

Case Studies

CASE STUDY: STONYFIELD FARM, INC.

Judging by the names of its products – Yo-Baby, Moo-la-la, Moove Over Carbs, Squeezers, and “Screamin’ Strawberry/Banilla Burst” multipack for kids – Stonyfield Farm’s 245 employees in Londonderry, NH, must have a lot of fun on the job.

Yet the yogurt manufacturer is drop-dead serious about its corporate mission, which includes three important goals:

1. promoting sustainable farming methods and high-quality natural and certified-organic products,
2. educating consumers and producers about the value of protecting the environment, and
3. proving that an environmentally and socially responsible business can also be profitable.

“Our organic and environmental commitment is core to who we are and how we do business,” says environmental engineer Lisa Drake, Stonyfield Farm’s Natural Resource Manager.

Sustainability Begins with Attention to the Product Life Cycle

Consider the deep thought the company puts into making and selling yogurt. First, Stonyfield chooses only all natural and certified organic ingredients like organic milk and fruits to make its yogurt.

“Although most people think of ‘organic’ as keeping chemicals out of products and away from farmers, it’s much more than just the absence of certain chemicals,” Drake says. “[It includes thinking about] how you operate the farm in tune with nature, and how you care for the soils, plants, and the animals, keeping them healthy so they don’t need chemical fertilizers, toxic pesticides, and in the case of the animals, artificial growth hormones and antibiotics.”

Stonyfield Farm’s use of certified organic ingredients supports more than 30,000 acres of organic farmland. This protects farmers and animal and plant food sources from toxic and persistent chemicals. When farms do not use toxic pesticides, herbicides, and chemical fertilizers, they are less likely to pollute nearby lands and streams.

Next, the company looks at how the yogurt is manufactured. For example, because yogurt production uses a lot of energy, Stonyfield invests in tree planting, energy efficiency, and renewable energy projects to offset the impact of the energy used to make the product.

Then, to find out how packaging and distribution methods impact the environment, Stonyfield has conducted environmental studies. These studies, called “life cycle assessments,” evaluate how well a project, organization, or piece of equipment is performing. The goal is to help safeguard the environment.

A life cycle assessment might look at current production processes and materials, investigating questions like the following: How many resources are used to make the product? How much pollution does the process create? How much energy is used? What would these numbers be if alternative processes and materials were used?

“We’ve learned that packaging has an absolutely huge environmental impact,” Drake says. “Food packaging requires lots of petroleum to make plastics, and paper fibers to make cardboard boxes, so we try to reduce [the amount of] packaging [we use] to get our product to the consumer.”

One result of the life cycle assessments was changing the container lid from hard plastic to foil, which saves 16% of the energy, 13% of the water, and 6% of the solid waste over the life of the lid. It eliminates the need for 100 tons of packaging and is more ergonomic for workers (a roll of plastic weighed 50 pounds, Drake explained; now the employees only have to lift short stacks of foil lids weighing about one pound). The lids also served another purpose – they send important messages to consumers.

“Talking to our consumers through our lids is the most prominent marketing thing we do,” Drake says. Using the lids as part of the marketing and education plan allows us to get our messages out to consumers, and more importantly, helps create a relationship with them. Every cup has the company president’s name on it and invites consumers to “let us know what you think.”

And at the end of their useful life, the yogurt containers can be recycled into other products, like toothbrush handles.

Good to the Planet Means Good for Business

Stonyfield Farm has won awards for its energy efficiency, waste reduction practices, and environmental advocacy. It was the first U.S. manufacturer to offset 100% of its carbon dioxide (greenhouse gas) emissions from its facility energy use. The company researches green packaging sources and recycles over 60% of its manufacturing solid waste. And through its “Profits for the Planet” program, the company gives 10% of its profits to efforts that help protect and restore the earth.

Stonyfield Farm is always learning and finding new ways to accomplish its missions. Partnerships with nonprofits – such as Environmental Defense around climate change and global warming – are one way the company tries to get support for its efforts in environmental stewardship. Networking with other “green businesses” is another, through sharing resources that help meet today’s environmental challenges.

As an environmental engineer, Drake’s role is to find ways to continuously minimize environmental impacts and move Stonyfield Farm ever closer to sustainability.

“We always try to balance economic and environmental concerns,” Drake says. “A lot of times it’s easy. Other times, like when we thought about installing solar panels to provide electricity to our operation, we found it’s not yet affordable, and that we couldn’t do it in an economically sound way.

“Our goal is to be an environmental leader and conduct business in the most environmentally responsible way possible. But you can’t expect others to follow you if you’re not doing the things that make both environmental and business sense.”

Sustainability Goal: Continuing to Be a Positive Force for the Environment

As Stonyfield Farms continues to grow its business, the company will also continue to reduce its overall environmental impacts and be a positive force for the environment.

Through increasing sales, Stonyfield will grow its support of sustainable farming methods. The company will continue to work on reducing packaging and improving packaging choices, and try to minimize global warming, focusing on both energy efficiency and “greening” its energy supply.

“I hope that some day we will be free from fossil fuels altogether,” Drake says. “Like all manufacturers, we are a long way from being a truly sustainable company, but we’re pushing ourselves to be smart about improving our environmental performance, and make changes that take us toward that end goal.”

For more information:

Butschli, J. (1999, October). Stonyfield blends environmental, economic goals. Packworld.com. Retrieved October 15, 2004, from www.packworld.com/articles/Features/10536.html

National Environmental Education and Training Foundation (NEETF). (n.d.) Life in the trenches. Greenbiz.com. Retrieved October 15, 2004, from http://www.greenbiz.com/jobs/lifecareer_detail.cfm?LinkAdvID=6696

Recycline®. (2004, October 28). Recycling partnership with Recycline gives new life to more than one million Stonyfield Farm yogurt cups. NPI Center. Retrieved October 28, 2004, from <http://www.npicenter.com/retail.aspx> (full text available at <http://www.npicenter.com/anm/templates/newsATemp.aspx?articleid=10813&zoneid=31>).

Stonyfield Farms, Inc., web site, www.stonyfield.com

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FACTOID:

An average acre of fully stocked forest will remove about 3.6 tons of carbon dioxide per year.
(Source: *Orion Afield*, Winter 1999/2000. “Finding the Real in Real Estate,” by John Lane, p. 12.)

What One Company Can Do.

CASE STUDY: FEDEX KINKO'S

FedEx Kinko’s serves customers who need help with communicating, whether that means putting together a great résumé or presentation, or printing a flyer that will help them find their lost dog.

Since the late 1990s, FedEx Kinko’s made changes in its business practices so that it could help customers communicate in more environmentally friendly ways. The company – and Larry Rogero, Director of Environmental Affairs at FedEx Kinko’s – “champions” sustainability, especially with respect to energy efficiency and waste generation and disposal.

Rogero says the company is going through an interesting exercise with The Natural Step, an international advisory and research organization that helps people operate businesses in ways that don’t deplete resources for future generations.

FedEx Kinko’s set up a team made up of representatives from 11 of its corporate departments. “We are asking ‘What is sustainability?’ and ‘What does it look like?’” he says. “Where are we now with regard to that [definition] – and where will we be compared to that in the next two, five, or 10 years?”

This exercise is showing that FedEx Kinko’s efforts will have to target several areas, three of which are highlighted below:

1. paper-based products for printing and copying;
2. technology such as computers, copiers, and printers; and
3. energy for running the business, which in some areas means “‘round the clock.”

Buying Paper Made from Well-Managed Forests and Recycled Content

As a “custom communications manufacturer,” FedEx Kinko’s uses a lot of paper, which in turn uses a lot of trees. If this is done unsustainably, it can deplete natural forests. When forests are depleted of their trees, climate is affected, and animals and plants lose their habitats. To avoid negative impacts on climate and biodiversity, FedEx Kinko’s made significant changes in the composition of its paper supply, and in its decisions about which suppliers to use when buying paper and other forest-based products.

In 1997, the company became one of the first to say no to using products from old-growth or endangered forests, or from forests that have high conservation value. In 2003, the company expanded that commitment with a policy that set many standards for its suppliers. The company decided to only buy paper-based products from suppliers certified as having well-managed forests.

Since 2003, FedEx Kinko’s has been working toward using paper and packaging made up of an average of 30% post-consumer recycled content. The company prints its corporate letterhead, envelopes, and business cards on 100% post-consumer recycled content paper. Its centers offer “tree-free” papers made from agrifibers (e.g., sugar cane and cotton). Instead of using paper to distribute many memos and other kinds of internal communications, Kinko’s uses electronic emails and forms, and offers discounts to customers who choose to copy their materials double- rather than single-sided.

Choosing and Using Electronic Products Wisely

One of the biggest problems around using electronic products such as computers, copiers, and printers is the disposal issue. Technology changes fast and soon gets replaced – so what do you do with the old equipment?

“We’re in our infancy in what we’re trying to do [in this area],” Rogero says. “We’re not yet sure of what role we play in this, but what we’ve done at minimum is to establish a policy of what happens to materials we’ve used that are obsolete.”

This policy involves an agreement with a company that takes back the old equipment. The company agrees to refurbish and/or recycle the equipment, and not to send any of the equipment for processing to developing countries.

When installing new computer equipment, FedEx Kinko’s chooses flat screen LCD monitors over the older and less-expensive CRT (cathode ray tube) monitors that resembled a television set.

“LCD monitors use two-and-a-half times less energy than CRTs,” Rogero says, “and they don’t contain the lead that is found in the cathode tubes.”

The lighter weight and smaller size of the LCD monitors reduces transportation and packaging costs, because transporting lighter packages uses less fuel and packaging smaller items conserves source material.

Moving Toward “Green Power”

FedEx Kinko’s was an early adopter of renewable energy – or “green power” – when it began purchasing it in 1999. By 2003, 25% of FedEx Kinko’s locations in the United States were meeting at least some of their energy needs with green power.

“Right now, 10% of the energy we use comes from renewable sources like wind, solar energy, geothermal, and small hydro-electric power,” Rogero says. “We also buy energy using renewable energy credits. These credits can be purchased on the open market, and basically FedEx Kinko’s is buying the positive environmental attributes (i.e. lack of air pollution) that are generated by renewable energy sources.”

FedEx Kinko’s also focuses on reducing the amount of energy it needs to run its business. Here’s how:

- installing motion sensors in back offices, so that people leave the rooms, lights automatically turn off;
- replacing incandescent “EXIT” signs with LED “EXIT” signs;
- using energy efficient lighting systems; and
- implementing new operating hours to be more economically and environmentally efficient.

Technology Advances Sustainability and Good Corporate Citizenship

“Part of the sustainability story involves the move away from using raw materials and hard copy to digital production methods,” Rogero says. “Consumers can send a document electronically now, which allows both us and them to be more productive. Efficiency goes up as a result.”

To take advantage of this move toward digital production, FedEx Kinko’s created an online document management tool for medium and large companies. Using FedEx Kinko’s DocStore, companies can store an electronic library of files, such as those needed to produce brochures and other information materials. Documents are produced when they’re needed rather than being produced on paper and then stored in warehouses until they’re needed. When it’s time to update the information, the electronic files can be easily changed, and there are no old brochures or portfolios to throw away.

FedEx Kinko’s has created something similar for individuals, small businesses and mobile professionals. Customers can send a document electronically now, which allows us and them to be more productive. Efficiency goes up as a result.

Business has moved this way, Rogero explains, because it’s easier and more efficient: it costs less money, and uses fewer resources. “Let’s use that as a model to say here’s an opportunity to use sustainability as an innovative library,” Rogero says. A library full of resources for being creative about protecting and respecting the natural environment.

Efficiencies definitely help with the bottom line. But they also impact a company’s identity as a corporate citizen and whether that company is recognized as a “good neighbor” in the communities in which it operates.

“We track our ecological footprint,” Rogero says. “The indicators we use demonstrate that we are becoming more eco-efficient. This means we are using fewer virgin raw materials and less energy per dollar of revenue we generate.”

Resources

Business Wire. (2004). Smart multimedia gallery: Web-based software called File, Print FedEx Kinko’s. Retrieved October 25, 2004, from www.businesswire.com/cgi-bin/mmg.cgi?eid=4702814 (registration required).

Durazone Technology. (2004, April 23). Kinko’s fifth annual award recognizes green branches. WhatTheyThink? Retrieved October 25, 2004, from <http://members.whattheythink.com/allsearch/article.cfm?id=15772>

FedEx Kinko’s web site, www.fedexkinkos.com

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Nike Just Does It Environmentally.

CASE STUDY: NIKE BRAND

You know Nike because of sports. Maybe you even own a pair of Nike footwear or have played soccer using a Nike soccer ball.

But Nike the sports company is also an innovative and inspirational “corporate citizen” – a company that believes in contributing positively to the environment and in communities in which it does business. One way Nike practices “corporate citizenship” is by considering sustainability principles.¹ Nike made a long-term commitment to sustainability and to minimizing its impact on the environment in three long-term target areas: (1) toxics elimination; (2) waste elimination; and (3) sustainable product innovation.

“We’re striving to incorporate environmental responsibility throughout our operations and product life cycle, and use our long-term environmental goals to direct efforts to where we can have the greatest impact,” said communications manager Jill Zanger.

Toxics Elimination

Nike wants to minimize or entirely eliminate toxic substances in Nike-branded product – substances known to be harmful to health or to biological or ecological systems. Some of the substances targeted for elimination include polyvinyl chloride (PVC), commonly used in shoes and soccer balls, and volatile organic compounds (VOCs), often found in glues and petroleum-based products. Even common substances like rubber can contain toxic chemicals.

So employees began to develop a palette of “environmentally preferred” materials, often working closely with universities, scientists, suppliers, and other businesses to discover these alternatives. For example, the company worked for four years with an outside consultant and a chemistry team to develop a rubber outsole material that is free of six of the eight toxic compounds normally found in rubber.

“The benefit is the decreased exposure of toxic substances on humans and in the environment,” said global footwear sustainability director Bill Malloch. “Environmentally preferred rubber looks the same, performs the same, costs the same – so why wouldn’t we do that?”

“We looked at what we could eliminate without compromising the quality of the rubber compound,” Zanger said. “Thirty percent of our high-volume shoe models use this new rubber.”

Though all potentially toxic substances have not been completely eliminated from Nike products, the company has made significant progress toward its goal. The footwear, apparel, and equipment teams work with their suppliers to find PVC-free materials for its products, and Nike footwear has eliminated VOCs in the manufacturing process by over 92%.

Nike has developed a corporate restricted substance list (RSL) for finished products and for packaging. These lists include substances that are either restricted by law or that Nike has voluntarily chosen to eliminate.

Nike employees also work with other companies in the footwear, equipment, and apparel industries to raise awareness about toxic substances and to help create industry standards for dealing with them.

Waste Elimination

Many companies, including Nike, could use water, energy, and materials more efficiently. Inefficiency wastes resources and money, and contributes to making a business ultimately unsustainable. Nike is moving toward greater sustainability by working with suppliers and contract manufacturers to eliminate waste in the product life cycle.

For example, Nike strives to get the maximum use out of raw materials – some of which are chosen because they are renewable or recycled/recyclable – by finding ways to create a product without leaving scraps on the cutting room floor. And by discovering new uses for a used-up product.

Take the athletic shoe, for instance. Through the Reuse-A-Shoe program, the nylon and leather uppers in many shoes can be shredded and used in padding under hardwood basketball floors. The foam midsoles can be ground and used in synthetic basketball courts, tennis courts, and playground surfaces. The ground-up rubber outsole goes into baseball and soccer fields, as well as golf products, weight room flooring, and running tracks. All of these materials are called Nike Grind.

When waste cannot be eliminated, Nike looks for ways to recycle it. The Nike footwear division, for example, has created the Closed-Loop Vendor program. As materials are cut to make shoe products, waste from toe boxes, heel counters, and linings is collected and returned to the vendor to be used as input in new material. Nike processes a large portion of the rubber waste from manufacturing operations into small bits of rubber, also called Nike Grind. Nike Grind is then used as a component in sports surfaces like synthetic soccer fields and basketball courts. And the paper Nike uses to make shoe boxes and wrap the shoes is made from recycled content and is in turn recyclable.

Sustainable Product Innovation

“Sustainable product innovation is really about an integrated approach to product design that drives progress toward other long-term environmental goals and integrates sustainability into the product creation process,” Zanger said.

This means that when the company has an idea for a product, product development teams look at

- how the product will be created,
- what the product creation process will need (“Product teams consider how to use or increase usage of materials that are renewable or regenerated [meaning recycled or recyclable],” Zanger said) and
- what will happen to the product when it is in the consumer’s care and then when it comes to the end of its useful life.

By looking at and evaluating the different parts of the product life cycle, the product development team can focus on whether the intended product does what it is supposed to do, and that any potential environmental impacts.

New Sustainability Initiatives in Footwear, Apparel, and Equipment

Nike continues to explore and learn from its efforts to become a more sustainable business. Below is a round-up of what’s new in three product divisions.

Footwear. “In 1999, we had Reuse-A-Shoe but we didn’t have a team [dedicated to] footwear sustainability,” Malloch said. “Now, we’ve formalized the team and the process for assessing every model we make against sustainability attributes.”

The company is continuing to work on finding solvent-free source materials. Making synthetic leather, for example, requires lots of solvents in general and dimethyl formamide (DMF) in particular. Malloch said that even though DMF outgassing can be reduced, a lot of DMF still escapes into the environment. Right now the company is very close to putting the finishing touches on approving a 95%-solvent-reduced synthetic leather for use in some Nike footwear.

Equipment. Nike’s long-term toxics elimination goal, which includes work in phasing out PVC, spurred the elimination of millions of pounds of PVC from sports equipment like soccer balls, yoga mats, and packaging within a relatively short time.

“With a corporate goal to reduce wastes and toxics, our apparel and footwear divisions have played a big part in providing education at all levels throughout our Equipment division and supply chain,” said Jerry Hauth of Nike’s Equipment Division.

Today Nike soccer balls no longer contain PVC, and the company is introducing a PVC-free yoga mat in 2005. Sport gloves, formerly packaged in PVC containers, are now simply stapled to a sales tag smaller than a business card. Hauth said that these “header cards” have increased shipping efficiencies three times over.

The equipment division is also collaborating with Sustainable Solutions, Inc., on the possibility of grinding up material like the nylon used in backpacks into plastic, and then pressing it into a stabilizer board for the bottoms of sports and duffle bags. If production moves forward, the stabilizer board will help sports bags keep their shape. “Then when the bag is no longer needed, the contents will be able to be broken down, shredded, and reused,” Hauth said.



Apparel. Back in the late 1990s, Nike created a runner’s singlet tank made of material derived from recycled plastic bottles, which made news for how it conserved resources from design through production. Nike continues to introduce sustainable fitness apparel into its product line. The Fall 2004 Men’s Active Life introduced a collection of polyester track suit products featuring advanced chemical recycling technology. Post-industrial scrap waste as well as post-consumer products such as uniforms are collected and recycled into new high-quality materials. The apparel division is constantly looking for opportunities to use recycled, renewable, and organic materials in its sport and active life products.

“We have replaced the paper used in many of our hangtags with paper that contains higher amounts of post-consumer recycled content and virgin fibers from forests that are sustainably harvested,” said Eric Brody, sustainability business integration manager in Nike’s Apparel division. And more and more of the company’s sales catalogs are being produced from a paper made from 40% post-consumer recycled fiber processed without chlorine.

“We want to make the right environmental decision but retain cost effectiveness and efficiency,” Brody said.

Sometimes there are data gaps and shortfalls. Yet working with other groups and coalitions that have similar environmental goals makes sustainability ever more possible. “As a single company we can’t make all the changes ourselves, but working together, we hope to change the system,” Brody said.

The Organic Exchange: A Success Story in the Making

One example of changing the system is evident in Nike’s efforts to increase the amount of certified organic cotton, which is produced without the use of pesticides and synthetic fertilizers, in its cotton-containing apparel.

In 1998, Nike set a goal of making tee shirts with 3% organic cotton. In 2001, 34% of all cotton-containing garments contained at least 3% certified organic cotton. In Fall 2002, Nike created its first line of active wear for women featuring cotton that is 100% certified organic, and then set a goal to use a minimum of 5% certified organic cotton in all cotton-containing materials by 2010. For the 2005 retail year, approximately 50% of all cotton-containing garments will contain at least 5% certified organic cotton.

But the supply of certified organic cotton is small – less than one-half of one percent of all the world’s cotton. So Nike has worked with more than 50 leadership companies and organizations to form the Organic Exchange. The Exchange holds meetings of representatives from organic farms, cotton cooperatives, cotton merchants, processors, and sourcing agents to explore the roadblocks to bringing certified organic cotton to market.

The first steps have been taken to achieve the Exchange’s primary goal of increasing the percentage of the world’s organically grown cotton from less than 0.5% to 10% by 2013. Stay tuned: the longest journey always begins with one, albeit small step.

NIKE AND CLIMATE CHANGE

Nike is concerned about the climate change effect of its business. Greenhouse gasses, which cause climate change, are emitted by using energy in buildings, making and transporting products, and in business travel. These are the steps Nike is taking so that the effects of these substances on climate and on the rest of the environment are reduced:

- Set goals with the World Wildlife Fund’s Climate Savers program for reducing carbon dioxide emissions for Nike facilities.
- Study the climate change impact of the contracted suppliers who provide manufacturing and transportation services to Nike and develop best practices to reduce those impacts.
- Partner with Delta Airlines and Hertz to offset the impact of employee travel.

Resources

Berry, P. (2000, June 27-28). Greening the supply chain via outside supplier networks. Presentation at Pacific Northwest Pollution Prevention Roundtable in Portland, Oregon. Retrieved October 26, 2004, from <http://www.pprc.org/networking/frtt/jun00min.html>

Business for Social Responsibility web site (www.bsr.org)

Kelley, M. G. (2004, n.d.). From trash to – workout wear?" Health.

Nike web site, www.nikebiz.com: Responsibility/Environment. Retrieved October 27, 2004, from <http://www.nike.com/nikebiz/nikebiz.jhtml?page=27>

Organic Exchange web site, www.organicexchange.org

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¹In 1993, the company started its first sustainability program, Reuse-A-Shoe. The program was designed to take used athletic shoes, separate and grind up their components (Nike Grind), and turn them into a product that could be used to make athletic courts, tracks, and fields. In 1998 the company established the position of Vice-President, Corporate and Social Responsibility, and continued to move forward in creating policies and sustainable business practices intended to minimize its environmental impact throughout the product life cycle.

Resources

The resources listed below can supplement background material in the lessons or provide additional opportunities to explore environmental issues related to conservation of resources and sustainable societies. Teachers should preview resources before using them and exercise their own professional judgment as to the fairness and accuracy of the information presented.

Multi-media

General Environmental

(**Videos**, all available from SVE/Churchill Media, 800-829-1900; online catalog at <http://www.svemediacom.com>)

Garbage, the Movie: An Environmental Crisis

Recycling: Conserving Natural Resources

GarbageTale: An Environmental Adventure

(**Films**, available from Bullfrog Films, 800-543-3764; online catalog at <http://www.bullfrogfilms.com/>)

Wetlands Technology

The Home

It's Eco-Logic

Journey of the Blob

The Car

Hungry for Profit (older and advanced students)

Taken for a Ride (older and advanced students)

Science of Sports/Energy

Science of Sports: Spring Man. Teaching Guide. Useful for teaching concepts of kinetic and potential energy, particularly about how kinetic energy changes to heat energy, and for demonstrating law of conservation of energy. Available online from Public Broadcasting Service, <http://www.pbs.org>. PBS Online offers teacher resources such as lesson plans for various subject areas, a searchable list of learning standards by state, and video clips that teachers may use for professional development in such areas as cooperative learning, teaching through inquiry, and more.

Minds-On Science: For profit, for planet (Laserdisc multimedia package developed by the Smithsonian Institution). According to abstract, includes simulation that encourages awareness of important scientific and industry issues that affect society and the environment. Grades 5-9. Available from Tom Snyder Productions, Inc., 80 Coolidge Hill Rd., Watertown, MA 02472; 800-342-0236 (fax 800-304-1254); or online at <http://www.tomsnyder.com/index.html>.

Music

Banana Slug String Band. Albums: *Adventures on the Air Cycle* (Music for Little People, 1994); *Dirt Made My Lunch* (Music for Little People, 1994); *Penguin Parade* (Warner Brothers, 1996); and *Slugs at Sea* (Music for Little People, 1994).

Earth Mama Joyce Johnson Rouse: Albums, Concerts, Public Speaking Engagements. Contact her via e-mail at earthmama@songnet.com or visit her website at <http://www.songnet.com/earthmama/>.

John Denver. Songs: "World Game" and "It's About Time," on *It's About Time* album (RCA, 1983).

Literature

Fleming, Denise. *Where Once there Was a Wood*. New York: H. Holt. 1996.

Gibbons, Gail. *Recycle!: A Handbook for Kids*. Boston: Little, Brown. 1992.

Hadingham, Evan, and Hadingham, Janet. *Garbage! Where It Comes From, Where It Goes*. New York: Simon and Schuster Books for Young Readers in association with WGBH Boston. 1990.

Harlow, Rosie, and Morgan, Sally. *Garbage and Recycling*. New York: Kingfisher. 1995.

Lauber, Patricia. *Too Much Garbage*. Champaign: Garrard Pub. Co. 1974.

Miles, Betty. *Save the Earth!* New York: published by Knopf, distributed by Random House. 1991.

Peet, Bill. *Farewell to Shady Glade*. New York: Houghton-Mifflin. 1966.

Quinn, Daniel. *Ishmael*. New York: Bantam Books. 1995.

Roettger, Doris. *Pollution, Recycling, Trash, and Litter*. (No location given.) Fearon Teacher Aids. 1991.

Sanera, Michael and Jane S. Shaw. *Facts, Not Fear: Teaching Children about the Environment*. (No location or publisher listed.) 1999.

Seo, Danny. *Heaven on Earth: 15-Minute Miracles to Change the World*. New York: Pocket Books. 1999.

Silverstein, Shel. "Sarah Cynthia Sylvia Stout." *Where the Sidewalk Ends*. New York: Harper Collins Juvenile Books. 1974.

Showers, Paul. *Where Does Garbage Go?* New York: Crowell. 1974.

The Earthworks Group. *50 Simple Things Kids Can Do to Recycle*. Kansas City, MO: Andrews and McMeel. 1990.

Williams, Karen Lynn. *Galimoto*. New York: Lothrop, Lee & Shepard Books. 1990.

Sports/Science Related

Barber, Jacqueline; Buegler, Marion E.; Lowell, Laura; Willard, Carolyn. *Discovering Density*. Berkeley, CA: Lawrence Hall of Science, University of California, 1988. (for teachers)

Barr, George. *Sports Science for Young People*. New York: Dover Publications. 1990.

Duncanson, Neil. *Sports Technology*. New York: Bookwright Press. 1992.

Websites

Key to Audiences: T=teachers; S=students (general); O=students (older or advanced)

T	S	O	
■	■		Bigchalk.com – http://www.bigchalk.com Resources for teachers, students, and parents. Links to Beginner's Guide to Climate Change for Kids as well as to a clearinghouse of subject-oriented environmental education sites.
■		■	Center for the Defense of Free Enterprise – http://www.cdfefree.org/ Individual rights, free markets, private property, limited government.
■			Center for International Private Enterprise – http://www.cipe.org Information on sustainable business practices.
■	■	■	Competitive Enterprise Institute – http://www.cei.org Advancing the principles of free enterprise and limited government.
■	■	■	Consortium on Green Design and Manufacturing http://www.greenmfg.me.berkeley.edu.green.Home/Index.html Lists companies that practice "green," environmentally conscious, production.
■			Co-Op America – http://www.coopamerica.org/ Practical approaches related to asserting power of consumer and investor.
■			Corporate Watch – http://www.corpwatch.org Reports on business activities that impact the environment.
■	■		Discovery Channel Online – http://www.discovery.com Contains searchable resource directory. For example, searching "petrochemicals" yielded names of countries and businesses that rely on petrochemicals for economic reasons, which could be contacted for additional information about products made from petrochemicals, production processes, etc.

T S O

■	■	E/The Environmental Magazine – http://www.emagazine.com Online, searchable environmental issues magazine produced by Earth Action Network. Contains articles on recycling shoes and on shoes made with sustainable practices.
■		EcEdWeb (Economics Resources for K-12 Teachers) – http://ecedweb.unomaha.edu/teach.htm “Fundamental Economics Concepts Students Should Know.” Site has links to other resources such as Midlink Magazine (electronic magazine for kids in the middle grades) and Kile’s “Where Shall We Locate?” (suggestions for a project in which students use the Internet to research a good location for a firm).
■	■	EE-Link – http://www.nceet.snre.umich.edu/ Compendium of classroom resources and EE student resources. Includes links to environmental organizations and projects, such as National Library for the Environment, Berit’s Best Sites for Children – Environment (up to age 12), and Education for Sustainable Development Toolkit. Links to “Ask an Enviroscientist,” which says it offers free answers to research questions within 48 hours.
■	■	Envirolink – http://www.envirolink.org/ Compendium of environmental education resources; includes link to Environmental Education Network Students Page.
■	■	Environmental Education Resources – http://www.cnie.org/educate.htm Resources and links for all ages.
■	■	Environmental Law – http://www.law.cornell.edu/topics/environmental.html Information on specific aspects of law and environmental litigation cases.
■	■	Environmental News Network – http://www.wenn.com/index.asp Articles about current environmental issues.
■	■	Environmental Protection Agency – http://www.epa.gov Resource for status of environmental issues. Contains page specifically for kids, and a section called “Green Chemistry Page.”
■	■	Environmentally Friendly Alternatives – http://www.ecomall.com/class/menu.htm Searches hundreds of sites for green products.
■	■	FedStats: Environmental Statistics – http://www.epa.gov Statistics related to environmental issues; use search function on EPA home page.
■	■	Footwear Industries of America – http://www.fia.org Includes guide to art and science of footwear manufacturing and statistics on shoe production (1998).
■	■	Global Recycling Network – http://www.grn.com Information on international efforts to recycle materials.
■	■	Green Pages Global Directory for Environmental Technologies – http://eco-web.com Lists companies that provide environmental technology services. Could be used as “experts” for research purposes.
■	■	The Heritage Foundation – http://www.heritage.org/ “Leadership for America” – a conservative think tank.
■	■	Individual.Com – http://finance.individual.com News on energy, other topics.
■	■	International Institute for Sustainable Development – http://iisd.iisd.ca Information and resources for sustainability.
■	■	Know Your Environment – http://www.acnatsci.org/ Sustainable solutions to environmental issues.

T S O

■	■	McDonough Braungart Design Chemistry – http://www.mbdc.com Design for the new industrial revolution.
■	■	Puget Sound Green Page – http://www.wolfenet.com/~greenway Links to national and international environmental organizations and to those that hold corporations environmentally responsible.
■	■	Recycle.Net (Recycler’s World) – http://www.recycle.net Contains links to textile and leather recycling associations, publications, and traders.
■	■	Recycle.Net – http://www.recycle.net/recycle/Textile/index.html Hyperlinked to Recycler’s World; provides links to information on recycling used clothing and footwear.
■	■	Social Venture Network – http://www.svn.org/resources.html Guide to “green” companies.
■	■	Sustainable Business Network – http://sbn.envirolink.org Information on running businesses with an eye to principles of long-term environmental sustainability rather than short-term profit.
■	■	Thomas Register of American Manufacturers – http://www4.thomasregister.com/index.cgi?balancing Searchable database of manufacturers, company profiles, and contact information.
■	■	U.S. Department of Energy – http://www.usdoe.gov OR http://www.afdc.nrel.gov Latter link contains information on alternative transport fuels.
■	■	U.S. Global Change Research Information Office – http://www.gcric.org/edu/educ.html Resources for information on global change and conservation education.
■	■	Worldwatch Institute – http://www.worldwatch.org/ Statistics, reports, and position papers on environmental issues.

Websites for Learning Standards

T S O

■	■	Explorasource – http://www.explorasource.com/educator/EAS5/502_stdmore/stdmore.htm Offers links to sites that support parents and educators in finding information related to education standards.
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Websites (Miscellaneous)

T S O

■	■	Consumer Product Safety Commission – http://www.cpsc.gov/indexmain.html Information on Product Safety
■		National Writing Project – http://www.gse.berkeley.edu/Research/NWP/nwp.html Resources for teachers who want to teach writing as a process, writing across the curriculum, and research as inquiry (I-search).
■	■	http://www.Nikebiz.com Homepage for Nike, Inc., with information on company, business and labor practices, global community, environmental policy, jobs, and investors.
■		Projects Registry – http://www.gsn.org Collaborative learning through connecting with other schools.
■		Writing Across the Curriculum – http://www.heinemann.com/ Resources for using writing activities in classes other than English or Language Arts.

Glossary

air classification	a system for separating objects for downcycling/recycling by using moving air, such as from a fan. In this system, lighter-weight materials will be blown by the air while the heavier objects remain.
back-casting	looking at the end result one hopes to achieve and then working backwards (“casting back”) from that point to determine how to reach the goal.
biodegradable	a material that decays and returns to the soil. Materials can be natural (such as fruits) or manufactured (such as paper).
carbon dioxide	a colorless, odorless, incombustible gas (chemical symbol CO ₂) formed when living things breathe out, when substances burn, and when organic matter decomposes.
closed-loop recycling	taking an old product (like an aluminum can) and turning it into a new product of the same kind.
closed system	a system in which nothing comes in and nothing leaves. For example, the Earth is a closed system: nothing comes in except energy in the form of heat and light from the sun, and nothing leaves except heat and reflected light.
cradle to cradle	term coined by William McDonough. According to McDonough, as designers design they must factor out the concept of waste. Human-made objects must imitate nature, a system in which living things die and become food for other living things. McDonough says that recycling should be the last in a series of processes that begins with redesign. A product should be redesigned so that it is capable of being reused. Another way to think of this is to design for disassembly: i.e., when a car is no longer of service, the user would return it to the manufacturer who can then disassemble it and put the parts back into the manufacturing process where they become “food” (technical nutrients) for the system. (<i>Interiors and Sources</i> , May 1995).
cushioning	the material or material property that protects against force or shock. See also shock absorption.
cycle	a series of events that recur regularly and usually lead back to the starting point.
density	the ratio of an object’s mass to its volume. Another way to think of it: how tightly the molecules in an object are “packed.”
downcycle	to make new, but different, products from used ones (see downcycling, below). Athletic shoes can be downcycled into sports surfaces, equestrian arenas, carpet underlayment, playground fall protection, and other products.
downcycling	when highly sophisticated and refined human-made compounds are combined into substances of lesser technical value. For example, the variety of highly engineered steel in automobiles is melted together and “downcycled” into reinforcing steel for concrete construction. (<i>Interiors and Sources</i> , May 1995).
drop height	the height above the surface from which a test object is released.
ecosystem	an ecological community, together with its environment, functioning as one unit.
ecosystem service	the functioning of natural ecosystems, such that they provide services essential to human survival. Collectively, these services maintain the Earth in a state that can support life.
efficiency	the ratio of the effective or useful output to the total input in any system.
energy	usable heat or power; a source of usable power, such as petroleum or coal.
energy return	the material property that gives back energy (or returns force) rather than absorbing it. For example, sand is high in shock absorption but low in energy return. Concrete is high in energy return but low in shock absorption.



Tiffeny Milbrett:

“Each one of us has to be more careful and thoughtful of how we affect the environment.”

environmentally intelligent	a product in which natural resources, energy, and technology are used efficiently and appropriately in a manner that mimics natural systems and ensures that damage to the environment is avoided at every step of the manufacturing process, during use, and after disposal (McDonough Braungart Design Chemistry).
evolution	the theory that groups of organisms change over time, mainly as a result of natural selection, so that their descendants differ morphologically and physiologically from their ancestors; a gradual process in which something changes into a different and usually more complex or better form.
funnel	a utensil, in the shape of a cone, with one large round opening at one end and a smaller round opening at the other; used to guide the flow of a substance into a small-mouthed container.
glucose	(chemical symbol $C_6H_{12}O_6$). A sugar that occurs widely in most plant and animal tissue. It is the main sugar circulating in the blood and the major source of energy for the body.
granulation	the process of forming into grains or granules.
habit	a recurrent pattern of behavior that is acquired through repetition.
industrial revolution	the time period of history (England, late 1700s) when the means of producing goods shifted from home-based hand manufacturing to large-scale factory production.
kinetic energy	moving energy, or energy associated with motion.
landfill	a system of trash and garbage disposal in which waste is buried between layers of earth. Landfills are typically large holes in the ground that are lined with a synthetic material such as plastic or nonpermeable clay. They are required (in the United States) to have a leachate collection system to collect, remove, and treat any liquids that pool on the inside, and a methane gas collection system. Landfill operators must use monitoring wells to monitor the ground water below and around the landfill to maintain safe water. If a leak occurs, the landfill is closed and repaired. In a landfill, each day's trash is compacted into a cell and then covered with one to three inches of dirt or synthetic material. When a landfill is full, plastic is used to cover the top and seal the trash inside. Nothing biodegrades in a landfill: in order for biodegradability to occur, oxygen, sunlight, moisture, and microorganisms must be present to start the process of decay.
matter	something that occupies space and can be perceived by one or more senses; something that has mass and exists as a solid, liquid, or gas.
midsole	the material (such as foam) used for cushioning an athletic shoe. It is the material found between the outsole and the upper fabric.
molecules	the smallest particle of a compound that has all the chemical properties of that compound. Molecules differ in size and structure as well as in molecular weight.
Nike Grind	the trademarked name for materials created from recycling athletic shoes through the Reuse-A-Shoe program or for shoe manufacturing waste that is recycled in products through the Reuse-A-Shoe program (See also regrind.)
nonbiodegradable	materials that do not decay and return to soil, such as plastic jugs or Styrofoam™ packaging
nonrenewable resources	resources that will not "grow back" once they are used, or take such a long time to be replaced (such as petroleum) that they are virtually nonrenewable.
open system	a system in which matter and energy come in and out but not in a balanced way. Matter and energy may be wasted or dispersed, and more importantly, resources are depleted.

outsole	the bottom of a shoe or boot.
oxygen	(chemical symbol O) a nonmetallic element that makes up 21% of the Earth's atmosphere and occurs as a gas or as a part of many other compounds, such as water and iron ore. It combines with most other elements, is essential for plant and animal respiration, and is required for nearly all combustion.
packaging	the container or combination of materials used to wrap a product and protect it from damage, theft, or decay.
petrochemicals	substances made from petroleum products.
petroleum	a thick oily liquid found below the earth's surface used to make gasoline, heating oil, chemical products, and other products. Petro fuel is thought to have been formed over millions of years by incompletely decayed plant and animal remains buried in thick layers of rock. It is considered a nonrenewable resource because of the length of time it takes to replenish.
photosynthesis	the process used by green plants and other organisms to make carbohydrates from carbon dioxide and water, using light as an energy source. Most forms of photosynthesis release oxygen as a byproduct.
pollution prevention	eliminating waste before it's created.
potential energy	the capacity for doing work (exerting a force) that a body possesses because of its position or condition. For example, an egg lifted to a certain height has potential energy because of its position in the earth's gravitational field. An egg, dropping, has kinetic energy because it is moving.
product life cycle	the predictable stages through which a product passes from its origin to the end of its useful life. In this curriculum, the product life cycle is defined as having five stages: research and design, manufacturing, retail, consumer use, and downcycling/recycling.
recycle	to pass an object through a series of changes or treatments in order to regain material for human use.
reduce	to use less of something; to diminish in size, amount, extent, or number.
regrind	the excess rubber produced when manufacturing shoe outsoles. This excess is incorporated into the manufacturing process so as not to waste it. Regrind is technically a part of Nike Grind.
renewable resource	a resource that can grow back, such as trees.
resilience	the ability of a strained body to recover its size and shape after deformation, especially deformation caused by compressive stress.
resources	an available supply that can be drawn on when needed; the total means available to a company for increasing production or profit, including plant, labor, and raw materials.
reuse	to use an object, a material, or a resource again.
shock absorption	the material property that allows energy to be absorbed.
size sorting	a system for using a screen or other device to sort objects for downcycling/recycling by size. In the case of downcycling shoes, ground-up shoe materials are placed on a screen. The smaller particles (midsole foam and outsole rubber) fall through the holes in the screen while the larger pieces stay on top.
source reduction	using less of a resource in design or manufacturing. Source reduction can involve pollution prevention or resource efficiency (getting the most and best use of resources in design or manufacturing).

sustain	to keep in existence, maintain, or provide for the support of.
sustainability	the principle of using a resource so that it is not depleted or permanently damaged and so that it is available to future generations.
sustainable	using a resource so that it is not depleted or permanently damaged; of or relating to a lifestyle that reflects an understanding of practices that maintain or prolong the availability of natural resources (from <i>A Child's Place in the Environment</i> , California Dept. of Education, 721 Capitol Mall, PO Box 944272, Sacramento, CA. 1996.)
sustainable community	a community that works with nature by recycling and reusing discarded material; by preventing pollution; by conserving matter and energy resources; by not degrading renewable resources; by not allowing the population to exceed the carrying capacity of the environment; and by preserving biodiversity. A community that manages its economic development and population growth in ways that do no irreparable environmental harm and that do not jeopardize the natural resources for future generations of people and other species. (G. Tyler Miller, Jr., <i>Environmental Science: Working with the Earth</i> [fifth edition]. Belmont, CA: Wadsworth Publishing Co., 1995. Referenced in <i>A Child's Place in the Environment</i> , California Dept. of Education, 721 Capitol Mall, PO Box 944272, Sacramento, CA. 1996.)
sustainable development	meeting the needs of today without sacrificing the needs of future generations. This is a term for the dual imperative of economic growth and environmental sustainability has been gaining ground among business leaders since the 1992 United Nations Earth Summit in Rio De Janeiro (<i>Harvard Business Review</i> , Jan-Feb 1997).
system	a group of interacting, interrelated, or interdependent elements that form a complex whole; an organism as a whole, especially with regard to its vital processes or organs.
upper [fabric]	the material, usually made of nylon, polyester, or leather, that makes up the "top" of an athletic shoe
waste materials	useless or worthless byproducts, as from a manufacturing process.
waste stream	the collective term for the waste disposed of by a community; also known as municipal solid waste (MSW).
water separation	a system of using water to separate materials for downcycling/recycling. Denser objects sink while less dense materials float, allowing them to be skimmed off the water and reprocessed.