

SECOND  
EDITION 

# A Field Guide

Eco-Friendly, Efficient and Effective Print



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# Eco-Friendly by Design

Print is an enriching medium that is resource intensive. When we use those resources efficiently before, during, or after production, we can reduce the size of our footprint on the natural world. In today's climate of growing social and fiscal responsibility, designers and printers are adapting design and business practices to conserve resources and lessen overall impact on the environment.

The purpose of this guide is to offer information in support of sustainable design and print. The message is threefold: Eco-friendly design can be cost-efficient, environmentally sensitive and beautiful. This guide gives graphic professionals the opportunity to think about design differently.



**RECYCLE LOGO** | This indicates that a product or package is recyclable and/or made with recycled materials. Use of the recycling logo is not regulated by law; however, the Federal Trade Commission does offer guidelines. Claims should be made in language that makes the environmental attributes clear. In addition to recyclability, claims can be made regarding content and processing (for example, to note soy ink content or the use of chlorine-free processing).

# Paper

The manufacture of paper requires the use of natural resources. How much and how efficiently those resources are used depend quite a bit on the processes manufacturers use in resource acquisition and production. By obtaining tree fiber from sustainable sources, by using water judiciously and responsibly and by making greener energy choices, manufacturers and their suppliers can drastically reduce the size of their environmental footprint. Over the last several decades, foresters, environmentalists and paper manufacturers have made great strides to protect forestland and wildlife habitat, manage natural resources for sustainability and maintain air and water quality. Designers can make a difference by choosing manufacturers who subscribe to these best practices.

Paper is manufactured with a variety of fiber content. Some fibers may be virgin and various blends of recycled paper, some may be totally recycled content and some may be post-consumer recycled content.

**VIRGIN PAPER** | Coming directly from trees, it contains the strongest and purest fiber and requires the most energy to manufacture. It obviously has the most immediate impact on the forest. However, that impact may be mitigated if the pulp is harvested from a source that is part of a forest sustainability program. Its first-generation status means that virgin paper has not undergone prior printing, which can make it the most chemical free depending on its bleaching process. When specifying virgin paper, care should be taken to ensure that the pulp comes from a sustainable source. Designers should include a note to end users encouraging recycling of printed pieces made with virgin paper.

**RECYCLED PAPER** | Use of this has grown substantially. Recycling allows the same fiber to be used and reused many times over. Recovered fiber now provides almost 37% of the domestic raw material used to make paper products,<sup>1</sup> which has helped reduce the pressure on forests and landfills. Recycled paper uses less energy and produces fewer emissions in manufacturing than virgin paper. Content may include pre-consumer waste, post-consumer waste (PCW), totally recycled fiber (TRF), or various blends of each. Recycled paper has dramatically improved in quality over the past decade, in most cases performing as well as virgin stock and has become cost competitive.<sup>2</sup>

A printed piece or package can be labeled as recyclable only if it can be recovered from the solid waste stream for reuse through an established recycling program. Claims do not have to be qualified if the entire piece is recyclable. Otherwise, state how much or what specific components can be recycled. Paper suppliers and printers will have this information. The claim of recycled content can be made only on products manufactured from materials recovered during the manufacturing process (pre-consumer) or after they have served their intended purpose (post-consumer). The Federal Trade Commission stipulates that the distinction be made between pre-consumer and post-consumer content (see example below).

**Recycled content** can be any blend of recycled paper fiber and may also contain virgin paper fiber.

**Pre-consumer waste** content paper contains fiber that was recycled from waste at a mill, fabricator and/or printer. It has never been used by a consumer and often is derived from the trimmings that occur in manufacturing or from unsold magazines and periodicals.


**Post-consumer waste (PCW)** content paper contains fiber that has been in circulation in finished form and has been recycled by the end user. It is considered the most environmentally efficient since it has had at least one useful life before returning to service. Papers with the highest post-consumer waste content are the most eco-friendly.<sup>3</sup>

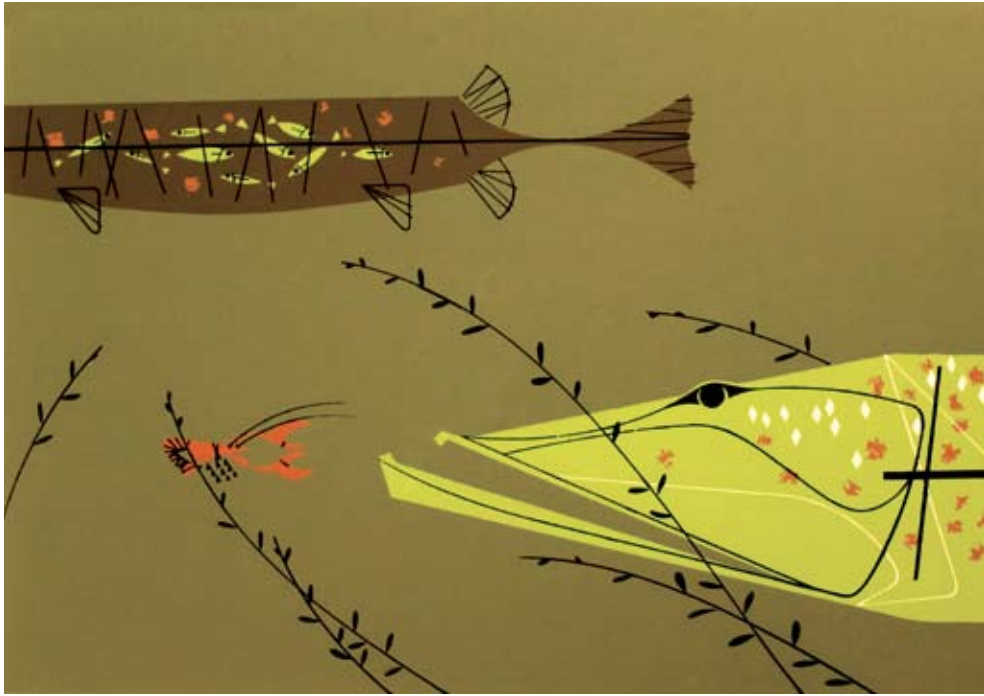
**Totally recycled fiber (TRF)** content paper contains 100% recycled material and may contain pre- and post-consumer content.

### How to Communicate Paper Contents

Recycled content is often expressed in an equation denoting its percentage of content. It is generally labeled with the total amount of recycled content first and the amount of post-consumer material second.

### Example:

 **100/30PCW**  
(100% recycled content, of which 30% is post-consumer waste)



**TREE FREE** | Nearly 40% of the trees cut in North America are used for paper production.<sup>4</sup> An alternative to wood pulp is plant fiber—either agricultural residue recovered from crops or fibers harvested from plants grown intentionally for tree-free paper. The most common are kenaf, hemp, flax, cotton and combinations thereof. In addition to their environmental value, plant fiber papers—especially kenaf and hemp, with their combination of long and short fibers—tend to be more durable.<sup>5</sup> Containing less lignin than trees, kenaf requires fewer chemicals, takes less energy to process, is naturally acid free and can be recycled. One-hundred-percent cotton paper has low acidity and is frequently used for archival purposes.

**ARCHIVAL** | Buffering agents added in the papermaking process can absorb acids from external contaminants and any residual acids in the paper. Acids can dramatically affect the life span of papers by breaking down the cellulose fibers and making the paper yellow and brittle. A truly “archival” sheet of paper is acid free (alkaline pH) and is usually buffered with calcium carbonate to stabilize the level of alkalinity. This protects the paper from discoloration and deterioration over time. Alkaline pH

Coated papers, as a group, are harder to recycle because of the clay coating that gives the papers their shiny, smooth surfaces.<sup>6</sup> Forty percent less fiber is extracted from coated paper than uncoated paper.<sup>7</sup> Although uncoated has a different look and feel, a premium uncoated post-consumer-waste paper can yield excellent-quality results in multicolor offset printing.

and buffered papers offer a longer life and should be considered for projects that require longevity.

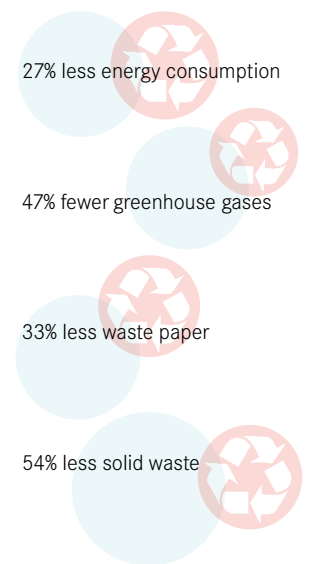
For many years, elemental chlorine was used to bleach pulp to make it white and improve paper strength, absorbency and softness. This process created a hazardous byproduct which adversely affected aquatic ecosystems throughout the world. Today, most North American and European pulp mills have found alternative, environmentally safe methods for bleaching pulp.

**PROCESS CHLORINE FREE (PCF)** | The PCF designation indicates that no chlorine or chlorine compounds were used in the pulp and papermaking processes. PCF fibers have not been re-bleached with chlorine-containing compounds, though some chlorine may remain from the manufacture of the source material.

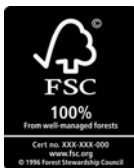
**ELEMENTAL CHLORINE FREE (ECF)** | ECF is a designation for virgin paper that uses a chlorine derivative (usually chlorine dioxide) instead of elemental chlorine for whitening in the pulping process. ECF pulp has become the most widespread replacement for elemental chlorine pulp to date, and produces paper with the same tactile qualities, strength and brightness. The U.S. Environmental Protection Agency and the European Commission recognize it as “Best Available Technology.”<sup>9</sup>

**TOTALLY CHLORINE FREE (TCF)** | The TCF label, designated for virgin fiber papers, indicates that no chlorine or chlorine compounds were used in the pulping process. Thanks to recent process improvements, many TCF papers now approach the brightness levels of ECF papers.

It has been argued that the added energy consumed in the recycling process minimizes any savings in the use of recycled paper versus virgin paper. However, assessments<sup>8</sup> by Environmental Defense and the Alliance for Environmental Innovation reveal clear environmental benefits to recycled paper:



For an illustration of how your paper choices affect the environment, visit [www.papercalculator.org](http://www.papercalculator.org), a website operated by Environmental Defense.



**FSC 100%** | Material comes from forests certified as meeting the environmental and social standards of the Forest Stewardship Council.



**FSC Recycled** | Post-consumer reclaimed material includes wood fiber reclaimed from a product that has been used for its intended end use.



**FSC Mixed Sources** | Material comes from FSC-certified forests, company-controlled sources and/or post-consumer reclaimed material.



**Rainforest Alliance logo** | Indicates that the products have come from agricultural or forestry businesses that are managed in accordance with strict standards for social and environmental sustainability.

## Paper | Pulp Sources

One of the challenges for graphic professionals has been to identify and verify environmentally responsible pulp and paper sources. This changed in the 1990s with organizations whose goal was to certify that member companies met established sustainable forestry standards. Two of those organizations are the Forest Stewardship Council and the Sustainable Forestry Initiative. Designers can be assured that their paper comes from a responsible source if it is FSC- or SFI-certified.


**ABUNDANT FORESTS ALLIANCE** | Composed of members of the North American wood and paper products industry. The alliance's goals are to manage the delicate balance between supplying wood and paper products; maintaining healthy, abundant forests; and protecting trees, soil, air, water and wildlife habitats. The group advocates sustainable forest practices, such as harvesting and replanting, as well as recycling.

**FOREST STEWARDSHIP COUNCIL\* (FSC)** | The presence of the Forest Stewardship Council chain-of-custody logo ensures that the materials used to produce the product or printed piece were sourced responsibly. Every entity that touches the product—from the logger to the printer—must be FSC certified. Designers and printers who wish to use the FSC logo or would simply like more information may contact the FSC at [www.fsc.org](http://www.fsc.org).

**RAINFOREST ALLIANCE** | The Rainforest Alliance works with FSC to help companies incorporate sustainability into their sourcing strategies. It ensures that wood products do not negatively impact indigenous populations, come from conservation areas, come from genetically modified trees and are not illegally harvested. For more information about the Rainforest Alliance, the Smartwood program and its overall mission, visit [www.rainforest-alliance.org](http://www.rainforest-alliance.org).

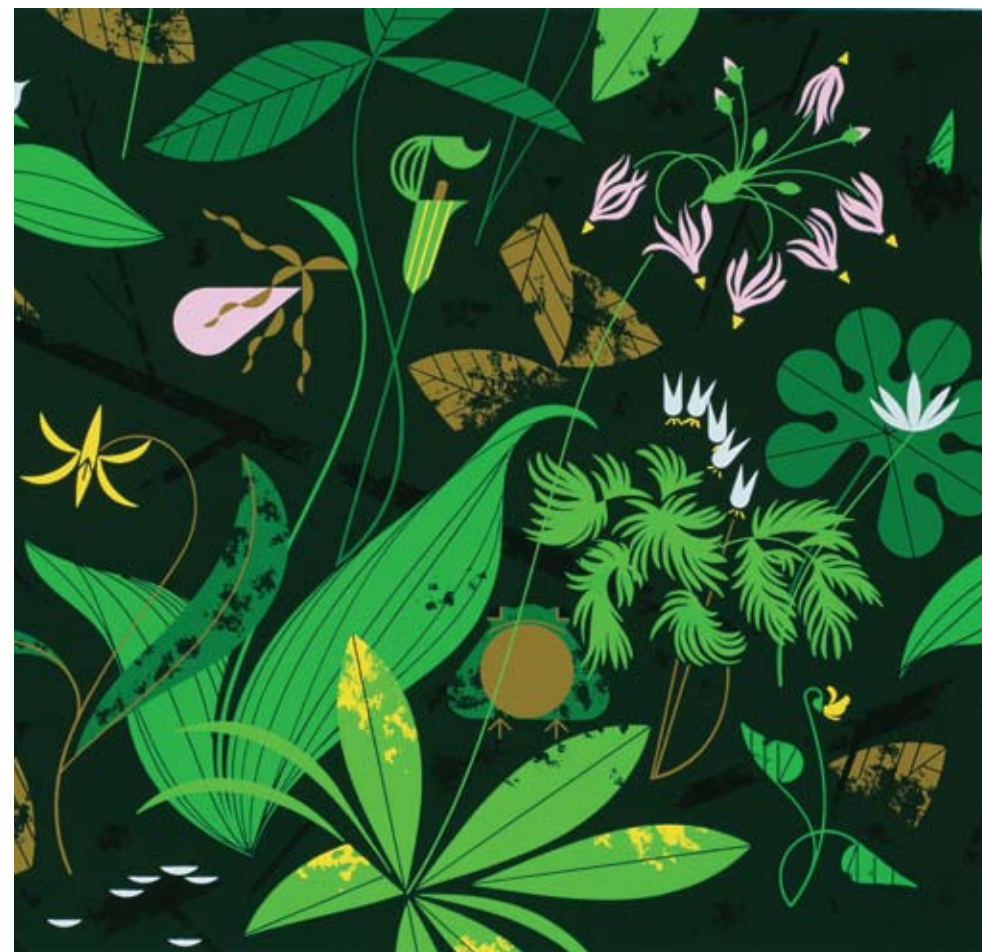
**SUSTAINABLE FORESTRY INITIATIVE\* (SFI)** | A comprehensive forest management/reforestation program that balances the demand for wood products with the need for forest sustainability. Developed in 1994 by the American Forest & Paper Association (AF&PA), the Sustainable Forestry Initiative combines environmental responsibility with sound business practices. Providers of wood and paper products, member companies plant over a million acres of trees per year.<sup>4</sup> Participation in the program is a condition of membership in the American Forest & Paper Association. The SFI program is overseen by the Sustainable Forestry Board, an independent nonprofit organization responsible for maintaining and verifying SFI standards.

\* Third-party audit is required for certification

 Environmental Commitment (Inside Back Cover)



**SFI logo** | The Sustainable Forestry Initiative employs an on-product SFI logo, or label, available for use by participating companies. The SFI Office of Label Use and Licensing must approve each company that uses an SFI logo. For information about the labeling program and the criteria for use, visit [www.aboutsfi.org](http://www.aboutsfi.org).



## Paper | Energy and Emissions

When thinking about paper, another consideration is to buy from sources that use renewable energy in production. Each year more and more paper manufacturers make the claim of green power when discussing the energy used to power their plants. Literature from most major paper mills would seem to indicate that virtually every manufacturer is entirely off the energy grid and has a wind farm next door supplying it with all the clean power it requires. This is the exception rather than the rule. So how can paper manufacturers make such claims? In general, there are three ways that paper manufacturers (or anyone else) can make a claim of using “renewable energy.” One is by purchasing green power directly from a renewable energy power plant. The second is by purchasing Renewable Energy Certificates and the third is by generating their own renewable energy on site.<sup>11</sup>

**DIRECT PURCHASE** | Manufacturers with facilities whose electrical grid is fed by green-power plants may be able to purchase energy directly from the utility. Electricity suppliers offer these products either as a percentage of electricity usage or in a fixed number of units or blocks of kilowatt-hours.

**RENEWABLE ENERGY CERTIFICATES** | The way most paper mills achieve the claim of green power is through the purchase of Renewable Energy Certificates. Renewable Energy Certificates provide a subsidy to designated renewable energy sources such as wind, solar, geothermal, hydro-electric and biomass power plants. The theory behind REC’s is that by providing a subsidy to renewable energy producers, it will make them more competitive in the energy market. This will allow them to sell energy at closer to local market rates and encourage renewable energy use and growth versus less expensive fossil fuel or nuclear based power sources. Many companies, environmental organizations and government bodies see REC subsidies as a long-term method of growing the renewable energy infrastructure. Third party certification by organizations such as Green-e and the Climate Neutral Network ensure a valid source of supply.



**GREEN-E** | The Green-e logo indicates use of certified renewable energy. Green-e is the nation’s largest independent certification and verification program for renewable energy. Eligible sources of supply include solar electric, wind, geothermal, low-impact hydroelectric, biomass, biodiesel and hydrogen fuel cell technology. For more information about Green-e certification for renewable energy, visit [www.green-e.org](http://www.green-e.org).

**ON-SITE GENERATION** | A few paper mills use green power by actually producing their own renewable energy on site. This is accomplished in most cases by “low-impact” hydroelectric generation. Turbines are placed on an adjacent river to turn generators that produce electricity. Unlike the large-scale hydroelectric operations of the past, low-impact hydroelectric preserves the flow of a river, allowing it to maintain healthy oxygen levels while also allowing fish migration to occur. On-site generation has one immediate advantage over RECs because it lowers the demand on the power grid.

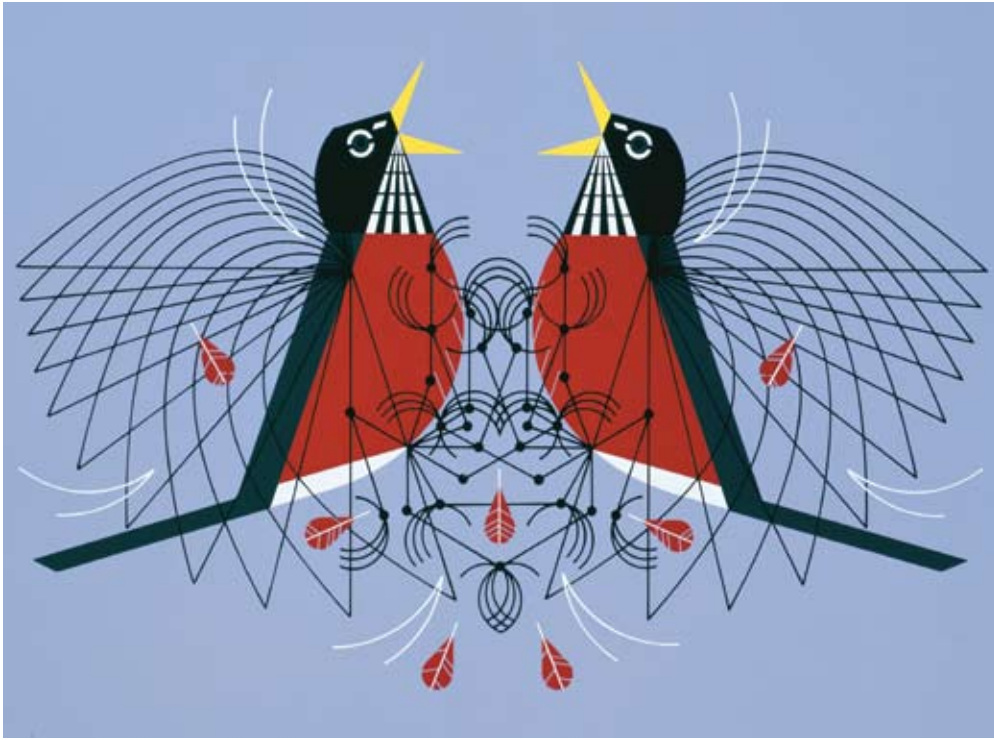
**ENERGY AND EMISSIONS** | One of the many advantages of renewable green energy is that it produces far fewer polluting emissions than traditional fossil-fueled power. It dramatically reduces carbon emissions. Wind, hydroelectric, solar and geothermal power sources all generate little if any carbon emissions after the emissions created by building the initial infrastructure are accounted for. Though some green energy methods, such as biomass fuels, use combustion and therefore release carbon, they still emit far less pollution than their coal and oil counterparts.

**CARBON NEUTRALITY** | As a response to global climate change and its impact on consumer behavior, manufacturers, corporations, government entities and even individuals are looking for ways to become “carbon neutral”. They are taking actions to reduce atmospheric carbon emissions in proportion to those generated by their activities in business and daily life. This is generally accomplished in two ways: lowering carbon emissions directly by lowering consumption and by promoting activities that aid the natural process of carbon reduction such as preserving wilderness areas.

**CARBON OFFSET CREDITS** | The concept of carbon offset credits is based on trading carbon emissions as a commodity. Under these programs an entity that produces emissions beyond an allotted level, must purchase emissions credits to offset their activity from an entity that either produces less than their allotted amount, or promotes activity that results in emission reduction. The incentives are financially based, rewarding those who lower or reduce emissions, while penalizing those who exceed their quotas. The emission credits are currently traded throughout European markets and through the Chicago Climate Exchange (CCX) [www.chicagoclimatex.com](http://www.chicagoclimatex.com).



Most mills that create renewable energy on site also need to supplement their power needs. Those wishing to claim “100% green power” accomplish this by supplementing their on-site generation with RECs or direct green energy purchases from a utility.



## Paper | Environmental Programs

It should be noted that carbon offset programs have stirred controversy. Critics claim that the programs allow polluters to purchase their way out of eco-unfriendly practices while claiming carbon neutrality. Proponents claim that the programs encourage carbon reduction and carbon reduction awareness on a large scale.

**ISO 14001 CERTIFICATION** | The International Organization for Standardization (ISO) is a network of the national standards institutes of 157 countries that sets international business and manufacturing standards. ISO 14001 is a standard for environmental management. Companies attaining an ISO 14001 certification have developed both a comprehensive system to minimize harmful effects on the environment caused by manufacturing, and a process to continually improve environmental performance. Before a certification is issued, compliance to the standard is verified by an independent auditing organization. Though ISO has no internationally recognized logo, companies that have been certified may either use their own logos with the full ISO designation (e.g., ISO 14001:2004) or ask their certifying body for permission to use the certifier's logo with the designation. For a list of certifying organizations or more information about ISO 14001, visit [www.iso.org](http://www.iso.org).

**EPA PROGRAMS** | The Environmental Protection Agency has several partnership programs, each with a corresponding logo. Of note to eco-oriented designers are the Performance Track Program, the Climate Leaders Program and the Green Power Partnership program. Partners may use the respective logos of programs they qualify for by meeting prescribed criteria.

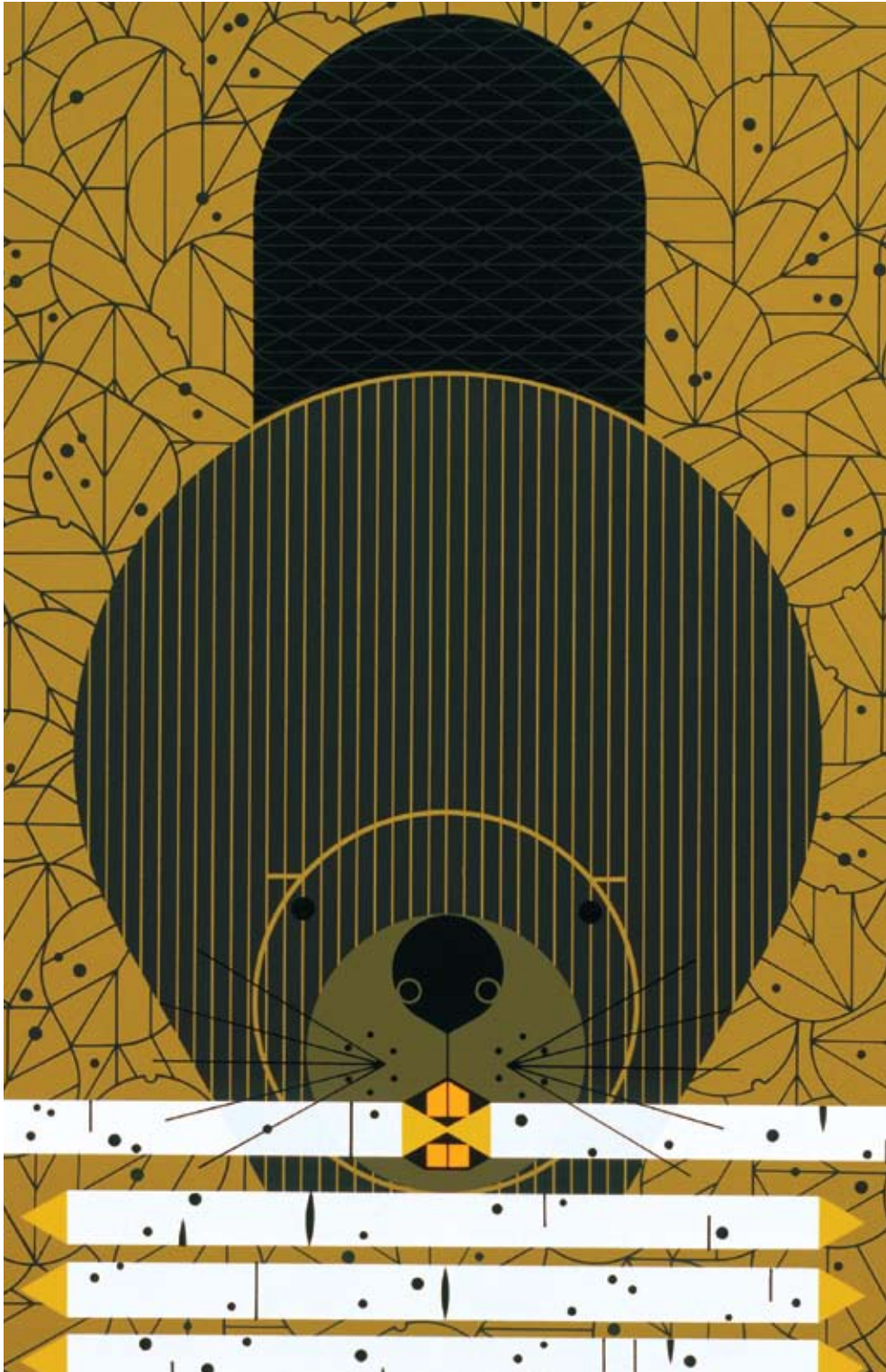
**The Green Power Partnership** is a voluntary program designed to support the increased use of green power among leading U.S. organizations, in order to reduce the environmental impacts associated with fossil-fuel electricity use. Partners commit to purchase an amount of green power that is proportional to their annual electricity consumption. Eligible renewable resources include wind, solar, geothermal, qualifying biomass and low-impact hydropower. Purchase requirements may be met with green power products, renewable energy certificates (RECs), power from on-site generation, or any combination of the three. Minimum purchase requirements must be met with power from "new" renewable facilities. Participants that have met all criteria may use the Green Power Partnership logo. Similar to the Green Power Partnership Program, the Green Power Leadership Program is a higher level of commitment to the procurement of renewable energy credits. Commitment is defined as a minimum of 20% of a "leader's" total electrical load. For the largest electrical consumers, the amount can be as high as 40%. For additional information on these EPA programs, visit [www.epa.gov](http://www.epa.gov).

**Performance Track Programs** are voluntary partnership programs that recognize and reward private and public facilities that demonstrate strong environmental performance beyond current requirements. Partners must consistently meet environmental legal requirements, have voluntarily made unregulated environmental improvements and have implemented environmental management systems that are subject to third-party audit. Another component of the program is environmental public outreach.

**Climate Leaders Programs** are industry-government partnership programs that develop long-term comprehensive greenhouse gas (GHG) reduction strategies. Participants set a reduction goal, inventory their emissions to measure progress and report their progress in data form to the EPA. Participants enrolled in the program may display the Climate Leaders logo.



**GREEN SEAL** | The Green Seal logo may be used by products that pass Green Seal certification. Green Seal is an independent, non profit organization whose goal is to promote sustainability by identifying and promoting environmentally preferable products and services. Green Seal has developed environmental leadership standards for several categories, including printing and writing paper. Criteria for certification include that papers contain at least 30% post-consumer material or be manufactured without chlorine or chlorine derivatives. Additional information about Green Seal certification can be found at [www.greenseal.org](http://www.greenseal.org).

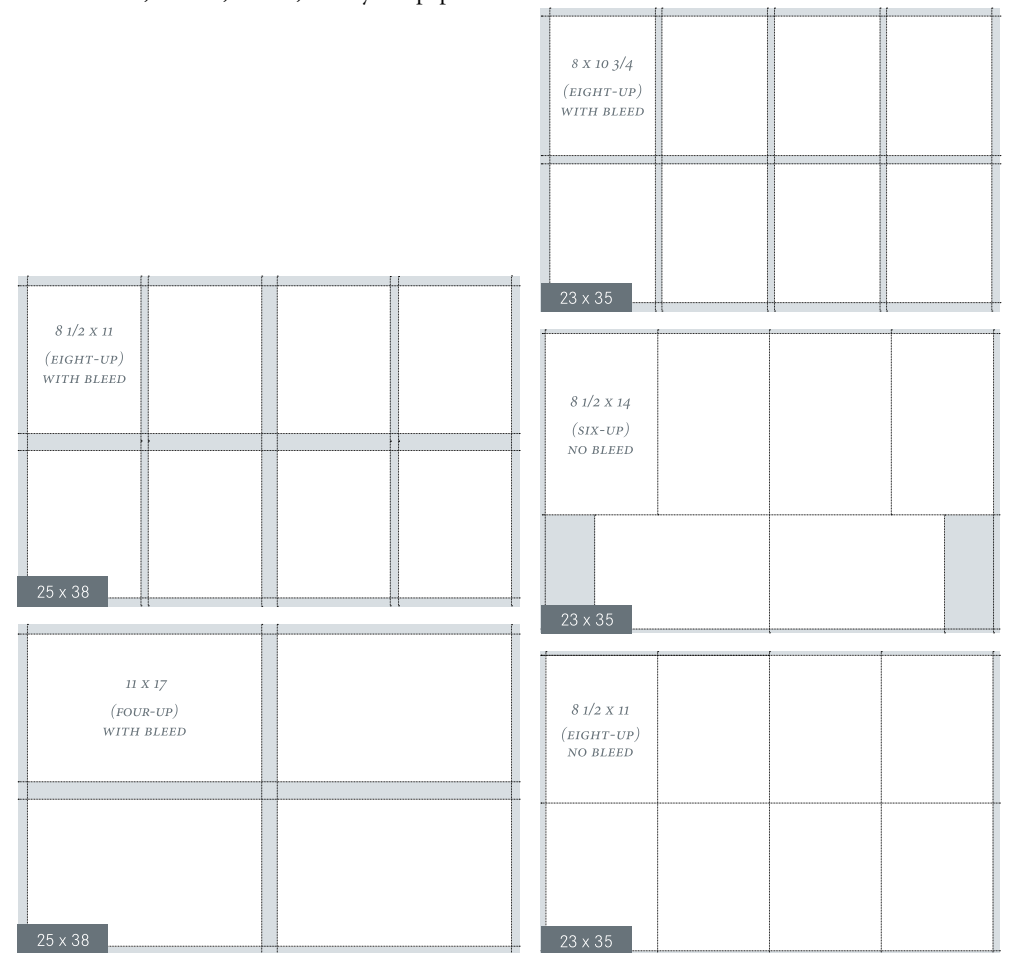


# Production

Environmental conscientiousness includes every step in the process of getting a printed piece into the hands of end users and beyond. Once print options are chosen, but before printing actually begins, steps can be taken for production to minimize chemical and paper waste.

**OPTIMUM SHEET USE** | Work closely with the printer early in the planning process. Parent sheets of paper typically come in several standard sizes. Designers can size their projects to make more efficient use of standard sheet sizes—printing two-, three-, or four-up (or more) to use less paper and to minimize the amount of waste. When making comps, designers can request the use of double-sided, smaller, reused, or recycled paper.

Some efficient uses of standard-size press sheets (assuming light-to-medium-coverage color work). It is best to work directly with your printer early in planning, as press needs vary.



**SMALLER SAVES** | Rethinking size in general is a good place to begin. Can a smaller piece serve the same purpose and have as much impact as a larger piece? Large or odd-sized designed pieces may not use paper efficiently and can result in substantial amounts of waste. Reducing size not only minimizes waste and energy consumption, but also saves money.

**LESS COMPLEXITY EQUALS LESS WASTE** | Simplifying a piece can also reduce waste. Complex folding specifications can use more paper, resulting in more waste. For example, while elegant, a french-folded book uses twice the paper necessary, as it is composed of sheets with printing on one side, folded to reveal the printed side only. Sometimes, reducing complexity might be as simple as adjusting the size of a pocket or folded section.

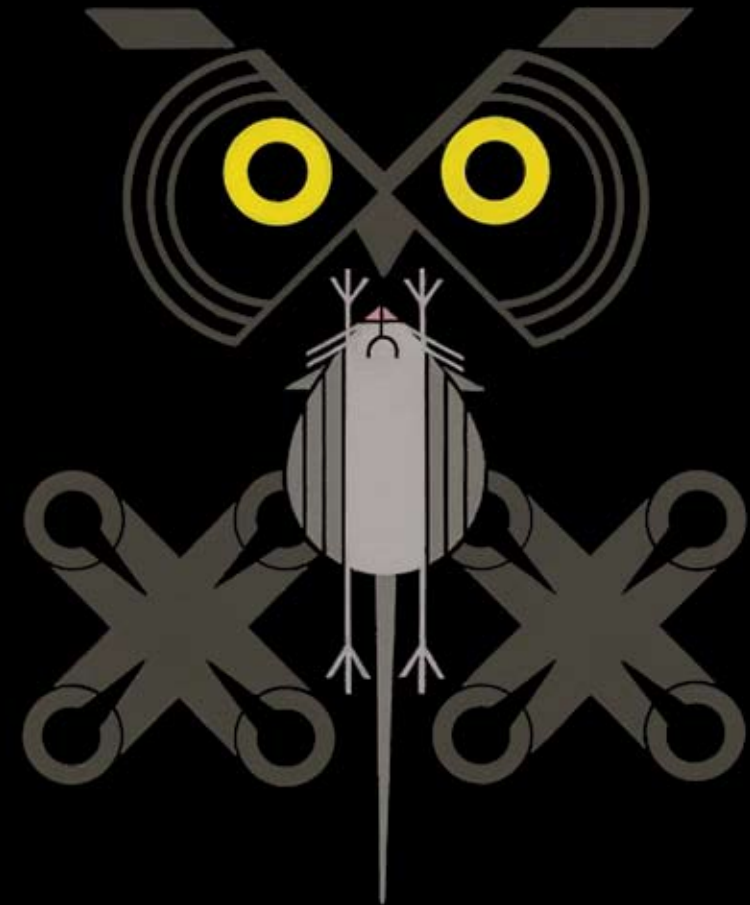
**COMBINE JOBS** | Ganging multiple print jobs uses less paper. By working with their printer early in the conceptual stage, designers creating multiple pieces with the same paper stock and ink can combine similar print jobs in the same print run. Ganged print runs reduce paper use, decrease the number of press make-readies, use fewer printing plates and save money.

**DIGITAL PHOTOGRAPHY** | The advent of digital cameras has drastically reduced waste output. Gone are the developing chemicals and the celluloid negatives. Paper is considerably reduced or eliminated entirely. However, not all digital photography is equal—care must be taken to ensure high resolution and quality.

**DIGITAL PROOFING AND FILE DELIVERY** | The electronic technology of the PDF (portable document format) can save not only resources but also time. Delivering art directly to the printer via PDF and/or server uploads eliminates wasted storage media. On-screen proofing, via PDF, eliminates paper waste.



For print jobs of sufficient quantity, designers can custom-order a sheet size that meets the specifications of their design—significantly reducing or eliminating paper waste and saving money.



Evaluating your print-design practices from an ecological standpoint can result in the added benefits of increased effectiveness and cost efficiency.

- Would an alternative typeface or document layout increase legibility while decreasing page count?

- Can the piece serve more than one purpose?  
Can a poster series be double-sided?  
Can a brochure double as a poster?
- Can a mail promotion become a self-mailer?

- Can specific content be omitted from a bound piece and inserted into a back pocket for a targeted audience?

- For mailings, can the size, aspect ratio, or weight be optimized for lower postage rates?

Bleeds can give design an increased impact; they can also impact the waste stream. Designs with bleeds are printed on oversized sheets and then trimmed to finish size. This not only increases the number of paper sheets but also increases the amount of trim waste. Consider downsizing to allow for trim on bleeds without upgrading to an oversized sheet of paper.



# Inks

From a green standpoint, two factors to consider when researching ink options are the effect on the environment of the printing process and the recyclability of the finished piece. The areas of concern are volatile organic compounds, non-renewable resources and heavy metals used in pigments. Designers may want to discuss ink options with their printer with these factors in mind. Cost is, of course, another important factor; any opportunity to reduce ink usage also saves money.

**PETROLEUM-BASED INKS** | These contain ozone-damaging distillates and volatile organic compounds (VOCs), with heat-set web offset inks emitting the most. (Many of these pollutants can be eliminated through catalytic converters.) In addition, petroleum is not a renewable resource and is not considered environmentally sustainable.

**VEGETABLE OIL-BASED INKS** | These can be an effective alternative. Often referred to as “agri-based inks,” they are well suited for uncoated paper due to their low VOC content. Biodegradable, they are made with renewable resources, such as soy, linseed, cottonseed, tung, or china wood oil. The soy or vegetable content may vary, typically from 20% to 100% of the oil in the formulation, with the remainder being petroleum.<sup>12</sup> Although agri-based inks may contain petroleum, they don’t have the VOC levels found in solvent-based formulations, which can be as high as 25–40%.<sup>13</sup> It should be noted that there are no minimum percentages of soybean oil required to use the American Soybean Association’s soy logo. Because of the variations and content of VOCs, designers will want to check with their printer about soybean oil content and insist on a low VOC rating.

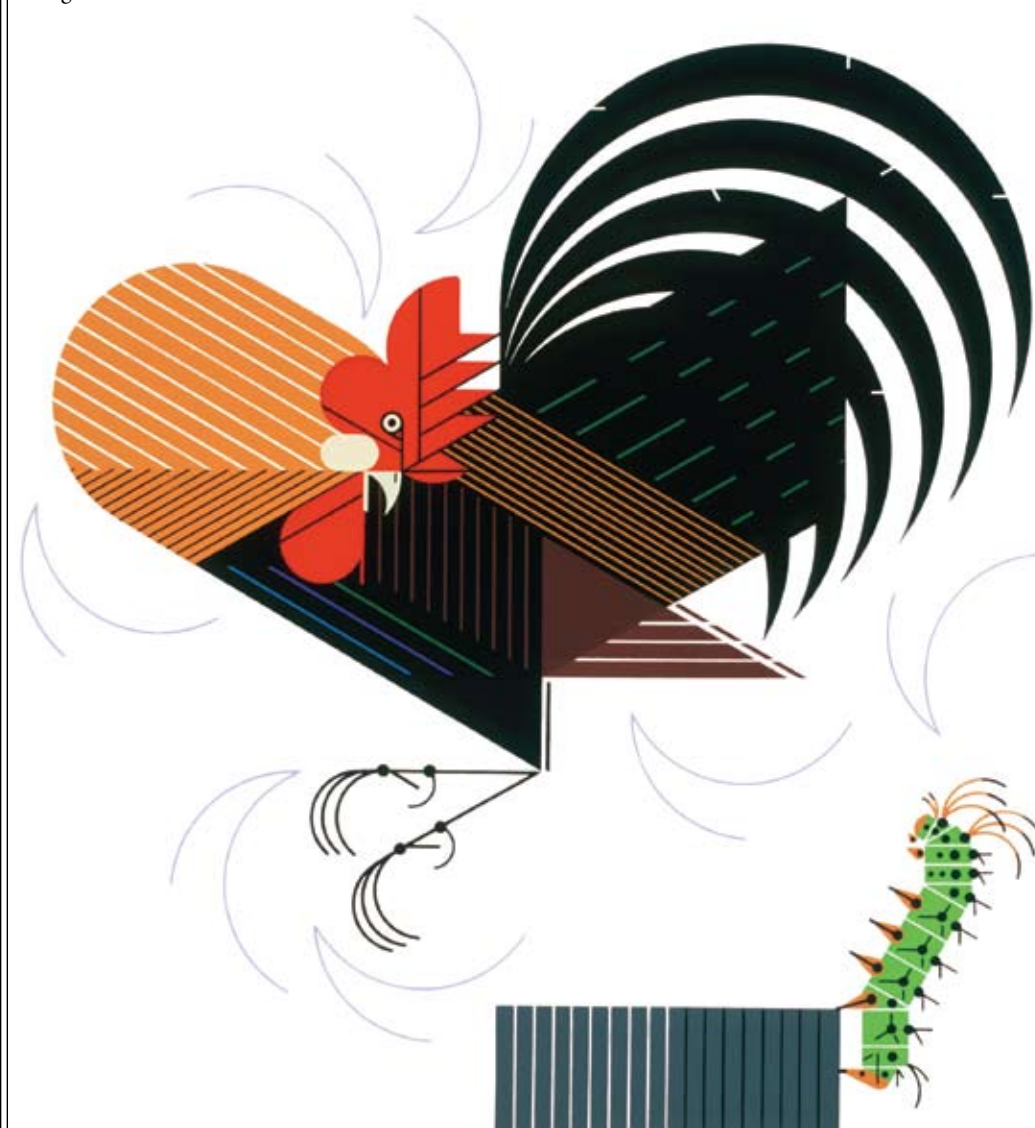
**RECYCLED INKS** | These can also lessen the environmental impact of printing. Inks are not recycled in the same way as paper, plastics, or glass. Some printers can reuse old or spent inks by blending them together. Otherwise, such inks may be returned to ink distributors or disposed of through a registered disposal company. It should be noted that color quality can vary greatly when using recycled inks.

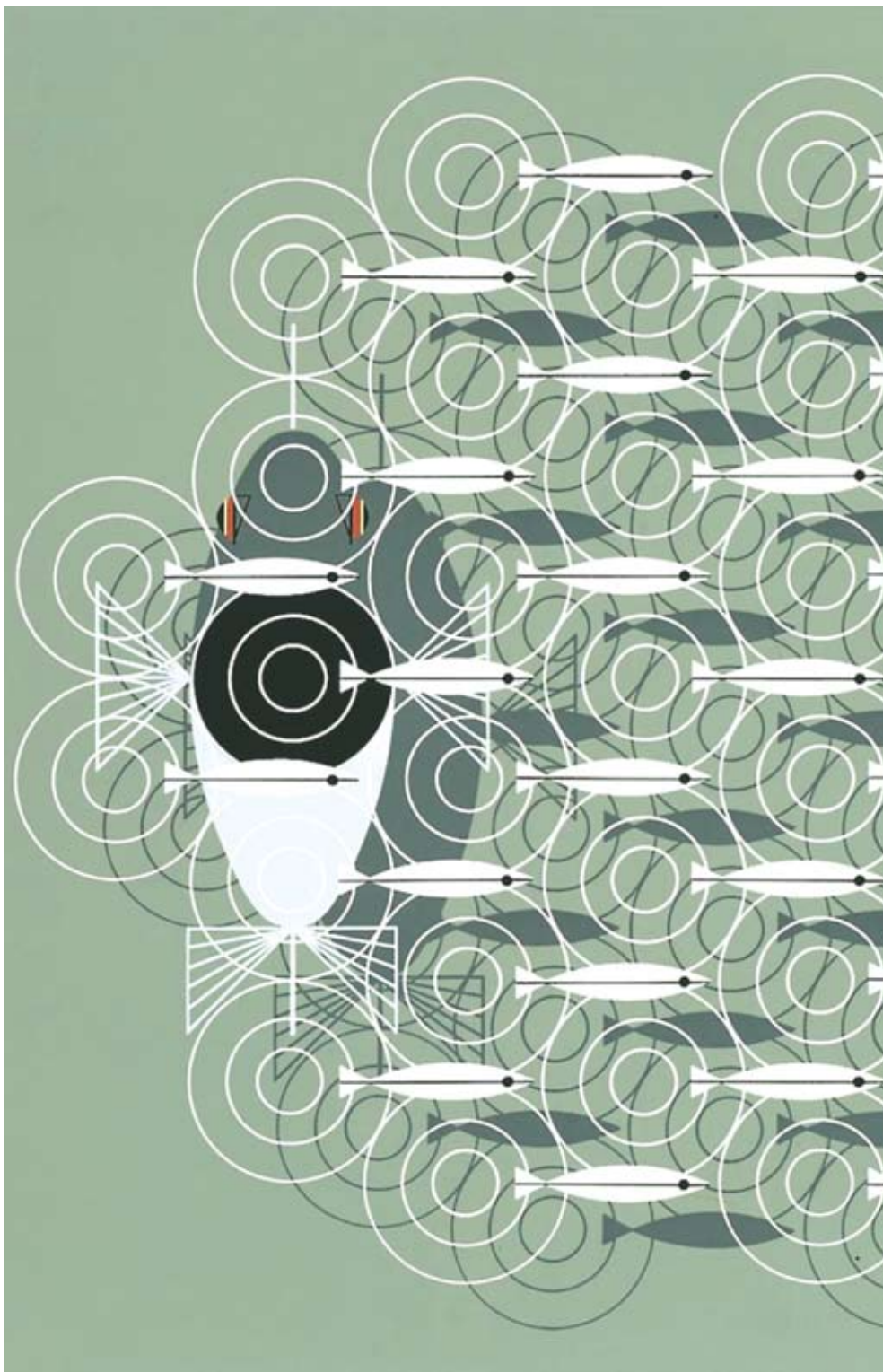


Consider using fewer ink colors, perhaps two instead of four. Four-color printing involves four metal printing plates and four separate inks. Attractive alternative designs can be made with effective use of spot colors. In addition, reduce full-page ink floods—more ink means more de-inking. De-inking is the process by which inks, adhesives, glues, staples and other non-paper elements are removed from recovered paper. De-inking raises some concern because the byproduct is waste sludge that must be disposed of. Less ink has less of an impact on the environment.

**HEAVY METALS** | Some pigments contain heavy metals. Although such known carcinogens as lead, chromium and cadmium have been replaced with carbon-based substitutes, some pigments still contain barium, copper and zinc. For a greener choice, designers can discuss with their printer which colors do not contain heavy metals and what alternative pigments can be found to match the desired color. In general, fluorescent and metallic inks are more toxic, because they contain heavy metals. Although some materials printed with metallic ink may be recycled, they are not easily decomposed and the heavy metal component can be hazardous to groundwater.

Even vegetable-based inks are harmful if they exceed EPA threshold levels of copper and/or barium. Metallic inks and fluorescent inks, particularly greens, oranges and opaque yellows, have some of the highest levels of carcinogens.





# Printing

The offset printing industry has made great strides in developing and implementing products and processes that are friendlier to the environment. By partnering with printers whose practices promote environmental sustainability, designers will be able to explore all the available options. Selecting the right printer and the right process will influence not only the quality and environmental impact but also the cost of a project.

**LITHOGRAPHY (OFFSET PRINTING)** | Lithography accounts for more than 50% of the commercial print industry.<sup>14</sup> It is a process by which the art, or graphic content, is transferred to a printing plate. The plate is coated with ink and fountain solution (98% water), and the image is then transferred to a rubber blanket before being printed on paper. In recent years, the offset printing industry has shifted away from the solvent-based products of the past to ones that have the least impact on the environment.

Printers are now using alcohol-free substitutes that use glycol<sup>15</sup> during the plate-making process, soy- and vegetable-based ink during the printing process (with the exception of heat-set web offset), low-VOC, water-miscible solvent blanket washes during press cleanup and disposal of any chemicals through EPA-licensed hazardous-waste-disposal companies.

**DIGITAL IMAGING** | Toner-based digital printing, often referred to as “print on demand,” is the least environmentally invasive. Because all graphic content is in electronic form from creation through printing, the chemicals associated with film processing and plate making are eliminated, as is make-ready waste. The toner is non toxic and biodegradable. The digital process is flexible, allowing for small-quantity, on-demand print runs that reduce inflated inventories and ultimately reduce stockpiles of obsolete printed materials.



Digital printing is well suited for short runs and quick turnarounds. Efficient quantities are fewer than 1,000 and typical sheet sizes no larger than 12 x 18. Four-color, market-targeted items like brochures, flyers, postcards and promotional pieces are typical candidates for this process.

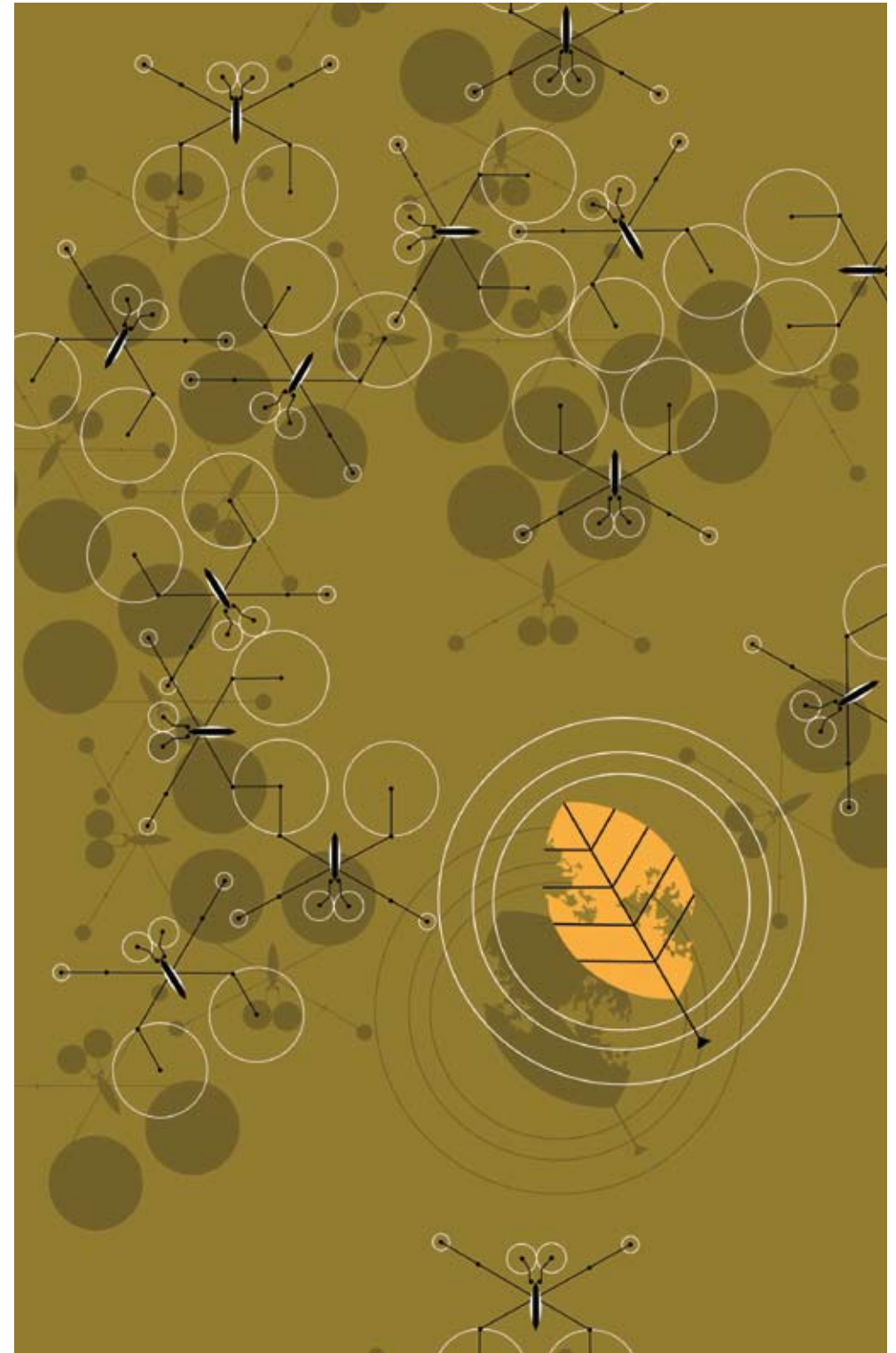
**WATERLESS PRINTING** | The waterless process eliminates the fountain solution, or dampening system, used in offset lithography, both web and sheet fed. Instead of conventional metal printing plates, this process uses a multilayered silicone rubber plate and special ink. The process is faster and cleaner, with reduced paper and energy waste.<sup>16</sup> Beyond mere VOC reduction, this process is said to really shine in providing high quality and efficiency with low dot gain for enhanced detail, better color saturation and faster make-readies.

**VARNISH** | Varnishes, both matte and gloss, come in petroleum-based and water-based versions. Press-applied varnish typically is solvent based and emits VOCs. Aqueous-based varnishes, a mix of polymers and water, emit fewer VOCs, do not require solvents for cleanup, and can be recycled and repulped. They are the most economical and environmentally friendly. As with inks, the less varnish that is applied to the sheet, the better for the environment.

**UV INKS AND COATINGS** | Touted for their beauty and durability, UV formulations are printed as a paste/liquid and immediately change to a solid film when exposed to ultraviolet light energy, releasing no VOCs or solvents into the air. This process involves such special equipment as UV lamps for energy, reflectors to intensify the light and cooling systems for the lamps, as well as special safety equipment and precautions for the press crews. Although the process has been questioned for its recyclability, a study by the Beloit Corporation of Wisconsin has proven that paper printed with UV ink and coatings can be repulped, de-inked and recycled.<sup>17</sup>



Varnish is applied to protect the printed surface. The less ink coverage, the less varnish, if any, need be applied. Spot varnish on only the heavily inked areas is an alternative to a flood coating of varnish.





# Finishing

Designers who have taken the trouble to choose environmentally sustainable paper, low-VOC ink and a design that minimizes paper waste will want to be sure that all their efforts are not wasted through finishing techniques that hamper the ability of their projects to be recycled.

**SADDLE STITCHING** | Metal staples that are used in binding do not need to be removed for recycling in most municipalities. Staples are removed at the recycling pulp mill using magnets, screens and filters during the repulping process. Although the staples are not themselves recyclable, this is still a good option.

**PERFECT-BOUND ADHESIVES** | In order for perfect binding to be recyclable, all adhesive residues must be removed from the paper fiber. Hot-melt, petroleum-based glues are hard to remove during de-inking. Water-based, non-chlorinated glues, however, break down easily during the recycling process.

**WIRE ROLLS AND PLASTIC COMBS** | Both wire rolls and plastic combs are recyclable as long as they are separated from the printed pieces. Consider including a note to end users on the printed piece with instructions on how to recycle.

**EMBOSSING** | Using no chemicals or inks, this technique of creating a raised or receding image is an environmentally friendly way to add dimension. The die can be reused and it also works beautifully on uncoated paper.

**DIE CUTTING** | In this method, the die acts like a cookie cutter. Similar to embossing, there is no use of chemicals or inks and the die can be reused. This is another environmentally friendly way to achieve a dramatic effect that works well on uncoated paper.

**ENGRAVING** | The complicated engraving process involves etching designs into dies, inking the dies and pressing the die to paper. This classic and typically costly technique imparts elegance with minimal environmental impact, as most engraving inks are water- or vegetable-based.

**FOIL STAMPING** | Foils are a polyester film coating that impart a polished look with various finishes from matte to metallic. Although not all foils use toxic chemicals, they still pose a challenge, as they don't break down in the de-inking process and may make paper unrecyclable.



Consider working with an FSC-chain-of-custody-certified printer. The Forest Stewardship Council ensures environmental accountability by tracking wood or fiber from its origin through shipment to the customer.



# Packaging

While all of the paper, inks and finishing techniques reviewed in prior chapters of this guide can also be applied to packaging, there are additional considerations to take into account when designing packaging to be as eco-friendly as possible.

According to the Environmental Protection Agency (EPA), as much as a third of the developing world’s non-industrial solid waste stream consists of packaging.<sup>18</sup> As a result, designing packaging with the environment in mind can dramatically impact energy use and the waste stream overall.

**MAKE IT SMALLER** | Designers intent on pursuing eco-friendly packaging options need to look first at the attribute that can have the most immediate impact: size. While oversized packaging was once considered to be a good way to gain more visibility on the shelf, today’s eco-oriented consumers see oversized and overpacked items as wasteful. Designing a product’s packaging to be more in line with the product size dramatically reduces the amount of packaging waste. It also increases the perceived value of the product.

**DESIGN IT TO LAST** | Although it might seem a bit counterintuitive, another way to make packaging eco-friendly is to design it to last. Packages themselves can become keepsakes if they are attractive and durable enough to provide an alternative use. Similarly, packaging for nonperishable products can be designed to be an appealing and efficient storage method for the product throughout its useful life. Package longevity can also be encouraged by building convenience features into the package design. Features such as hang tabs for easy storage, contours that aid in stacking and insets that provide a base for more unsteady products can all add to a package’s lifespan.

**PAPER OR PLASTIC?** | The choice of materials can greatly influence a package’s impact on the environment. Choosing packaging components that are made from recycled materials is a good way to start. Materials also need to be considered in terms of the amount of energy required to create them and the amount of waste and pollution created during their manufacture. Other considerations include a material’s level of biodegradability and how easily and likely it is to be recycled. Last but not least is whether or not a material comes from a sustainable resource.



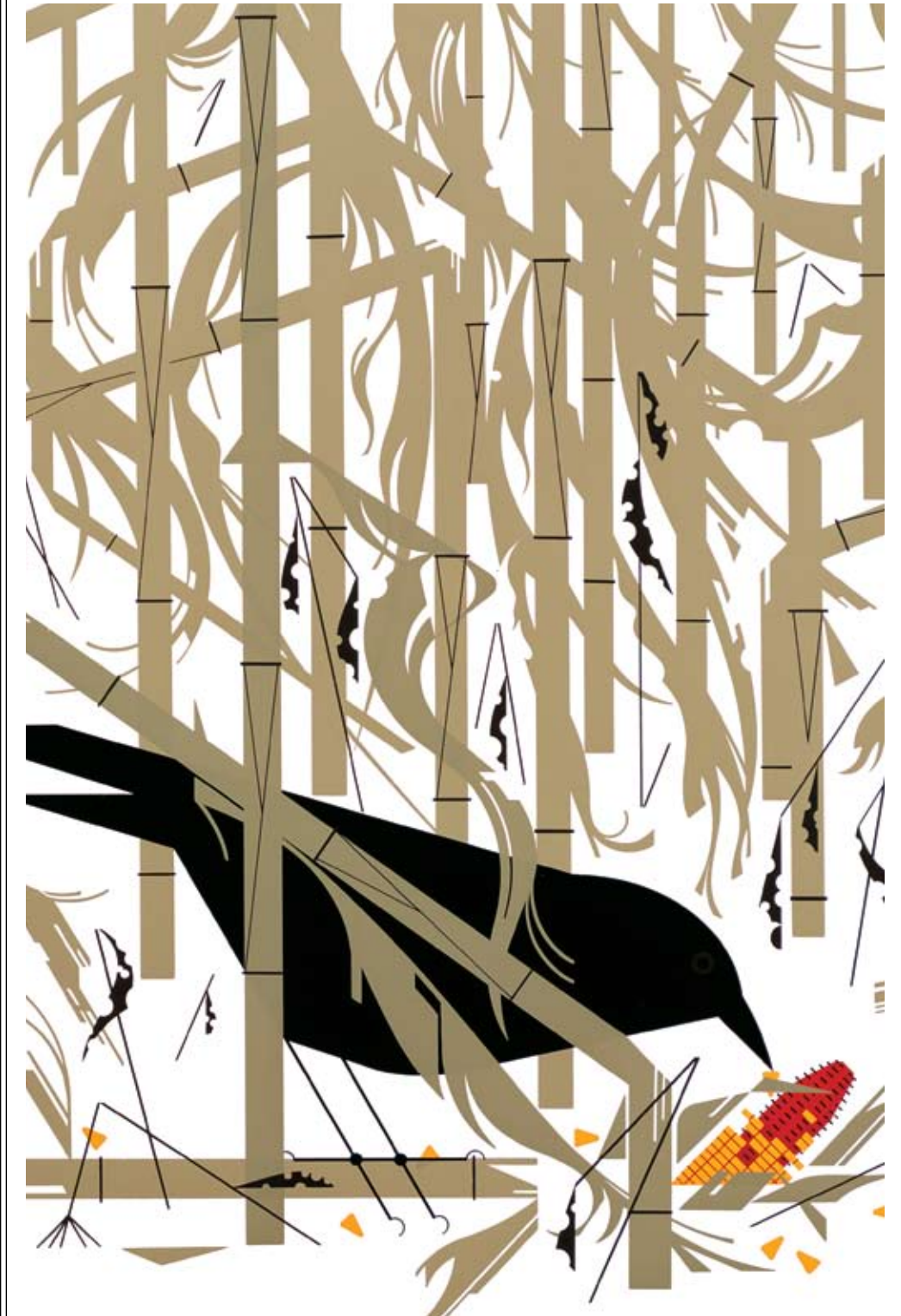
| Material                        | Sustainable Source | Energy to Manufacture | Energy to Recycle |
|---------------------------------|--------------------|-----------------------|-------------------|
| Aluminum cans                   | No                 | Very high             | Moderate/low      |
| PET plastic                     | No                 | Very high             | Moderate          |
| LDPE plastic                    | No                 | High                  | Moderate          |
| HDPE plastic                    | No                 | High                  | Moderate          |
| Steel cans                      | No                 | Moderate              | High              |
| Paperboard (bleached)           | Yes                | Moderate              | Low               |
| Bleached corrugated cardboard   | Yes                | Low                   | Moderate/low      |
| Paperboard (unbleached)         | Yes                | Low                   | Low               |
| Unbleached corrugated cardboard | Yes                | Low                   | Low               |
| Glass                           | No                 | Low                   | Low               |

**THINK INSIDE THE BOX** | Packaging size and waste can be reduced by placing instructions, warranty information and less purchase-relevant information on inserts that fit inside the package. This can reduce the area needed on package exteriors to convey this information. Another way to reduce the amount of packaging needed to convey information is to print the information on the inside of the package and design it to be disassembled.

The method used to protect products can dramatically improve a project's environmental impact. For fragile products that require added protection, consider recycled pulp-based molded inserts and water-soluble, cornstarch-based packing materials instead of molded and loose polystyrene. If the materials inside the package are made from the same or similarly based materials as the package itself, it is more easily and more likely to be recycled.

**SHIPPING SAVVY** | The sizes and shapes of individual packages directly impact the efficiency and amount of outer carton materials required to get packages to market. As much as 50% of packaging waste can occur in outer carton packaging that a consumer or end user will never see. Savvy designers know how many packages are intended to be shipped at once, how the packages will be displayed when in store, and for smaller runs, what standard outer carton sizes are available. This information allows them to design for the most efficient packing in addition to packaging.

Shape also affects outer packaging material requirements. Round or cylindrical packages are less efficient to ship in bulk, as outer shipping cartons are rectangular. A general rule of thumb is that the more voids there are inside a shipping carton when packed, the more waste there is in outer carton materials. The use of pre-packs can also reduce waste. Often outer shipping cartons can be designed to work as in-store displays, eliminating the need for added merchandising materials.





## Planning

Consider 100% PCW, uncoated paper

Consider Elemental Chlorine Free or Totally Chlorine Free paper

If using virgin paper stock, consider one that has FSC or SFI certification

Buy paper from a source using sustainable energy in production

For long shelf life, choose a paper that meets the American National Standards Institute standards for product longevity

Plan ahead to avoid air and rush shipping.

Use targeted, updated mailing lists

## Production

Carefully target your audience to maximize print effectiveness along with other media options

Use the fewest materials necessary to be effective

Maximize long-term value with useful, multipurpose design

If the printed piece isn't reusable, ensure that it is recyclable

Use digital photography

Use PDF digital proofs in place of paper printouts

## Inks & Finishing

Consider vegetable-based inks

Use fewer ink colors

Consider less ink coverage

Avoid metallic and fluorescent inks when possible

Consider using aqueous varnishes and coatings instead of UV coatings and laminates

Consider alternatives to foil stamping

Consider water-based glues



## Printing

Involve the print vendor in the planning stages

Choose an FSC-certified printer

If not FSC certified, check that the printer has an environmental management system in place

Consider filmless and plateless digital printing for small runs

Send art to printer electronically or on a rewritable CD (to be returned)

Clearly outline specs to vendor

At project close, recap with client and vendors to learn from successes or failures

## Logo Use

Use recycled logo and indicate PCW content

Use "FSC" or "SFI" logos according to guidelines

Indicate ISO certification where applicable

Use PCF, ECF, or TCF designations where appropriate according to pulp-bleaching method

Note vegetable ink use

Encourage end user to either share or recycle the printed piece

## Other

Use "energy saver" features on computer equipment

Institute an office recycling program and promote the purchase of recycled office paper

Print double-sided and/or in draft mode

Use silverware and mugs instead of paper and plastic

Donate old office equipment to schools

Shake toner cartridges occasionally to lengthen life

Use alternative modes of transportation



**Charley Harper**

*This second edition of A Field Guide: Eco-Friendly, Efficient and Effective Print is dedicated to Charley Harper whose six decade career of capturing the natural world in illustrations are featured throughout its pages. Charlie was an American original—both artist and conservationist and had been called "The Audubon of his time." He was beloved for his delightful, graphic and often humorous illustrations of nature, animals, insects and people alike. When asked of his minimalist style, Charley liked to say that when he paints a bird, he doesn't count all the feathers in the wings, he just counts the wings. He was best known for his illustration work in The Ford Times, The Golden Book of Biology, Betty Crocker's Dinner for Two Cookbook, as well as numerous posters for the National Park Service and the National Audubon Society. Charley passed away at age 84 on June 10th 2007 while this guide was in production. A compendium of Charley's work, Charley Harper: An Illustrated Life designed by Todd Oldham, was released in summer 2007 through Ammo books.*

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*Disclaimer: Information for this brochure was obtained from the best sources available at the time of printing.*

Monadnock Paper Mills | Environmental Commitment

All Monadnock's Graphic Arts and Packaging Papers are made with **100% renewable** electrical energy.

All Monadnock's Graphic Arts, Printing and Packaging Papers are manufactured **Carbon Neutral**.

Monadnock is the only premium uncoated text and cover paper mill in the United States with a **certified ISO 14001:2004** Environmental Management System.

All Monadnock's recycled papers are **FSC Certified**.

Monadnock only buys pulp from suppliers who prove it was **sourced responsibly**.

Monadnock **continuously reduces** the amount of resources it consumes in manufacturing even as its production increases.

Monadnock's **solid waste is recycled** and reclaimed for uses that actually green the environment.

All Monadnock's Papers are **Process Chlorine Free**.

|                                  | Envi by Monadnock* | Astrolite PC100* | Astrolite* | Dulcet* | Caress* | Authority &/or Certifier                        |
|----------------------------------|--------------------|------------------|------------|---------|---------|---|
| Made with 100% Green Electricity | ●                  | ●                | ●          | ●       | ●       | Green-e / EPA Green Power Leadership            |
| Manufactured Carbon Neutral      | ●                  | ●                | ●          | ●       | ●       | ISO 14001:2004/SGS/Environmental Resource Trust |
| Environmental Management System  | ●                  | ●                | ●          | ●       | ●       | ISO 14001:2004/SGS/EPA Performance Track        |
| Responsibly Sourced Fiber        | ●*                 | ●*               | ●          | ●       | ●       | CSA/FSC/PEFC/SFI                                |
| Solid Waste Reclaimed/Recycled   | ●                  | ●                | ●          | ●       | ●       | ISO 14001:2004/SGS/EPA WasteWise                |
| Process Chlorine Free            | ●                  | ●                | ●          | ●       | ●       | ISO 14001:2004/SGS/Supplier Documentation       |
| Elemental Chlorine Free          |                    |                  | ●          | ●       | ●       | ISO 14001:2004/SGS/Supplier Documentation       |
| Post-Consumer Recycled Content   | ●                  | ●                |            |         |         | FSC/Smartwood                                   |

\*Astrolite PC100 and Envi by Monadnock are FSC certified.

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**ISO 9001: 2000, ISO 14001: 2004**

For information, see page 10 and back cover.

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In 2006, Monadnock Paper Mills' renewable energy production had environmental impact of improvements equal to:

- 1,200 cars not driven for 1 year
- 11,041 barrels of oil saved
- 120,322 tree seedlings grown for 1 year
- 41 acres of forest preserved

We generated 49% of our electricity from our hydro-electric turbines in 2006.



We've doubled our purchase of post-consumer reclaimed material in 3 years. (2004-2006)



We've decreased trash sent to landfills by 80% in 2 years. (2005-2006)



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