 90,000,000 tons per year.

This adds up to roughly 700 pounds of paper per person each year. In office use alone, the average employee uses approximately 10,000 sheets of paper every 12 months. 10,000 sheets of paper stack up to a height of almost four feet! What is more discouraging is that the use of electronic media has actually increased paper consumption in the past few years (e.g., printing out electronic mail messages).

The average employee uses approximately 10,000 sheets of paper every 12 months.





Many purchasers are unaware that an alternative to tree based papers currently exists in a class of products collectively referred to as "tree free" paper. Some of the more promoted papers include hemp, kenaf, cotton, and agricultural by-products. As these products exist today, they certainly are an option for every consumer, although some questions about production methods are being voiced. Hopefully, these issues will be resolved with more time and research.

Green Seal would like to present these tree free papers as an option for your organization, while recognizing that these papers may not meet all of your needs. However, by choosing to switch at least some of your office paper to even a partially tree free paper you can help reduce the square mileage of forests felled each year.

continued on page 2

Printed on tree free paper containing 50% kenaf fibers and 50% recovered cotton.

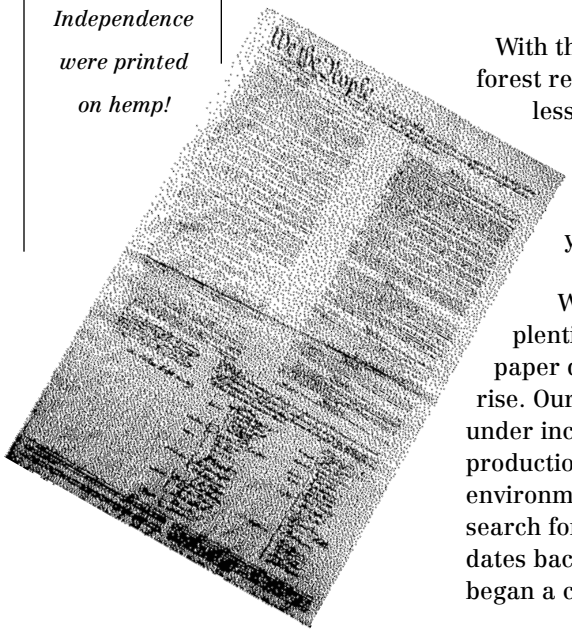
continued from page 1

For this report Green Seal examined a variety of tree-free papers, including bamboo, kenaf, hemp, agricultural by-products, cotton and recovered cotton, and flax. Green Seal reviewed the paper making, including bleaching, pulp content, location of growth and processing, transportation methods, and availability, from 9 different alternative paper producers. Green Seal reviews and recommends 23 environmentally responsible tree free papers.

Tree free papers have the advantage of offering the consumer an alternative paper. The impact of tree based papers is a widely publicized problem focused around issues such as deforestation. Tree free papers however, change the focus of the impact to issues such as transportation. Some of the potential advantages of these alternative sources consist of: less energy required for fiber processing, decreased production time, and increased yield. However, when considering these alternative sources potential disadvantages include excessive water usage, increased pesticide and fertilizer demands, transportation impacts and price.

Tree free paper is an option which has recently hit the market and is one which will continue to develop over time. Tree free paper is not necessarily preferable in all cases, but in general it presents a viable alternative. With papers made from agricultural wastes or other residues the issue of preferability is more clear cut. However the current prices for tree free papers may be up to twice the cost of tree based paper. All of the recommended tree free papers are recyclable. It is encouraging though to know that increased consumer awareness and desire will only cause the market to respond favorably.

Even early copies of the Declaration of Independence were printed on hemp!



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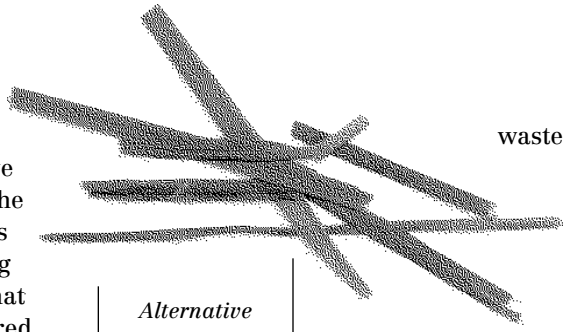
A Brief History of Paper

The early history of paper focuses on papyrus, and never includes a discussion of wood pulp. Papyrus is the oldest known plant to be written on, but the first sheets of paper were produced about 105 AD in China from hemp, fishnets, rags, and bark. The first European paper made in the first half of the 16th century never included wood. Instead, paper was made from hemp and flax rags. Even early copies of the Declaration of Independence were printed on hemp!

The industrial revolution saw the invention of faster printing machines, increasing the demand for paper. This caused paper makers to turn to a source of pulp that was plentiful and relatively easy to process. Hence, wood soon became the most popular source of pulp for paper. In fact, it is now the source of approximately 95% of the world's paper. Currently North America is the largest producer of paper and pulp.

With the easy access to vast forest reserves, the U.S. produces less than 1% of the tree free paper supply. This corresponds to less than 20,000 tons of pulp per year.

While wood is still a plentiful source for paper, paper demands are expected to rise. Our forests are coming under increasing attack from production demands and environmental stresses. The search for a suitable alternative dates back to 1957 when the USDA began a comprehensive study to



find an alternative source. The USDA was continuing a study that was spurred by severe fiber shortages for paper during World War II. The committee was looking for a fiber crop that could be used for paper production. After testing more than 1200 samples, researchers decided in 1963 that kenaf had the best potential to replace wood fiber.

Alternative sources of pulp are seaweed, banana stalk, bagasse, kenaf, bamboo, ramie, tobacco leaves, hemp, coffee bean residues and esparto grass.

Fine quality paper is now being produced from a wide variety of non-wood sources. Some other alternative sources of pulp are seaweed, banana stalk, bagasse, kenaf, bamboo, ramie, tobacco leaves, hemp, coffee bean residues and esparto grass, as well as multiple types of agricultural or manufacturing residues. For example, paper can be made from money that has been taken out of circulation, or from denim trimmings.

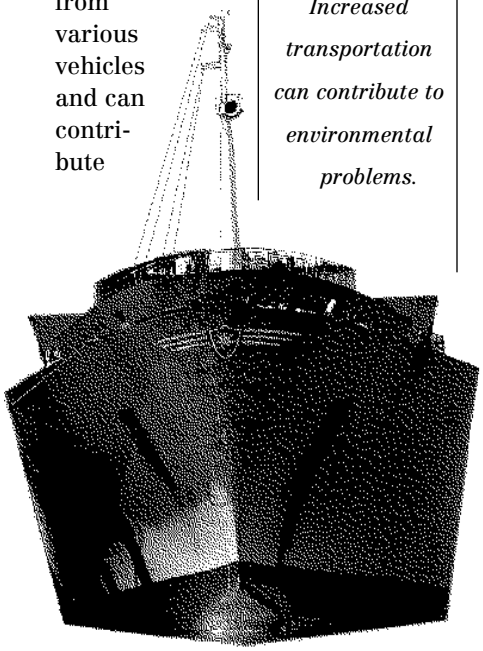
The Impact of Choosing Alternative Paper

Many papers are made from agricultural or manufacturing wastes such as rice straw, wheat straw, bagasse, vegetables or even waste textile cuttings. By using paper which contains some percentage of these wastes, you actively keep them out of landfills or incinerators. With 1.5 billion tons of agricultural wastes being produced each year around the world and most of that being burned or buried, many groups, including state governments, are trying to find alternative outlets. For example California, a large producer of rice, generates massive amounts of rice straw as a by-product. Traditionally this rice straw has been burned or sent to a landfill. However, since California is already besieged with air quality problems, the state is phasing out the burning of rice straw through encouraging its use in paper.

Transportation

Increased transportation, whether domestic or from abroad, causes emissions from various vehicles and can contribute to environmental problems such as urban ozone, acid rain or smog. For this reason, Green Seal recommends papers both grown and processed in close proximity to your business. By limiting transportation costs, environmental costs such as declining air quality also become less of a concern.

Increased transportation can contribute to environmental problems.



Understanding Tree Free

To begin to understand the difference between many of the tree free products, we need to understand some of the industry terminology. When a fiber source is harvested for pulp, it usually goes through a delignification process to separate the lignin from the cellulose fibers. Removing the glue-like lignin brightens the paper appears to take on a brighter color. Often a separate bleaching process can be used to brighten the paper even further. Traditionally, chlorine gas was used to separate the lignin, however when chlorine reacts with some organic materials found in paper-making, dangerous organochlorides such as dioxin are formed. Dioxin is a known carcinogen and is suspected to have dangerous effects on the reproductive, developmental and immune systems of humans. A fiber source that has a lower amount of lignin relative to wood, such as hemp or cotton, would need fewer chemicals to remove the lignin, lowering the chances of environmental degradation and possible detrimental health effects.

In an effort to move away from chlorine gas delignification, much of the industry is changing to alternative chemicals.

continued on page 4

continued from page 3

Totally Chlorine Free (TCF) products are bleached through alternative processes such as oxygen, hydrogen peroxide and ozone. TCF bleaching do not produce any of the toxic chemicals formed during chlorine bleaching. However, the cost of the new technology to switch a plant to TCF is extremely expensive, so until consumers demonstrate a strong desire for TCF paper, much of the industry will remain hesitant to change over.

Process Chlorine Free (PCF) is used to describe paper which has some post consumer waste content. It means that no new chlorine has been introduced to the paper making process. However, the manufacturer cannot guarantee that the PCW paper was not originally processed with chlorine.

Elemental Chlorine Free (ECF) products are delignified and/or bleached with chlorine derivatives such as chlorine dioxide. By using ECF processes, a wood pulp paper manufacturer can reduce dioxin emissions by 80–90 percent.

Dioxins from chlorine bleaching accumulate in the food chain, endangering the health of wildlife and humans.

The Wide Variety of Tree Free

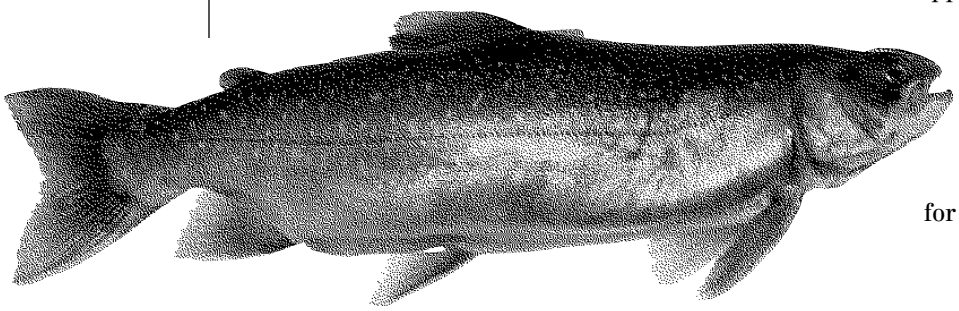
Tree free paper may not need much of a clarifying definition based on its name, however since there is such a wide variety of options we have defined a few common types. The following summary of many of the tree free fibers is by no means allinclusive, but instead it is provided so that you may make informed decisions about some of the more common alternative fibers used in printing and writing papers. At present, many tree free papers contain some post consumer content.

Bamboo is widely used as a non-wood fiber around the world because of its quick growth rate. Bamboo reaches maturity in about four years at a height of 60 feet or more, although at times it can have unpredictable behavior which has caused some economic loss to those companies growing it. Currently all of the bamboo that is imported into the US is grown in Southeast Asia and therefore involves the environmental impacts of transportation to the US. However, species of bamboo can be found in both temperate and tropical regions, so there is a possibility that the future may bring commercial bamboo production closer to home.

Cotton is one of the most frequently used tree free fibers. It is usually grown with the assistance of considerable amounts of pesticides, however there is one company which make paper from certified organic cotton. It should be recognized that most paper producers do not grow cotton to produce paper, but instead they make use of some form of by-product from the plant, such as linters. Cotton linters are the small fibers left on the cottonseed after the initial removal and cleaning of the seed. These fibers are often mixed with rag cotton to make high quality cotton paper.

Linen rags, cuttings and threads have long been a source of paper fibers. Flax growth in some European countries was very dependent upon climate and soil conditions. In 1843, a woman pioneer found that flax grows well in Oregon, and as a result, this industry boomed through World War II when they became the primary supplier of flax for military needs. Recently flax has been seeded simply for paper.

Hemp is a rather controversial alternative fiber in the United States because hemp cultivation is presently illegal. Until relatively recently hemp was one of the most widely used fibers for paper making all around the world. However, hemp produces 3–8 tons of dry fiber per acre annually, approximately 2 times more than pine. Some of the benefits of hemp include a natural resistance to most pests and a lighter color fiber compared to wood. These add up to decreased needs for pesticides, herbicides,



chemicals for bleaching and energy used for processing. However, the majority of hemp is grown in Europe and China. There may be a future for hemp in the US; for example, in 1997 North Dakota State University began to study the overall farming potential of hemp and its market feasibility.

Kenaf is an annual plant related to cotton and okra, which is now being grown throughout the world, including southern parts of the United States. The kenaf crop can produce 6–10 tons of dry fiber per acre annually, approximately 2–4 times more than pine. Kenaf is naturally resistant to most pests and diseases and is naturally whiter than wood based paper. Like hemp, kenaf has a considerably lower need for herbicides, pesticides, processing chemicals and overall energy input. Kenaf is also ideal for rotation with legumes and other food crops to maintain the soil quality. Because of kenaf's favorable qualities, in 1963, the USDA identified kenaf as the fiber source with the best potential to replace wood. Concerns about the plant growing wild across the country and becoming a pest are unfounded, because the plant grows primarily in dry, tropical climates. Studies have also found kenaf to have lower production costs. Consumers are continuing to recognize the future of kenaf, and currently companies such as Apple, Aveda and Esprit are using kenaf paper for various internal and public uses.

Checklist

WHAT TO LOOK FOR IN AN ALTERNATIVE FIBER PAPER

- ❑ Look for paper which contains at least **50% Tree Free Content**.
- ❑ Seek out papers that incorporate **fibers which would traditionally be burned or wasted** in other ways (e.g., banana stalks; recovered cotton, denim, or currency; tobacco leaves; coffee bean residues; and other types of agricultural or manufacturing remainders).

- ❑ If you choose a paper which is not entirely tree free, look for paper which makes up the balance with **post consumer waste (PCW)**.
- ❑ If choosing a paper that has been bleached, choose a paper that is classified as either **TCF (Totally Chlorine Free)** or **PCF (Process Chlorine Free)**.
- ❑ Look for paper fibers that are **grown and processed near you**. This cuts down on transportation and environmental costs.

Recommended Tree Free Papers

MANUFACTURER - BRAND NAME	% TREE FREE	% POST CONSUMER WASTE	TREE FREE FIBERS	TF BLEACH METHOD	BASIS WEIGHT	FIBER ORIGIN	MINIMUM ORDER
Papers Containing Waste Fibers							
Crane and Co., Inc.- Continuum Old Money	100		PC US currency, Recovered cotton fiber	PCF, ECF	24, 80, 90	US	1 ream
Crane and Co., Inc.- Continuum Denim Blues	100		Recovered cotton denim	ECF	24, 90, 110	US	1 ream
Esleeck Manufacturing Co. Inc.- Blue Jean Bond	100		Recovered cotton denim	ECF or Unbleached	9 to 60	US, Mexico	1 carton
Crane and Co., Inc.- Crane's CrestR	100		Recovered cotton fiber (linters or rags)	ECF	24	US	1 ream
Crane and Co., Inc.- Crane's Crest, Bond and Distaff Linen	100		Recovered cotton fiber (linters or rags)	ECF	20, 24, 28, 90, 110	US	1 ream
Esleeck Manufacturing Co. Inc.- Collateral Bond	100		Cotton rags	ECF or Unbleached	9 to 60	US, Mexico	1 carton
Arbokem- Downtown Paper #3	*57*	43	Agricultural crop residue, Chalk filler	PCF	50 to 90	Canada, US	10 reams
Esleeck Manufacturing Co. Inc.- Reissue Bond	25	min. 25	Cotton (linters or rags)	ECF or Unbleached	9 to 60	US, Mexico	1 carton
Costa Rica Natural- Banana Paper	10	90	Banana fiber	PCF	24, 32, 56	Costa Rica	1 ream
Costa Rica Natural- Coffee Paper	10	90	Coffee beans	PCF	24, 32, 56	El Salvador	1 ream
Costa Rica Natural- Cigar Paper	10	90	Tobacco leaf	PCF	24, 32, 56	El Salvador, Honduras	1 ream

All of the papers in this table work in high speed photocopiers, plain paper fax machines, inkjet printers, and laser printers.

Recommended Tree Free Papers

MANUFACTURER - BRAND NAME	% TREE FREE	% POST CONSUMER WASTE	TREE FREE FIBERS	TF BLEACH METHOD	BASIS WEIGHT	FIBER ORIGIN	MINIMUM ORDER
Papers Containing Non-Wood Crops							
Crane and Co., Inc.- Continuum Kenaf	100		Kenaf, Cotton rag	ECF, PCF (depends on color)	24, 58	US	1 ream
Crane and Co., Inc.- Continuum Hemp	100		Hemp, Cotton rag	ECF,TCF	24, 58	Europe	1 ream
EcoSource Paper Inc.- Eco-21	100		Hemp, Flax, Cotton	ECF	22, 24, 27, 55, 74	Middle East, E. Europe	$50
EcoSource Paper Inc.- EcoHemp	100		Hemp	ECF	89	E. Europe	$50
Fox River Paper Co.- Fox River Select 100 Cotton	100		Cotton	Cl	24, 28	US	see merchant
Green Field Paper Company- ColorGrown	100		Organic cotton	TCF	24, 70	US	none
Fox River Paper Co.- Rubicon	100		Bamboo	ECF	70, 80	Thailand	see merchant
KP Products, Inc.- Vision Paper	100		Kenaf	TCF	45, 52, 60	US	whole carton
Living Tree Paper Company- Vanguard Hemp	50	50	Cotton, Hemp	TCF	24, 60, 80	Spain, France	none
Green Field Paper Company- Hemp Heritage	25	75	Hemp	PCF	24, 70	E. Europe	none
Fox River Paper Co.- Fox River Select 25 Cotton Line	25	30	Cotton	Cl	20 to 28	US	see merchant
KP Products, Inc.- Re:Vision	20	20	Kenaf	PCF	70, 80	US	whole carton

Paper Company Contact Information

Arbokem 1-604-322-1317
Costa Rica Natural 1-800-777-3378
Crane and Co., Inc. 1-800-5CRANE6
EcoSource Paper, Inc. 1-800-665-6944
Esleeck Manufacturing Co., Inc. 1-413-863-4326
Fox River Paper Co. 1-920-733-7341
Green Field Paper Company 1-619-338-9432
KP Products, Inc. 1-505-294-0293
Living Tree Paper Company 1-800-309-2974

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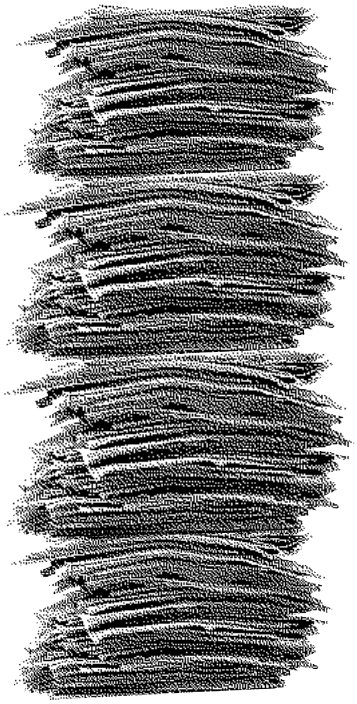
IN THIS ISSUE

The Cost of Choosing Tree Free

Tree free papers are currently available nationwide for prices somewhat higher than regular tree based paper. Green Seal found alternative paper prices ranging widely from approximately 10% to 200% more than current tree based paper prices, and the prices may be equal depending on order size. However, as with any product, increased demand raises the standard and lowers the price per unit.



The Future

The future of tree free papers is growing brighter every day. As it stands now, many tree free papers are a viable option for almost every consumer, albeit at extra cost. The market has several high quality, white alternative fibers readily available. The current trend for paper usage projects an increase far into the 21st century. As a consumer, your company can maintain our forests, our environmental quality and our landfill space by using an appropriate tree free paper.