Recycled Paper

By Brian Tomasik

June 2003 – September 2003

Update from 3 Aug. 2014: When I wrote this essay, I was an environmentalist. Now I sometimes oppose environmental conservation because shrinking habitats may reduce wild-animal suffering. The details are complicated, though, and vary on a case-by-case basis. I don't now have a strong opinion about whether recycled paper is net good or bad.

Introduction

Paper is one of the most basic and ubiquitous consumer products in the industrialized world. Many people use it daily, when receiving a package, drinking from a paper cup, drying their hands, or making a photocopy. Notwithstanding its virtual omnipresence, the production and wasteful disposal of traditional virgin paper products entail some of the most ecologically destructive and unhealthy practices on earth: deforestation, energy consumption, the creation of deleterious chemicals like dioxins, air and water pollution, and landfilling or incineration. However, a number of alternative resources and methods, including paper reduction, chlorine-free bleaching, tree-free fibers, and, as this report details, recycled paper, can alleviate, and in a few cases, almost wholly eliminate, the above impacts. As both the world's preponderate paper consumer and a country with copious room for improvement, the United States has an obligation to lead the world in the expansion of alternatives to virgin paper. The Guilderland Central School District (GCSD) can play a role in moving toward this objective by wielding its substantial purchasing power to increase demand for recycled paper, a step numerous governments, businesses, and schools have already done. This would both advance paper recycling and tell virgin manufacturers that the exorbitant environmental destruction of traditional paper production is neither sustainable nor acceptable any longer.

Paper Consumption

The ecological damage of traditional paper is multiplied enormously by the world's ravenous appetite for the product. In 1997, global paper consumption was 296.896 million metric tons (327.272 million tons), and the US, with five percent of the earth's population, used 30.3 percent of that total, or 89.9 million metric tons (99.1 million tons) (Abramovitz and Mattoon 12 and reference cited therein). In the same year, annual consumption in the US stood at 335 kilograms of paper per person (Abramovitz and Mattoon 11 and reference cited therein), an amount greater than a seven-meter (23-foot) stack of regular copy paper (Abramovitz and Mattoon 5). Regular office workers each use fifty to ninety kilograms (one hundred to two hundred pounds) of paper each year (Lotspeich). However, paper use is not so voracious everywhere; annual per capita consumption in the US in 1997 was twice the average for industrial countries, 164 kilograms, more than six times the global average, 51 kilograms, and nearly nineteen times the average for developing nations, eighteen kilograms (Abramovitz and Mattoon 11 and references cited therein). More than 71 percent of world paper is consumed by 22 percent of the global population (Abramovitz and Mattoon 10 and reference cited therein).

Paper consumption has not always been so edacious. In 1950, it was less than 1/6 of 1997 levels (Abramovitz and Mattoon 10 and references cited therein). Between 1992 and 1997 alone, per capita consumption in the US rose by twenty kilograms (forty pounds) (Abramovitz and Mattoon 8 and reference cited therein). One rapidly expanding category is printing and writing paper, which comprises 1/3 of all paper products. While global consumption of all paper types grew 74 percent from 1980 to 1999, use of printing and writing paper increased 110 percent over the same period (Abramovitz and Mattoon 12-13 and reference cited therein). In terms of its percentage of total paper, printing and writing paper is second to corrugated paper and paperboard, which comprise half of all paper products made. Third is newsprint at eight percent of paper products, fourth is tissue paper at seven percent, and last is packaging paper at five percent (Environmentally, Part II).

History of Paper

The precipitate accrescence of paper consumption is a relatively recent occurrence; for centuries, paper was a rare commodity. The first paper, made in China around 105 CE (105 AD) (Abramovitz and Mattoon 43 and reference cited therein) by Ts'ai Lun, was chlorine-free, tree-free, and recycled, for it was mixture of old rags and fishing nets, China grass, and hemp. By the 700s, Arabs had learned to make paper from linen, after which it spread further to the Middle East and Spain; the Japanese were able to re-pulp old paper by the eleventh century. The first printing of Gutenberg's Bible in 1456 was still on parchment (sheep or goat skin) or vellum (calf hide), but by the 1500s, Europe saw a burgeoning of cloth rag paper mills. North America's first paper mill was established in Mexico City in 1575; like European mills, the first paper mill in the present-day US--constructed near Philadelphia in 1690 by William Rittenhouse--utilized recycled fiber (Environmentally, Part III). In the eighteenth century, however, a paucity of rags limited paper production until wood pulping was developed in the mid-1800s. By the late nineteenth century, US federal and state governments provided subsidies and tax incentives to foster the manufacture of virgin paper from forests (Environmentally, Part I).

The Manufacture of Virgin Paper

The antiquated and pernicious practice of harvesting trees for paper that began in the nineteenth century continues to be a part of our virgin paper production process in the 21st. After wood for paper is logged, it must be shipped to mills—some of which are a long distance away—that cut it into pieces the size of poker chips. These are then transported to pulp mills, which employ either mechanical grinding or a chemical bath to convert the chips, along with any wood scraps added, to pulp (Abramovitz and Mattoon 19). Chlorine is usually mixed in because it serves both to bleach the pulp white and to remove remnant lignin from the fiber (Environmentally, Part III). The pulp is rinsed with water and sent to another mill that may or may not be connected to the pulp mill (Abramovitz and Mattoon 19). At the paper mill, the pulp enters a "headbox" where fibers are mixed into slurry that is 97 percent water. The slurry is dumped onto a wire mesh, which traps most of the fibers, while a trough underneath catches those that fall through and returns them to the headbox. The fibers that do catch on the wire, called "wet broke," are dried and rolled onto massive reels called "logs." When logs are cut, waste material, called "dry broke," is created; because it is economical to reuse this "recovered" paper, almost all mills do so. The paper is then sent to a "converter" to be cut into copy paper, envelope forms, or other kinds of paper products, the clean scraps of which are called "pulp substitutes" because they can be substituted for wood pulp without requiring further processing. Nearly all mills recycle these scraps because it is cheaper than using virgin wood. Paper is sent from the converter to end users or printers; scraps created by the latter is termed "deinking waste," as it must undergo a deinking process to eliminate glues, inks, and waxes before it is recycled. All of the abovementioned scraps, with the exception of wet broke, are considered "pre-consumer recycled" materials that are allowed to count toward recycled content, even though they are a normal part of traditional virgin paper production (Environmentally, Part IV).

Paper's Contribution to Deforestation

In spite of the recycling of pre-consumer scraps, the traditional manufacture of virgin paper results in tremendous ecological damage, some of which is due to its contribution to logging and deforestation. In 1993, 618 million cubic meters of wood, which was 18.9 percent of the global wood harvested, were consumed to produce pulp (Abramovitz and Mattoon 60 and references therein). That portion jumps to 41.8 percent of global wood when only industrial timber—that used for purposes other than fuel—is considered (Abramovitz and Mattoon 20, 63, and references cited therein). Close to half of North American timber is utilized to make paper (Environmentally, Part III). Such percentages will likely increase, for paper demand is rising twice as quickly as demand for "any other major wood product" (Abramovitz and Mattoon 20 and reference cited therein); indeed, the World Commission on Forests and Sustainable Development predicts that by 2050, paper will be responsible for more than half of industrial wood consumption (Abramovitz and Mattoon 20, 63, and reference cited therein).

It is important to note several complicating factors when considering the above percentages. For example, statistics on the quantity of wood consumed may be underestimated because they do not factor in the wood lost as sawmill detritus (Abramovitz and Mattoon 20). Additionally, only 63 percent of wood made into pulp is harvested specifically for that use, while the remainder is sawdust and other wood scraps; these scraps are not usually included in estimates of the amount of wood consumed by paper production (Abramovitz and Mattoon 20, 63, and reference cited therein). The proportion of wood harvested solely for pulp will likely grow, as sawmills become more efficient and as greater quantities of wood scraps are incorporated into engineered wood products instead of pulp (Abramovitz and Mattoon 20).

This factor of wood scraps, as well as the existence of trees with varying heights, widths, ages, and fiber types, similarly renders estimates of the number of trees required to produce a certain quantity of virgin paper only approximate. Notwithstanding these limitations, a former University of Maine graduate student involved with the Pulp and Paper Technology Program calculated that one ton (0.9 metric tons) of printing and writing paper consumes roughly 24 trees, assuming a mixture of softwood and hardwood trees fifteen to twenty centimeters (six to eight inches) in diameter and ten meters (forty feet) in height that are pulped chemically (Trees and reference therein). One pallet of normal virgin copy paper weighs one ton (has a mass of 0.9 metric tons) and contains forty cartons; each carton holds ten reams, and every ream contains five hundred sheets. Based on the above estimate, each carton uses sixty percent of a tree, each ream, six percent, and each sheet, 0.012 percent. GCSD annually purchases 2,500 cartons (Paquette, "Re:") of completely virgin copy paper (Paquette, Letter), which translates into the direct destruction of 1,500 trees each year.

Types of Forests: Old Growth

There are, however, different kinds of forests obliterated in the production of paper, each involving various degrees of ecological detriment. Of the total wood used to make virgin paper, sixteen percent is old growth, 55 percent is secondary growth, and 29 percent is plantation-grown (Abramovitz and Mattoon 21 and reference cited therein). However, the types of forests logged in certain geographic regions often vary markedly from this overall distribution. In British Columbia (BC), for example, a 1997 Sierra Legal Defense Fund and Greenpeace report estimates that more than 95 percent of logging is in old-growth forests and over 97 percent involves clear-cutting (Tree). Most of the old-growth stands still exploited for pulp are boreal forests in Canada and the Russian Federation, but some fiber continues to come from temperate and tropical forests in countries like Australia, Indonesia, and Malaysia (Abramovitz and Mattoon 23 and reference cited therein). Unless it is labeled otherwise, virtually all virgin paper contains fiber from at least one old-growth forest (Tree).

Old-growth forests are the most important and environmentally valuable on earth. They are defined as forests that have been subjected to little or no logging in the last century, that have avoided human influences enough to retain natural structure and plant diversity, that contain predominantly indigenous trees of various ages, that regenerate naturally, and that require little or no management (with the possible exception of fire control). Because they remain relatively unimpacted by humans, they often contain centuries-old trees and a prodigious diversity of species that is characteristic of higher stages of ecological succession. Dead standing and fallen trees, as well as lichen, fungi, and a thick forest floor, create a complex structure and biodiversity unmatched in plantations or even secondary growth forests (Tree).

An example of this spectacular biodiversity is BC's ancient temperate coastal rainforest, a habitat for over two hundred vertebrate species, including Black-tailed deer, Gray wolves, Grizzly bears, Marbled Murrelets, pacific Giant salamanders, Roosevelt elk, and Tailed frogs, many of which would not survive without the old-growth forest's specific ecology. In rainforest canopies of Vancouver Island, biologists have found 1.4 million invertebrates, which includes roughly 1/3 of Canada's known species and five hundred that are newly discovered; many of these organisms, likewise, could not live without the rainforest canopy (Tree and references therein).

Apart from astounding and fragile biological diversity, old-growth forests offer several other benefits and services: water purification, soil improvement and protection, fish habitats, recreational opportunities, and priceless aesthetic value. These trees mitigate global climate change by sequestering carbon dioxide into their tissues. Rare rainforest plants, many of which have not yet been discovered, contain unique genetic diversity and may serve as herbs or as the basis for new medicines. Several indigenous peoples depend on the habitat and organisms provided by ancient forests; the ravage of these regions disrupts native “cultures, economies, and languages” (Tree).

Several factors are responsible for forest degradation: development, the elimination of forested areas to create farmland and pasture, and forest harvesting for fuel, lumber, and, of course, wood for pulp (Abramovitz and Mattoon 20 and reference cited therein). In fact, “the timber industry has in all likelihood wiped out more habitat and more species per unit of production than has any other industry” (Hershkowitz, “Chapter 1”), and the results have been nothing short of devastating. The Food and Agriculture Organization (FAO) reports that the earth lost an average of 13.7 million hectares (33.9 million acres) of natural forest cover per annum between 1990 and 1995; that means an area of natural forest approximately the size of Greece is destroyed every year (Abramovitz and Mattoon 20, 62, and reference cited therein). Roughly twenty percent of the world’s old-growth forests remain in fair condition, according to the World Resources Institute (WRI) (Paper Campaign and reference therein), while the Organization of Economic Cooperation and Development (OECD) verified that clearing and logging has decimated 95 percent of original US forests (Hershkowitz, “Chapter 1” and reference cited therein). Before 1800, there existed approximately 800,000 hectares (two million acres) of American Redwoods in North America, but 96 percent have since disappeared, although most of the remainder is preserved as State or National Parks (Tree). US Forest Service data reveals that from 1952 to 1985, the southeastern US lost twelve million hectares (thirty million acres) of natural pine – an area as large as Mississippi State (Abramovitz and Mattoon 25 and reference cited therein). A mere 6.1 percent of coastal temperate rainforests worldwide are preserved, while logging has extirpated 53.1 percent of such forests. Only 69 out of 353 "primary watersheds" greater than 5,000 hectares (12,500 acres) remain unmarred, and clear-cut logging occurred in nine such watersheds between 1992 and 1997. Clear-cutting likewise threatens 624 different types of salmon in the Yukon and BC (Tree). Even though BC contains an estimated 70-74 percent of the flora and fauna diversity in Canada (Tree and reference therein), more than half of Canada's ancient forest logging occurs in BC, and eighty percent of it took place after 1960. Wood from BC, more than 1/3 of which originates from coastal rainforests, fills 2.15 million trucks per year – enough to fit around the earth's circumference 5/4 times if laid end to end. Logging has obliterated seventy percent of Vancouver Island's rainforest. Recklessly precipitate logging in Southeast Asia may completely expunge all old-growth forests that aren't protected as parks by 2010 (Tree). In addition to these overt forest losses, the quality of remaining forests is being vitiated by air pollution, fragmentation, invasive, nonnative species, and soil degradation (Abramovitz and Mattoon 20). The timber industry frequently boasts that it plants more trees than are harvested, and while this may be true, only a fraction of those planted ever reach maturity (Environmentally, Part III); overall, the types of timber used to manufacture paper are consumed more quickly than they are replaced (Hershkowitz, "Chapter 1").

Forest Types: Tree Plantations

The assertion regarding tree restoration connects to another industry claim, that trees are a "renewable resource." While it is true that trees can be replanted, they will have lost much of the diversity, complexity, and ecological value of old-growth forests; renewing a certain number of "trees" doesn't recreate a "forest." Instead, many of the replanted trees are in the form of plantations, which, unlike natural forests, cannot sustain themselves, and because they lack a variety of tree species, ages, bushes, and undergrowth, a rich multiplicity of amphibians, birds, and other wildlife is also absent (Environmentally, Part III). Plantation fiber, harvested every twenty to thirty years in temperate climates and every six to ten years in tropical regions, is especially desirable because trees of the same species and age are grown in rows to yield consistent and uniform fiber (Abramovitz and Mattoon 23).

Apart from furnishing optimal fiber, tree plantations offer other economic and environmental benefits. They have the potential to create jobs, revive damaged land, sequester carbon dioxide, and most importantly, lessen the consumption of old- and secondary-growth trees. The World Commission on Forests and Sustainable Development estimates that enough fast-growing trees could potentially be cultivated on plantations to satisfy world pulpwood consumption by 2050. This would require 100 million hectares (200 million acres) of trees, which, for comparison, is slightly more than seventy percent of the land currently devoted to corn or three hundred percent of the total area on which cotton is grown (Abramovitz and Mattoon 24 and references cited therein).

However, this may not be as promising as it sounds. Arable land is already scarce, and the situation will only worsen as the world population, now more than six billion, expands to its projected nine billion by 2050 (Abramovitz and Mattoon 25-26 and references cited therein). This is not the only downside of tree plantations. While they do provide greater species diversity, habitat, and soil protection than degraded farmland, plantations pale in comparison to natural forests. Because they are monocultures, tree plantations are highly vulnerable to pests and fungi, and as a result, pesticides and fungicides, as well as herbicides, are frequently applied.

Repeated preparation of the land and harvesting can cause damage to and potentially impair the long-term viability of the soil (Abramovitz and Mattoon 24).

In addition, land for plantations is often made available by clearing natural forests. In the southeastern US, pine plantations have replaced millions of hectares of natural forest (Abramovitz and Mattoon 25 and reference cited therein); Indonesia has demolished more than 1.4 million hectares (3.5 million acres) of natural forest to allow for plantations (Abramovitz and Mattoon 24-25 and reference cited therein); eucalyptus plantations are supplanting old-growth forests in Chile (Tree). Accompanying this elimination of natural forest is the displacement of indigenous peoples, including the Tupinikim and Guarani, native to Brazil, who have long been struggling to reclaim their land. Indonesian plantations have sometimes dislocated Dayak communities, and paper companies, which have not yet reached agreements over land acquisition, have occasionally harassed villagers and have failed to construct facilities as was promised (Abramovitz and Mattoon 25 and references cited therein).

Energy Use and Pollution Creation

The adverse environmental and human impacts of virgin paper production do not end once trees have been logged. The pulp and paper industry, which consumes four percent of global energy, is the fifth largest industrial energy user worldwide, the second largest in the US, and the largest in Canada. This industry is close to iron and steel in terms of intensity of energy use, which is the energy required to create one ton of product (Abramovitz and Mattoon 26 and references cited therein).

While this massive energy consumption contributes indirectly to air pollution, paper production entails no shortage of direct air emissions as well. A few of the pollutants released from mills include acetone, carbon monoxide, chlorine compounds, hydrochloric acid, methanol, nitrous oxides, particulates (which cause respiratory irritation), sulfuric acid, sulfur oxides, and volatile organic compounds (VOCs). Some of these substances exacerbate ozone depletion, while others are greenhouse gases; the sulfur compounds released from kraft pulp mills are redolent of addle eggs (Abramovitz and Mattoon 28-29 and reference cited therein). VOCs take part in "photochemical reactions in the atmosphere" that create ozone, a component of "photochemical smog." Federal US law acknowledges the dangers of these emissions to human health: "[P]ulp and paper facilities emit significant quantities of HAP's [Hazardous Air Pollutants…]. Some of these pollutants are considered to be carcinogenic, and all can cause toxic health effects following exposure, including nausea, headaches, respiratory distress, and possible reproductive effects" ("40 CFR Part 63"). Even though improvements have been made to the US pulp and paper industry, it remains a leader in terms of intensity of pollution, or the quantity of pollution emitted divided by the value of the output, among 74 industrial sectors examined by the Toxic Release Inventory of the US government (Abramovitz and Mattoon 28 and reference cited therein).

Pollution to water, as well as to air, results from traditional paper production. American mills utilize 44,000 to 83,000 liters (12,000 to 22,000 gallons) of water to produce one ton of virgin paper (Abramovitz and Mattoon 27 and reference cited therein), while the entire US pulp, paper, and paperboard industry creates 5.871 *trillion* liters (1.551 trillion gallons) of wastewater annually (Hershkowitz, "Chapter 1" and reference cited therein). Because writing paper is bleached and washed more than other types of paper, it consumes greater amounts of water; containerboard, for instance, requires only 1/3 of the water of writing paper (Abramovitz and Mattoon 27 and references cited therein). Wastewater contains thousands of types of particles, ranging from dissolved wood to compounds that haven't yet been identified, which can acidify, cloud, and deoxygenate streams, thereby killing fish and other aquatic species (Abramovitz and Mattoon 29 and reference cited therein). Among the numerous chemicals discharged into the water are absorbable organic halides (AOX), chloroform, dioxins, furans, methylene chloride, pentachlorophenols, and trichlorophenols (Hershkowitz, "Chapter 1" and reference cited therein).

Chemical Byproducts of Chlorine Bleaching

The dioxins and furans in mill wastewater are "halogenated aromatic hydrocarbons." The dioxin family includes 75 different compounds and the furan family, 135 compounds (State). These chemicals, along with other chlorinated organic byproducts, are formed in the pulp and paper industry when chlorine bleach combines with organic, carbon-containing substances like wood pulp (Environmentally, Part III). However, this is not the only source of these unintended byproducts (Dioxins). The incineration of medical waste, sewage, and solid waste, as well as coal, tires, and wood petroleum products, releases dioxins, as does scrap metal recovery, smelting, and steel creation at high temperatures (State). Vinyl factories are sources of the chemicals (Statement). Release of dioxins to the air or water can result from the manufacture of chlorine and chlorinated compounds (State), including pesticides and wood preservative (Colborn, Dumanoski, and Myers 113), while municipal and industrial procedures (like chlorine bleaching) predominantly pollute water (State). Although created naturally by forest fires and volcanoes (Colborn, Dumanoski, and Myers 113), dioxin is primarily anthropogenic, as EPA has reported that levels among Americans are fifty times higher than concentrations in ancient humans. Further, dioxins have actually declined since their peak in the 1970s due to strengthened environmental regulations (Statement). While numerous processes create dioxins, the pulp and paper industry is one of the most substantial contributors; in Maine, for example, seven "bleach kraft" mills, which *daily* release 400 million liters (100 million gallons) of wastewater, are the single largest source of the baneful chemical in the state's water bodies (Maine's).

Human exposure to dioxins and furans occurs in several ways, one of which is inhalation of contaminated air (Dioxins). The chemicals may travel through the air and sometimes over great distances, as is demonstrated by the occurrence of elevated levels in Arctic peoples who reside hundreds of kilometers from polluting sources (What's and references cited therein). Drinking water contamination, contact of some pesticides with skin, and propinquity to or work in incinerators and pulp and paper mills are other ways these byproducts can enter the body (State). However, approximately ninety percent of exposure is through food, especially beef, fish, dairy products, pork, and poultry, because dioxins and furans accumulate in fatty tissue (Dioxins).

Contamination of food may occur through emissions to either the air or water. When released into the atmosphere, the chemicals deposit onto plants, soil, or water. Because they don't easily break down, dioxins and furans remain there until they are ingested by animals (What's), at which point they collect in the fatty animal tissues (Dioxins). The chemicals bio-accumulate, which means they are concentrated as they ascend the food chain; thus, consumers at the top of the food chain, including humans, face greatest exposure (What). The same occurs after dioxins and furans enter the water, either through direct discharges or "fall-out" from the air. The chemicals build up in the fat of fish, insects, and shellfish to such a degree that concentrations in these aquatic organisms can be 25,000-50,000 times those in the surrounding environment; this poses an extra risk to frequent fish consumers, including some Native American groups. In addition, because dioxins and furans collect in fat, fetuses and babies are heavily exposed--during some of the most critical periods in development--through the placenta and later, breast milk (Maine's). The chemicals are generally more concentrated in minorities and people with little political and economic influence (Statement).

Exposure is of intense concern because the known and suspected health effects of dioxins and furans are so devastating. Able to kill guinea pigs at doses of one microgram per kilogram of body weight, dioxin is thousands of times deadlier to these mammals than even arsenic (Colborn, Dumanoski, and Myers 113). The most mortiferous form, 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), is the same compound that contaminated Love Canal, New York, and Times Beach, Missouri, as well as Agent Orange (What's).

Both the World Health Organization's International Agency for Research on Cancer (IARC) and the US Department of Health and Human Services' National Toxicology Program classify dioxin as a "known human carcinogen" (What's and references cited therein). In 1985, EPA characterized dioxin as "the most potent carcinogen ever tested in laboratory animals" (EPA qtd. in Environmentally, Part III). However, industry objections forced the agency to promulgate a reevaluation of the chemical in 1991 (What's). After nine years, EPA completed its draft report, which warned of a risk of cancer from dioxins as great as one in one hundred for heavy consumers of meat and dairy products high in fat. That conclusion was ten times previous estimates ("EPA") and ten thousand times the one in one million cancer rate considered "acceptable" (What's). Additionally, the draft classified TCDD as a definite human carcinogen and other compounds similar to dioxin as "likely" carcinogens ("EPA").

Dioxins' noxious effects are not limited to cancer; indeed, "Studies have shown dioxins to have a range of adverse effects on a wide number of animals" (State). High levels of dioxin result in chloracne—a skin condition characterized by acne-like lesions on the upper body—as well as excessive body hair, skin discoloration, skin rashes, and altered urine and blood, a potential sign of liver damage (State). Animals exposed to both dioxins and furans often show an impaired reproductive capacity (Dioxins), which may include decreased testosterone and sperm count, diminished ability to complete pregnancies, endometriosis, and reduced fertility (What's and references cited therein), as well as such birth defects as weakened immune systems and damage to the skeleton and kidney (State). Studies of workers exposed to dioxin show similar symptoms, such as reduced testosterone and smaller testis. In human children, dioxin may depress IQs, slow development of the brain and psychomotor ability, and change behavior, such as by contributing to hyperactivity (What's and references cited therein). Animal studies link dioxins and furans to a compromised immune system (Dioxins), and investigations on humans have demonstrated similar effects: depression of the immune system and greater susceptibility to infections (What's and references cited therein).

Though dioxin's contribution to cancer and reproductive, developmental, and immune system detriment are undeniably important, the most serious danger of dioxins may in fact be their ability to disrupt the human endocrine system (Colborn, Dumanoski, and Myers 117). This occurs when the dioxin molecules enter human cells and attach to protein receptors that serve the purpose of receiving hormones, chemical signals from other parts of the body. The attached dioxins can falsely mimic real hormones, thus triggering an unwanted cell response, or block real hormones from reaching the receptors, which would prevent a needed response (McQuaid 35 and references therein). Both animals and humans exposed to dioxins and furans have shown altered hormone levels (Dioxins). In both adults and infants, dioxin may disrupt thyroid levels (What's and references cited therein). It can also damage glucose metabolism (State), and may contribute to diabetes (What's and references cited therein).

Dioxins and furans are especially frightening because many of the aforesaid effects can occur at minute concentrations. Experiments conducted in the lab of University of Wisconsin scientist Richard Peterson underscore this point. While most animal studies on the health impacts of dioxins involve elevated levels of exposure, Peterson and his colleagues gave pregnant mother rats a *single dose* that, at the lowest, was close to concentrations in the regular populations of industrialized nations like the US. Even so, when those tiny amounts of dioxin were present at periods of critical prenatal development, the reproductive systems of male offspring were perniciously affected (Colborn, Dumanoski, and Myers 112-13 and references therein). Indeed, the abovementioned 2000 EPA draft report on dioxin warned that "It is likely that part of the general population is at, or near, exposure levels where adverse effects can be anticipated" (qtd. in "EPA"). This means that any additional emissions of dioxins and furans, such as from the pulp and paper industry, would be exceedingly dangerous and must be curtailed (Maine's).

Dioxins are deleterious not just to humans but also to wildlife, especially animals at the upper levels of the food chain. For example, the US Fish and Wildlife Service (USF&W) determined that a bleaching mill in Lincoln, Maine, was contributing to the incidence of inordinate rates of reproductive failure among bald eagles along the Penobscot River. Eagles living within three kilometers (two miles) of the mill were afflicted with reproductive success rates that, at the lowest, were forty percent less than the statewide mean. Upon measuring dioxin concentrations in unhatched eggs, USF&W found levels at most 85 times the limit considered "safe" (Maine's).

Dioxins and furans are not the only pestilent byproducts of traditional paper production. Chloroform, a colorless liquid that readily evaporates to become a toxic air pollutant, is created by water chlorination, as well as the pulp and paper industry; exposure occurs primarily through drinking water and inhalation. The chemical, which is also known as trichloromethane or methyltrichloride, was previously utilized in fire extinguishers, to expunge spots, and as an anesthetic, a fumigant, and a solvent before its dangers were fully cognized. Because acute (short-term) exposure impacts the central nervous system (CNS), it may cause headaches, dizziness, fatigue, and at high concentrations, death; liver ailments like including hepatitis and jaundice, as well as irritability, depression, and other CNS effects may result from chronic (long-term) inhalation exposure. Impaired conception and adverse impacts on the fetus—including reduced body mass and increased mortalities—have occurred in pregnant animals that inhaled chloroform. Because animals orally exposed have developed more tumors in the kidneys and liver, EPA considers chloroform "a Group B2, probable human carcinogen" (Chloroform). This is just another one of the hundreds of potentially detrimental chemicals produced by chlorine bleaching.

Landfills and Incinerators

In addition to the production of chloroform, dioxins, furans, and other forms of air and water pollution, the traditional virgin paper manufacturing process entails yet another environmentally destructive result: the creation of massive amounts of processing waste. More than 11 million metric tons (12 million tons) of solid processing waste are generated annually by US pulp and paper mills. This waste is landfilled, incinerated, or even applied to fields as an additive, an option that alarms many given that the waste is replete with chemicals like dioxin (Abramovitz and Mattoon 28 and references cited therein).

Those disposal possibilities reveal another problem with virgin paper, namely that it encourages the throwing away of waste, a trend that has risen markedly in recent decades. In 1960, the US generated 80 million metric tons (88 million tons) of municipal solid waste (MSW), by 1990, 178 million metric tons (196 million tons) were produced, and just four years later, in 1994, 190 million metric tons (209 million tons) of MSW were created (Environmentally, Part II). A full forty percent of that waste is paper, according to EPA, and ¼ of *that* amount is office paper (Lotspeich). In fact, the volume of paper thrown away each year could form a wall twelve feet high that stretches from New York to California (Environmental).

This is troublesome because that waste will end up in landfills or incinerators. Toxic materials often accumulate in landfills (almost 1/4 of the areas on the Superfund National Priority List are landfills for MSW), and even the best ones can only delay, not prevent, contamination of groundwater and other pollution. Furthermore, many landfills--including the "Fresh Kills" Landfill on Staten Island, the most colossal human creation ever–are becoming saturated, and there are few convenient locations to supplant them. Incinerators of MSW, meanwhile, emit pollution, waste fiber resources, and concentrate deleterious substances from paper that are landfilled anyway (Environmentally, Part II).

The Recycling of Paper

Most of the aforementioned consequences of traditional virgin paper–from tree consumption and enormous energy use to pollution and harmful methods of waste disposal–can be ameliorated or almost completely eliminated by recycling paper, a process of reincorporating used scraps into new paper. However, the extent of those environmental benefits depends on exactly what type of recycled paper is produced, which is why it is important to understand a few key definitions. "Post-consumer waste" (PCW) is material recovered from "consumers," people or organizations that use paper for their own purposes instead of reselling it or producing other goods from it (Environmentally, Part V). It is distinguished from pre-consumer waste, which isn't used by consumers and is almost never incinerated or landfilled. For this reason, the PCW content of paper is the *only* portion that matters in terms of environmental benefits because the pre-consumer waste would have been recycled anyway. Paper labeled as "100% recycled/30% PCW" should only be considered thirty percent recycled, because *only* the PCW content represents a deviation from the traditional paper manufacturing process and waste stream (Barber). Unless it is explicitly stated, there is no guarantee that paper labeled as "recycled" contains *any* PCW content, for such paper is only required to have "recovered materials" (which can *include* pre-consumer scraps), under Federal Trade Commission (FTC) rules (Kinsella 3).

Before it is recycled, post-consumer fiber is usually deinked to eliminate glues, inks, labels, laser and copier toner, paper clips, plastic windows, and other undesirable waste, including fibers too small to be recycled. The paper undergoes several separating, tumbling, and washing processes before it is sent to be recycled, while the remaining sludge is removed to be burned, landfilled, or utilized as fertilizer or to carry pesticides. Twenty to thirty percent of recovered printing and writing paper fiber is eliminated during deinking. Deinking mills used to employ pestilential solvents and detergents, but newer mills use chemicals that EPA doesn't regard as toxic. Some of them are mixed into the sludge but most, upon entering the wastewater, are neutralized by hydrochloric acid and sulfuric acid to form sodium chloride, sodium sulfate, and other innocuous salts (Environmentally, Part III).

Many of the environmental impacts of deinking are caused not by the recycling process itself but by chlorine bleaching and toxic inks and dyes, a few of which still contain such heavy metals as arsenic, cadmium, chromium, copper, manganese, mercury, nickel, potassium, and zinc. Though deinking sludge *is* environmentally injurious, landfilling and incineration are *even more* so, for paper that is thrown away contains almost as many toxics as deinking sludge. Whereas the latter can potentially be controlled and disposed of by relatively safe means, landfilling disperses the chemicals in paper over a large area, and incineration either releases them into the air or concentrates them in ash that will be landfilled anyway. In order to diminish the ecological effects of deinking, it is necessary to limit the use of chlorine bleach and baneful inks and dyes (Environmentally, Part III).

The Benefits of Recycled Paper

The concentration of toxics into deinking sludge is just one of the many ways that recycling lessens the baleful effects of traditional virgin paper. Another is that the recycling of fiber obviates the destruction of forests to create new pulp. This precludes the liquidation of irreplaceable old-growth forests, as well as the negative consequences of tree plantations, while surpassing many of the latter's benefits. To calculate the number of trees that recycled paper saves compared to virgin, simply divide the percentage of PCW by one hundred and multiply by the quantity of trees required to create a certain amount of virgin paper. For example, 30% PCW copy paper saves 0.18 trees per carton, since 0.60 trees make a carton of virgin copy paper. Since GCSD's current copy paper purchases destroy 1,500 trees annually, a switch to just 30%

PCW copy paper would conserve 450 trees every year. That's 1.2 trees each day and 5.1 percent of a tree every hour! The Worldwatch Institute estimates that realistically achievable expansions of recycled paper and non-wood fibers, coupled with reductions in paper consumption and efficiency improvements, can reduce the use of wood for paper by 56 percent and still allow paper consumption in Third-world nations to grow (Abramovitz and Mattoon 54 and references cited therein).

The manufacture of recycled paper instead of virgin also conserves energy. Whereas the production of one ton of virgin paper consumes at least two to three metric tons (two to 3.5 tons) of wood, the creation one ton of recycled paper requires slightly more than one ton of used paper; this helps to elucidate why the manufacture of recycled paper needs less energy, water, and chemicals and produces less manufacturing waste (Abramovitz and Mattoon 26, 37, and references cited therein). Though energy usage varies with different mills, the New York State Energy Research and Development Authority (NYSERDA) estimates that recycling linerboard paper (the kind found in cereal boxes) conserves twenty percent of the energy of virgin production, while recycling newsprint saves almost forty percent (Hershkowitz, "Chapter 1" and reference cited therein). The manufacture of recycled copy paper requires 35 percent less energy than virgin, which amounts to savings of 3.95 equivalent barrels of oil or 22.0 million kilojoules (20.8 million BTUs) per ton of paper (Hershkowitz, "Tables" and references therein). Based on these figures, GCSD would conserve 412 million kilojoules (390 million BTUs) or 74.1 equivalent barrels of oil every year by purchasing just 30% PCW copy paper; that's 13.0 kilojoules (12.4 BTUs) each second, enough energy to constantly power 217 sixty-watt light bulbs!

Recycling paper even saves more energy than incineration generates. The incineration of one ton of any type of paper will produce 2.24 equivalent barrels of oil or 12.5 million kilojoules (11.8 million BTUs). This is considerably less than the 3.95 equivalent barrels of oil or 22.0 million kilojoules (20.8 million BTUs) conserved per ton of recycled printing and writing paper (Hershkowitz, "Tables" and references therein). Moreover, because fine papers are recyclable up to twelve times before the fibers become unusably short (Kinsella 5), while incineration can only occur once, these already superior savings can be compounded many times over (Hershkowitz, "Chapter 1").

In addition to its requirement of lower amounts energy, recycled paper production entails the emission of less pollution to the air. In the 1970s, EPA prepared a report for Congress estimating that a ton of recycled paper prevents more than thirty kilograms (sixty pounds) of air pollution; however, this reduction is probably somewhat smaller today, as virgin mill efficiency has improved since then (Environmentally, Part III). One ton of 100% PCW recycled paper also precludes the release of 3,028 to 4,296 kilograms (6,675 to 9,471 pounds) of carbon dioxide into the atmosphere (Recycled and reference therein). By purchasing just 30% PCW recycled paper, GCSD could prevent the emission of between 56,770 and 80,550 kilograms (125,200 and 177,600 pounds) of carbon dioxide each year.

Recycled paper also results in less water consumption and pollution. Compared to virgin, a ton of 100% PCW paper conserves 37,000 liters (9,900 gallons) of water, according to EPA (Recycled). If GCSD purchases 30% PCW recycled copy paper, it can save 700,000 liters (190,000 gallons) of water annually, which is equivalent to 1.3 liters (0.35 gallons) every minute! Furthermore, whereas virgin paper mills generally use hundreds of dangerous substances in the production of paper, recycling mills require less than twelve nonhazardous chemicals; for example, some use a 0.5 percent solution of hydrogen peroxide, which is actually less concentrated than the solutions applied to skin (Hershkowitz, "Chapter 1" and reference cited therein). Because recycling utilizes fiber that has already been bleached, less chlorine is added the second time, which translates into the creation fewer dioxins and furans. It is also easier to altogether avoid chlorine with recycled fiber than with virgin (Environmentally, Part III).

Patents on chlorine-free bleaching technologies have existed since the 1970s (Environmentally, Part III). Recycled paper made without chlorine bleach is called Processed Chlorine Free (PCF); the original fiber, however, probably was bleached with chlorine, hence the other term for this type of paper, Secondarily Chlorine Free (SCF) (What). A minimum of 30% PCW must be included for paper to be considered PCF (Environmentally, Part V). Virgin fiber that has never been bleached with chlorine is referred to as Totally Chlorine Free (TCF) (What). When paper that does not contain 100% PCW is labeled "PCF," the virgin portion is TCF; if, however, the paper is labeled a certain percent PCF (for example, 40% PCF), the percentage indicates the PCW recycled content, which *is* PCF, but the remaining virgin fiber *is not* TCF (Recycling). These alternate bleaching methods utilize oxygen, ozone, or hydrogen peroxide as a replacement for chlorine compounds (What). Paper mills proclaiming themselves to be chlorine free should *always* be vetted by third-party certifiers, like the Chlorine Free Products Association (CFPA), to ensure that consumers don't support businesses that abuse and profit from prevaricatory and false claims. The United Nations, for example, has all of its chlorine free paper certified by CFPA (Barber).

Many paper mills advertise that they are Elemental Chlorine Free (ECF), a term that, while not false, can be misleading. ECF only means that paper is not bleached with chlorine in its elemental form, usually chlorine gas, although it is bleached with other chlorine compounds

(What), such as chlorine dioxide. ECF technologies do *reduce* dioxin and furan emissions–ECF mills discharge only six to nine metric tons (seven to ten tons) of organochlorines every day, whereas regular bleaching mills generally release 32 metric tons (35 tons)–but they do not completely eliminate them as PCF and TCF mills do (Abramovitz and Mattoon 51 and reference cited therein). Most North American mills have discontinued elemental chlorine bleaching but still employ dioxin-producing ECF technologies (Environmentally, Part III).

EPA regulations called "cluster rules" are intended to prevent pollution before it occurs instead of mitigating its impacts later on. The wastewater rules include two recommendations for "best available technology economically achievable (BAT)," both of which entail a complete transition to ECF bleaching and one of which suggested employing oxygen or longer cooking to enhance delignification; a program also exists to offer rewards to TCF mills for surpassing BAT (Environmentally, Part III). However, EPA failed to select TCF processing as BAT because of intense industry pressure not to do so (Abramovitz and Mattoon 51 and references cited therein); this decision means greater amounts of unnecessary dioxin, furan, and other emissions from the pulp and paper industry.

It also encumbers the expansion of the concomitant benefits of TCF processes, such as reduced water and energy consumption and the virtual elimination of toxic air pollution. The absence of highly reactive and explosive chlorine compounds, as well as dioxins, furans, and the like, enhances worker safety and health (Abramovitz and Mattoon 50 and references cited therein). By avoiding chlorine, these mills don't suffer the pipe corrosion caused by traditional bleaching, an advantage which allows them to more easily implement "closed-loop" effluent systems that clean and reuse wastewater to avert its release (Environmentally, Part III). Once these improvements have been made to existing mills, it should be noted, all of them save money. In addition, new TCF mills are cheaper than traditional ones because less equipment and lower-cost metals are requisite (Abramovitz and Mattoon 50 and references cited therein). An analysis of Great Lakes paper production by the Center for the Biology of Natural Systems, a group run by Barry Commoner at Queen's College, New York, concluded that a shift to TCF technologies would elevate prices only marginally, for even though chlorine bleach is half the cost of alternatives, the conversion would permit the utilization of wastepaper that is lower quality and cheaper (Environmentally, Part III). A study in the 1 June 1995 issue of *Pulp and Paper International*, which analyzed fifty mills in six countries—some of which had minimal environmental regulations—reported even more economically favorable results when it found that those mills which had invested in ECF and TCF processing earliest were not only competitive with conventional mills but actually yielded the greatest profits (Abramovitz and Mattoon 52, 70, and reference cited therein). Writing in the journal of the pulp and paper industry, the author of the report asserted a powerful conclusion: "Business people have been brainwashed by classes in traditional economics to believe that investing to reduce pollution is a waste of money. The problem with this view is that it makes assumptions that do not hold true in the real world" (Chad Nehrt qtd. in Abramovitz and Mattoon 52).

While most recycled paper facilities succeed only in *reducing* air and water pollution, it is possible to build mills, such as those incorporating the aforementioned closed-loop systems made possible by chlorine free processing, that create *no* such hazardous pollution whatsoever and that generate only minimal hazardous waste (Hershkowitz, "Chapter 1" and reference cited therein). Even typical recycling mills, however, generate less solid waste than virgin ones. EPA estimates that a ton of 100% PCW paper averts the addition of seven cubic meters (nine cubic yards) of materials to landfills (Recycled). GCSD's conversion to 30% PCW recycled paper would therefore save a hundred cubic meters (two hundred cubic yards) of landfill space each year.

Recycling may even reduce the energy used to transport wastes to those landfills. While some have asserted that by necessitating two separate fleets of collection trucks, recycling augments fuel consumption, it is often the case that the opposite is true and that even in the worst situations, the collection of recyclables requires only as much fuel as garbage disposal would alone. Several factors explain this. Recyclable collection trucks, because they are generally less massive than garbage trucks, consume less energy. At the same time, they idle for shorter periods since recyclable collection is considerably more expeditious than garbage collection. Since recycling trucks divert a portion of the total waste, garbage collectors have less to pick up, which accelerates collection at each location and enables garbage trucks to both make fewer routes and to unload less frequently during a day. In addition, while most landfills are far away from heavily populated regions (indeed, some cities even export garbage to distant areas), many recycling facilities are centered within large cities where substantial amounts of waste are generated (Hershkowitz, "Chapter 1" and reference cited therein).

Potentially diminishing the energy used by waste collection trucks is just one more way that recycled paper is ecologically beneficial. It should be no surprise that when the Paper Task Force of the Environmental Defense Fund (EDF) in 1995 performed a thorough comparison of the environmental costs of the entire production processes for various grades of totally recycled and totally virgin paper--considering such factors as recyclable collection, processing, and sludge disposal for the former and logging, wood transportation, processing, waste paper collection, and incineration or landfilling for the latter, as well as the pulping and manufacturing requirements of each--it concluded "clear and substantial environmental advantages from recycling all the grades of paper" that were evaluated (qtd. in Environmentally, Part III).

The benefits of recycled paper are not just environmental, however. Opacity (the lack of transparency of paper) is often greater in tree-free and recycled papers than in virgin; because it makes possible the use of thinner sheets for double-sided printing, a higher opacity can diminish the costs both of the paper itself and of mailings (Environmentally, Part IV). Many recycled papers are acid-free, a feature that is preferable for long-term paper storage (Kinsella 2). After 22 departments at James Madison University performed an informal test of recycled paper in copiers and printers, follow-up surveys revealed that it functioned equally well with or better than virgin paper most of the time (James). When *Paper Sales* magazine asked commercial printers about the quality of recycled paper, eighty percent opined its equivalence to or superiority over virgin paper (Environmentally, Part IV).

Many alternative agricultural fibers offer benefits similar to those of recycled paper, but even if such fiber sources made most of the world's virgin paper, recycling would still be necessary (Environmentally, Part III). The expansion of recycled paper is therefore critical in order to establish that indispensable foundation before a transition to tree-free fibers occurs.

The Necessity of and Potential for Expanding Recycled Paper Use

In spite of the overwhelming benefits of recycling, too much paper continues to be thrown away. Most printing and writing paper is disposed of within six to twelve months (Environmentally, Part II), and a mere ten percent of this high-quality paper is used for books, archives, and documents stored for the long term. Around forty percent of it is recycled, but fifty percent is landfilled or incinerated (Abramovitz and Mattoon 19 and reference cited therein). American

Forest and Paper Association (AF&PA) statistics reveal that, in 1995, 26 million metric tons (29 million tons) of printing and writing paper were consumed. Of that, almost eleven million metric tons (twelve million tons), or 41 percent, were recovered, but thirteen million metric tons (fourteen million tons) were landfilled, comprising close to nine percent of the total landfill waste (Environmentally, Part II). When all types of paper are considered, not just that for printing and writing, the US throws away 40 million metric tons (44 million tons) annually, which is more than the People's Republic of China, the world's most populous country, consumes in a year. Paper is the single greatest portion of MSW at 39 percent by weight (Abramovitz and Mattoon 38 and reference cited therein); this is in spite of the fact that paper is completely recyclable.

The horrendous amounts of paper in MSW are partially a result of the abysmal percentages of recovered content incorporated into new paper. A mere 38 percent of the total fiber that makes up paper is recovered, while 55 percent derives from virgin wood and seven percent from wheat straw, bamboo, and other non-wood fibers (Abramovitz and Mattoon 20-21 and reference cited therein). The proportions for printing and writing paper are even worse: in the US, it contains an average of slightly more than ten percent recovered fiber, according to AF&PA, and that category *includes* pre-consumer material (Environmentally, Part III). The quantity in the US drops to between six and seven percent when only truly recycled fiber is considered, which means printing and writing paper fiber is over ninety percent virgin (Abramovitz and Mattoon 41 and references cited therein).

One reason for these atrocious statistics is that recycled copy paper tends to cost slightly more than virgin because of several factors. Recycling is newer and less well established than tree-pulping, and recycling mills are generally smaller, which means they lack the economies of scale of virgin mills (Kinsella 4). When virgin mills transition to recycling, they must compensate for added costs of equipment changes. While it is cheaper to create pulp in a facility attached to the paper machines than to buy pulp on the open market, many recycling mills do the latter. Furthermore, some "paper marketers" may charge more than is necessary because they realize that many consumers expect and are willing to pay extra for recycled paper (Environmentally, Part IV).

In addition to these factors, perverse government subsidies often put recycled paper at a disadvantage. Unlike virgin, the price of recycled paper includes costs of disposal (Kinsella 4). These expenses are not subsidized by taxpayers, even though incinerators and landfills usually are. In fact, when the complete costs of landfilling and incineration are compared to recycling, taking subsidies and other hidden expenses into consideration, recycling is often the most economical (Environmentally, Part II). Logging, too, is heavily subsidized. For example, timber harvesters in BC receive $7 billion each year from the government, while Indonesia annually provides $1-$3 billion for logging. The US directly furnishes $811 million a year in the form of tax breaks at the same time that it subsidizes logging indirectly through defrayed energy, transportation, and water costs (Abramovitz and Mattoon 55 and references cited therein) on the commercial timber lands owned by the US government, which comprise over twenty percent of total US commercial timber lands. While originally meant to settle the West and to foster industry and transportation infrastructure in the late 1800s (Environmentally, Part III), the current effect of these balefully antiquated policies is not only to hinder recycled paper unfairly but also to unnaturally lower paper prices and thereby to promote overconsumption (Abramovitz and Mattoon 55).

In spite of these disadvantages, there has been an accretion in the quantity of wastepaper recovered in recent decades. In 1961, twenty percent of total fiber for paper was recovered; by 1997, that portion had grown to 38 percent (Abramovitz and Mattoon 37 and reference cited therein). Worldwide, the amount of paper recovered rose from 32 million metric tons (35 million tons) to almost 100 million metric tons (110 million tons) between 1975 and 1997 (Abramovitz and Mattoon 38 and reference cited therein). However, the simultaneous increase in paper consumption has compromised these gains: between 1961 and 1999, the total percentage of recovered fiber in paper only doubled, despite a sevenfold expansion in the overall volume of paper recovered over the same period (Abramovitz and Mattoon 40 and reference cited therein). Notwithstanding the growth of recovered fiber, "The potential for using old paper to provide a steady stream of fiber for new paper has yet to be fully exploited" (Abramovitz and Mattoon 40).

This is well illustrated by a comparison of paper recycling in the US with that in other industrialized countries. The "recovery rate" of paper is defined as the ratio of the volume recovered to the total volume consumed (Abramovitz and Mattoon 39 and reference cited therein). The US, which, with only five percent of the world's population, consumes twenty percent of global wood (How), had a paper recovery rate of 46 percent in 1997. While the worldwide recovery rate was only 43 percent in the same year, many countries surpassed the US: in Canada, the recovery rate was 47 percent, in Japan, 53 percent, in Sweden, 55 percent, in the Republic of Korea, 66 percent, and in Germany, an amazing 72 percent (Abramovitz and Mattoon 39 and reference cited therein). The contrast between the US and some European countries is even starker over the utilization of chlorine free technologies. As of the late 1990s, six percent of global bleached pulp and 27 percent of Scandinavian pulp production were TCF, while less than one percent of US and Canadian pulp production could boast the same (Abramovitz and Mattoon 50-51 and references cited therein). It is incumbent upon the US, both because of its preponderate paper consumption and its unparalleled economic and political strength and potential, to lead the world in recycling, not to lag behind smaller, weaker nations.

Purchasing Recycled Paper

One means to promote such an expansion of recycling is through positive changes in purchasing. Buying recycled paper augments demand, which expands its production and, consequently, its benefits. Greater production supports community recycling efforts and encourages mills to research and invest in recycling equipment, which further establishes recycling systems (Kinsella 3), reduces prices, and makes recycled paper more available (How). In the past, an incipient recycled paper production system was severely hampered by unstable prices and supplies, which retarded further investment, but now that recycling programs and mills have become more solidified, that volatility has been diminished (Abramovitz and Mattoon 41 and reference cited therein); this underscores the importance of creating a stable foundation for the expansion of recycled paper. Because of the school district's enormous purchasing clout, it would be able to greatly advance recycled paper production (How), while simultaneously telling virgin paper producers that their adverse environmental and human impacts are unacceptable, increasingly less profitable, and will no longer be supported by taxpayer money (Tree).

The increase in demand that GCSD could contribute would come at an important time. Purchases of recycled paper may actually be declining because consumers, assuming that all paper is recycled, are not specifically requesting it (Kinsella 5). Without adequate demand, paper that would have been recycled may instead be landfilled or incinerated (Abramovitz and

Mattoon 34 and references cited therein). At the same time, drops in demand can devastate the paper mills themselves. Because mills are so massive, they require enormous investments: a huge modern virgin pulp mill can cost $1.5-$2 *billion* dollars and may take two to three years to become operational. In order to profit, therefore, the mills must run constantly, which means that a decline in demand would glut the paper market, depress prices, and bring economic disaster to the mill (Abramovitz and Mattoon 18). After a general increase in all paper prices in 1994 and 1995, many consumers discontinued the purchase of recycled paper. Coupled with elevated prices for paper scraps, this proved detrimental to recycling mills, especially those that had recently installed new equipment, and caused some to terminate recycled paper production (Environmentally, Part IV). This demonstrates the importance of demanding recycled paper to its continued manufacture.

It is especially important to demand recycled *copy* paper. The US has low rates of recovery for mixed office paper, and most of what is recovered is incorporated into lower paper grades (Abramovitz and Mattoon 41 and references cited therein), such as newsprint, which is recyclable fewer times than printing and writing paper, and tissue papers, which won't be recycled again at all (Environmentally, Part II). Because high-quality papers have longer fibers than low-quality papers (Paper and), only recovered printing and writing paper, not these lower grades, can be recycled into new printing and writing paper (Environmentally, Part II). Therefore, the purchase of recycled copy paper would promote the preservation of high-quality recovered fiber through its recycling into new copy paper instead of lower grades. Greater demand for recycled copy paper could also encourage more consumers to recover, rather than throw away, their waste copy paper.

The Guilderland Board of Education should contribute to demand for recycled copy paper by enacting a policy ordering the purchase of copy paper containing at least 30% PCW, as well as encouraging all faculty members to reduce their paper consumption. The latter, apart from augmenting the environmental benefits afforded by the former, would serve to attenuate the slightly higher price that recycled paper is likely to cost. Although the brand has not yet been tested for performance in the school district's copiers, one type of 30% PCW copy paper is available from Graphic Paper NY for $21.50 per carton, which is $2.50 to $3.50 (thirteen to nineteen percent) more than the current $18 to $19 that GCSD currently pays per carton (Paquette, "Re:"); with 2,500 cartons purchased each year, this would represent an annual cost increase of $6,250 to $8,750 (neglecting savings from paper use reduction). This, of course, represents only the immediate, monetary cost of recycled paper. If the long-term detriment to people and their environment were included in the purchasing price of virgin paper, recycled alternatives would almost certainly be enormously cheaper. However, even considering only the immediate cost increase of recycled paper before paper reduction, the average per capita tax increase would be small. It seems likely that most taxpayers would prefer to pay a little extra if it meant supporting a more environmentally benign future. Moreover, as one of the most affluent school districts in the state, GCSD has a heightened responsibility to take this necessary step that would be nearly impossible for less wealthy districts. GCSD should become a positive role model, to thousands of its own students and other school districts as well, by actively demonstrating the importance of more environmentally benign purchasing.

A Growing Movement for Recycled Paper

By purchasing recycled copy paper, GCSD would join a growing movement of schools, businesses, and government agencies that have already taken a stand in support of more sustainable paper production systems. For example, the federal government purchases recycled paper and also requires the same for the fulfillment of contracts by companies that annually use at least ten thousand dollars worth of paper. Several states and local governments buy exclusively recycled paper; such paper is mandatory in California's state courts. Every state has at least one executive order or law supporting the purchase of products, like paper, that are made with recycled materials (Kinsella 4).

Likewise, several businesses have taken similar steps to advance sustainable paper. Bank of America's paper purchases were 3/4 recycled after 1997 and averaged 20% PCW (How). In November 2002, Staples, Inc. announced a policy to gradually eliminate paper manufactured from endangered forests and to make all of the paper sold average out to 30% PCW. The multibillion-dollar retail company also committed to strong marketing of recycled paper, to the creation of an environmental affairs division, and to the redaction a public report each year on its environmental progress (Lazaroff). Danna Smith, a director of The Paper Campaign, a coalition that lobbied Staples to effectuate such reforms, believes that "One day we're going to look back in disbelief that paper was ever produced by destroying endangered forests" (Smith qtd. in Lazaroff). In addition, 35 publishing companies in Canada and twenty in the US have already pledged to use paper made from recycled and alternative fibers. One such company, Raincoast Books, has printed the 935,000 copies of *Harry Potter and the Order of the Phoenix* intended for sale in Canada on recycled paper that contains no fiber from endangered forests, an action that will save nearly thirty thousand trees, according to Markets Initiative, a project of three environmental groups (Canadian). The book's author, J.K. Rowling, endorsed the decision: "[T]he Harry Potter books are helping to save magnificent forests in the muggle world [...]. It's a good idea to respect ancient trees, especially if they have a temper like the Whomping Willow" (Rowling qtd. in Canadian).

Colleges and universities, as well as businesses and governments, are advancing recycled paper through purchasing. Recycled paper is used for all of the printing at Bates College, which requests the paper in its bids (Bates). Indiana University enacted a policy that will avoid the purchase of products containing old-growth wood (Indiana). Policies encouraging departments to purchase recycled paper were passed by both James Madison University (James) and the University of Vermont. As of 2000, roughly 95 percent of copy paper used on the latter's campus contained at least 30% PCW, and some of that was even 60% PCW and chlorine free (University). Both Rutgers and the University of Virginia have taken similar steps to promote recycled paper (Tree). GCSD should join other schools and organizations in this growing movement for a more sustainable paper future.

Conclusion

The virgin paper production processes that have predominated since the nineteenth century continue to inflict an enormous environmental and human toll in the 21st. These impacts, which include the logging of irreplaceable old-growth forests, the intense use of energy in transportation and manufacturing, the emission of hazardous air pollutants, the release of noxious chemicals—including dioxins, furans, and chloroform—to the water, the massive generation of manufacturing waste, and the preponderate contribution to landfills and incinerators, have, if anything, been intensified and expanded in recent decades by burgeoning paper consumption.

Despite, and in fact, because of this alarming situation, it is more imperative than ever that we expand sustainable alternatives and practices, especially recycled paper, in order to mitigate theses detrimental consequences. Americans, in particular, have a special obligation to work toward this goal, both because of our edacious paper appetites and our unequaled ability to positively shape the rest of the world. By purchasing post-consumer recycled paper, GCSD would take an important and substantial step towards a healthier and more environmentally sustainable paper production system.

"We cannot stress enough that purchasing agents are the key to making the shift from a 19th-century industrial development/environment-be-damned model of papermaking to a resource-conservative, minimal-impact 21st-century system" (Environmentally, Part V).

Works Cited

"40 CFR Part 63, National Emission Standards for Hazardous Air Pollutants for Source Category: Pulp and Paper Production," Federal Register 61.47, 8 Mar. 1996: 9383 and passim.

Abramovitz, Janet N. and Ashley T. Mattoon. Paper Cuts: Recovering the Paper Landscape. Washington, DC: Worldwatch, 1999.

Barber, Greg. Trust Me is Not Good Enough. Greg Barber Company. 16 Oct. 2002. <http://www.gregbarberco.com/trustmenotgood.html>.

Bates College Lewiston, ME (Project Status, Spring 1998). Spring 1998. National Wildlife Federation (NWF). 20 July 2003. <http://www.nwf.org/campusecology/pdfs/bates_paper.pdf>.

Canadian Firm Prints Potter on Green Pages. 19 June 2003. Environmental News Service (ENS). 4 August 2003. <http://ens-news.com/ens/jun2003/2003-06-19-11.asp>.

Chloroform. 11 Dec. 2002. Environmental Protection Agency (EPA). 4 Aug. 2003. <http://www.epa.gov/region01/eco/airtox/chloroform.html>.

Colborn, Theo, Dianne Dumanoski, and John Peterson Myers. Our Stolen Future. New York: Penguin, 1997.

Dioxins and Furans. EPA. 4 Aug. 2003. <http://www.epa.gov/epaoswer/hazwaste/minimize/dioxfura.pdf>.

Environmental Benefits of Recycling. 23 Mar. 2000. University of Massachusetts Amherst. 26 Oct. 2002. <http://www.umass.edu/recycle/environmental_benefits.html>.

Environmentally Sound Paper Overview: Essential Issues Part I – Introduction. Conservatree. 14 Dec. 2002. <http://www.conservatree.com/learn/Essential_Issues/EIintro.shtml>.

Environmentally Sound Paper Overview: Essential Issues Part II – What's Going On? Conservatree. 14 Dec. 2002. <http://www.conservatree.com/learn/Essential_Issues/EIGoingOn.shtml>.

Environmentally Sound Paper Overview: Essential Issues Part III – Making Paper: Content. Conservatree. 14 Dec. 2002. <http://www.conservatree.com/learn/Essential_Issues/EIPaperContent.shtml>.

Environmentally Sound Paper Overview: Essential Issues Part IV – Making Paper: Production. Conservatree. 14 Dec. 2002. <http://www.conservatree.com/learn/Essential_Issues/EIPaperMaking.shtml>.

Environmentally Sound Paper Overview: Essential Issues Part V – Buyers: Consumers are Key. Conservatree. 14 Dec. 2002. <http://www.conservatree.com/learn/Essential_Issues/EIBuyers.shtml>.

"EPA Draft Report Cites Cancer Risks From Dioxin." CNN 17 May 2000. 31 Aug. 2003. <http://www.cnn.com/2000/HEALTH/cancer/05/17/dioxin.epa.02/>.

Hershkowitz, Allen, Ph.D. "Chapter 1 The Upstream Benefits: Reducing Pollution and the Use of Virgin Resources." Too Good to Throw Away: Recycling's Proven Record Feb. 1997. Natural Resources Defense Council (NRDC). 4 August 2003. <http://www.nrdc.org/cities/recycling/recyc/recyinx.asp>.

---. "Tables." Too Good to Throw Away: Recycling's Proven Record Feb. 1997. NRDC. 4 August 2003. <http://www.nrdc.org/cities/recycling/recyc/recytbls.asp>.

How to Encourage Forest-Friendly Purchasing in Your Community's Institutions. Resource Conservation Alliance (RCA). 14 Oct. 2002. <http://www.rca-info.org/consumerguide.html>.

Indiana University Student Coalition for an Old-Growth Free University Bloomington, Indiana (Project Status: Spring 1999). Spring 1999. NWF. 20 July 2003. <http://www.nwf.org/campusecology/pdfs/indiana.pdf>.

James Madison University Recycled Paper Purchasing Facilities Management Harrisonburg, VA (Project Status, Spring 1997). Spring 1997. NWF. 20 July 2003. <http://www.nwf.org/campusecology/pdfs/jamesmadison.pdf>.

Kinsella, Susan. Recycled Paper: The Best Choice. Mar. 2000. Conservatree. 26 Oct. 2002. <http://www.conservatree.com/paper/PaperTypes/RPCrecypprFactSheet.pdf>.

Lazaroff, Cat. Staples Plans Move to Recycled Paper. 12 Nov. 2002. ENS. 17 July 2003. <http://ens-news.com/ens/nov2002/2002-11-12-06.asp>.

Lotspeich, Chris. "Choosing Environmentally Preferable Paper." RMI Solutions Spring 2002. 15 April 2002. <http://www.rmi.org/sitepages/art7037.php>.

Maine's Dioxin Problem: The Paper Mill Connection. 10 July 2002. Natural Resources Council of Maine. 15 Nov. 2002. <http://www.maineenvironment.org/cfree/dioxin_update.htm>.

McQuaid, John. "Mystery in the Blood." Amicus Journal 23.1 (2001): 33-36.

Paper and Paperboard Products. 29 Oct. 2002. EPA. 31 Aug. 2003. <http://www.epa.gov/msw/paper.htm>.

Paper Campaign Facts. Forest Ethics. 8 July 2003. <http://www.forestethics.org/paper/facts.html>.

Paquette, Robert. Letter to the author. 24 Dec. 2002.

---. "Re: Guilderland Paper Purchases." Email to Student Environmental Action Coalition (SEAC). 29 Oct. 2002.

Recycled Office Products Co., Inc. Bangor: **?????----!!!!!!!!!!!!!!!!!!------????**

Recycling Terms. Recycled Paper Coalition. 15 Dec. 2002. <http://www.papercoalition.org/tnt-terms.html>.

Statement on Dioxin. Nader 2000. 31 Aug. 2001. <http://www.votenader.com/issues/enviro_dioxin.html>.

State of Knowledge Report: Air Toxics and Indoor Air Quality in Australia 2001. 9 July 2003. Australian Government, Department of the Environment and Heritage. 4 Aug. 2003. <http://ea.gov.au/atmosphere/airtoxics/sok/profiles/furans.html>.

Tree Free Campus: Students Take Action to Defend Forests. Rainforest Action Network (RAN). 31 Aug. 2003. <http://www.ran.org/ran_campaigns/old_growth/campus/campus.pdf>.

Trees Into Paper. Conservatree. 26 Oct. 2002. <http://www.conservatree.com/learn/Enviro_Issues/TreeStats.shtml>.

University of Vermont Recycled, Chlorine-free Paper Purchasing Burlington, Vermont (Status of Project, Spring 2000). Spring 2000. NWF. 17 July 2003. <http://www.nwf.org/campusecology/pdfs/uvm_paper.pdf>.

What is Chlorine Free Paper? Government Purchasing Project (GPP). 14 Oct. 2002. <http://www.gpp.org/clfree.html>.

What's Dioxin? Center for Health, Environment, and Justice (CHEJ). 26 Oct. 2002. <http://www.chej.org/dioxin.html>.