Green Fingerprints

Leaving our mark on the planet.

A Green Paper from the Center for Digital Education

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Introduction

"Education is the most powerful weapon with which you can use to change the world."

- Nelson Mandela

There is an old proverb that says: "It takes a village to raise a child." Now, it seems, it might take a child to save a village — a global village that is. It's no secret that our planet is in trouble, where terms such as polar ice caps, global warming, carbon footprint, pollution and sustainability are commonplace. But as these ideas become routine, general acceptance of the situation may emerge. A nonchalant repetition of the words with a misunderstanding of the gravity of the situation could be disastrous for our world. As a society we can become jaded to the stark facts and figures that bombard us in commercials, magazines, newspapers, movies and books. What's often missing is what can be done, not only on a societal level, but on an individual basis.

As a companion to *Simply Green: A Few Steps in the Right Direction toward Integrating Sustainability into Public Sector IT,* it is the intent of this paper to not only expand on these buzz words concerning the environment, but to provide information on tangible steps to solve them. In contrast to *Simply Green*, this paper is not aimed to break old habits, but is instead focused on using our education system to teach the ones that will matter most in undoing the damage that has already been done — our children.

Opportunities for Learning

"Warming of the climate system is unequivocal," the Intergovernmental Panel reported at the 2007 United Nations Conference on Climate Change. "As is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level."[i]

While this U.N. report is foreboding, its unwavering sentiment can be a great catalyst for change and for learning opportunities, especially in education. School systems are often thought of as vehicles of change, and have proved themselves as such throughout history. It was in 1954 that eight-year-old Linda Brown challenged the "separate-but-equal" school systems and took her case to the Supreme Court. The decision of this case was pivotal in the Civil Rights movement and was the driving force that led to the end of segregation in schools.[ii]

The best part about teaching sustainable practices to our children is that they already know the importance of a clean and healthy environment. They may not know what the word sustainability means; in fact, the younger ones most certainly do not. What they do know is that they love the way the fresh air feels as they run to the playground, the coolness of the clean water after a splash in the ocean or the awesome wonder of seeing an African elephant.

What our educational system can do is find ways to help children begin thinking outside the box, approaching the world in a way that includes conscious consideration of sustainability of the environment. From here, we will look at ways to change our education system and reduce its carbon footprint, and in the process, inspire the next generation to live their everyday lives with the same mindset.

The following are ways in which schools can begin to integrate greener solutions into students' academic lives. Some of them are forward-thinking — things that are already in place and have proven to work. Others are on the cusp, a reality in the not-so-distant future. But in all, there is a common theme that emerges, a theme that is of the utmost importance

when trying to invoke any sort of change on a grand scale: they can be fun.

Digital textbooks

When it comes to buying textbooks, it can be the bane of every student's existence. A study in 2006 by the U.S. Department of Education found that the average cost to a student at a four-year public university for textbooks was $893 a year. According to the same study, those costs are rising at 6 percent per year.[iii]

Traditional textbooks are not just hard to afford, they are harmful to our environment with the depletion of trees and the chemical byproducts of the paper-making process. The U.S. book industry emits over 12.4 million tons of carbon dioxide into the atmosphere each year, or approximately 8.85 pounds of carbon per book, with most of the impact connected to forest carbon loss, according to a report from the Green Press Initiative and Book Industry Study Group.[iv]

It is true that trees are a renewable resource, and trees destined to line our bookshelves can be planted specifically for that purpose. It's also true that paper mills have become increasingly friendlier to the planet in recent years.

But enter the digital textbook. It's cheap, environmentally friendly and a lot easier on a college student's back. Regardless of the increased efficiency of producing a traditional paper textbook, digital textbooks are in a class of their own — and a new crop of entrepreneurs know it. Products and Web sites dedicated to digital books have popped up in recent years. Some of these sites, like Freeload Press, offer many of the books for free, if one doesn't mind the occasional advertisement. Sans advertisements, books cost a fraction of what they would in a traditional version.[v]

Printing purge

In both K-12 and higher education arenas, paper waste can run rampant. Everyone has seen it; it can happen with almost every click of the "OK to print" button. It's the page that comes out with one or two lines of gobbledygook, just enough to ruin a good piece of paper. Other times, course-long syllabi are handed out to every student in a 600-student lecture class, and half of them end up in the trash bin.

Many institutions are now taking measures like instituting a paper-waste taskforce or implementing printing technology designed specifically for optimal paper use.

In Bethlehem, Pa., the Lehigh University library and technology services piloted a new software program in fall 2007 called GreenPrint. GreenPrint's mission is to reduce excess print waste and to also save the university thousands of dollars. GreenPrint scans documents before sending a job to the printer, thereby eliminating superfluous pages and images — saving both ink and paper.

The program also provides the option of printing on regular or recycled paper and monitors how much paper is used. With this, it can calculate the level of carbon dioxide emissions made, in addition to the amount of trees and money saved. This allows students and teachers to see their impact immediately.[vi]

According to the California Integrated Waste Management Board, prevention is the most environmentally preferable means to reduce paper waste.[vii] Individual paper fibers can only be recycled a limited number of times — generally between five and 10 occasions — which means, even if all paper products on the planet were recycled, there would still be a need for paper to be made from virgin resources. Eliminating paper waste helps to minimize the environmental impacts of both paper production — including the stress on our woodland resources — and paper recycling.[viii]

Traditionally paper-centric processes are also garnering a second look by school personnel. Some schools are looking to automate tasks like student registration. Student registration usually involves a thick packet of paperwork and often many copies of students' information must be created for separate files. By moving to an electronic-based registration system, schools benefit from quicker response time between registration steps, as electronic file exchange is inherently more efficient than paper transactions and "snail mail."

Electronic registration systems can also help schools lessen (or avoid) the need for mass paper storage, which reduces heating, cooling and maintenance costs associated with storage units and structures.

Networking for change

Everyone knows of the big two: MySpace and Facebook, the social networking home bases that draw millions of users. Although these sites began as ways to reconnect with long-lost friends and as a procrastination tool for many students, they are evolving into a hub for social change.

…there is no such thing as throwing something "away."

Facebook, home to more than 69 million active users, has created a "causes" application within its home page.[ix] Facebook Causes are philanthropy groups that users can join such as Stop Global Warming, which currently has over 1.7 million members. There is no fee to join a Cause but users can make online donations and recruit other members.

Facebook creates an avenue for students to act in a socially conscious way.

"The Facebook Cause application has ultimately allowed me to connect with more than 400,000 people worldwide," said one Facebook Cause group creator, Christa Laukevicz. "It's helping me to be able to, slowly but surely, work my way to reaching my goal." Laukevicz said that young people are on the right path to becoming socially conscious, but there is still more that can be done. "I think it takes time. You can't rush change, but we are working our way there."[x]

And Facebook isn't alone in using social networking as a means for societal betterment. A Web site called TakePart inspires viewers by showing trailers of movies like Al Gore's "An Inconvenient Truth" and even has a carbon footprint calculator for those looking to figure up their impact on the Earth. Participants can then connect with others like them and choose to "act," searching for different causes with which they'd like to be involved.[xi] Sites like this connect people who have common passions and beliefs but might not have had the opportunity to meet otherwise.

Another group melding volunteerism with social networking is Do Something.org — a site dedicated solely to teens that want to enact change. With an average of 500,000 page views per month, Do Something has delivered over $1 million to teens affecting change. The premise of the site is that students brainstorm group activities to address a societal problem and then, in effect, write mini-grant proposals to Do Something. The site also sponsors clubs at schools across the country. One such club, The Lawrenceville Do Something Club in Lawrenceville, N.J., put together an interscholastic energy-saving competition between schools to see who could be the "greenest," which saw schools cutting energy use by as much as 16 percent.[xii] Also, the club created energy-saving initiatives, including a school-wide presentation on "Why be sustainable?" which involved putting plastic bottles collected over one week on the steps of the building to show there is no such thing as throwing something "away."[xiii]

"Through our online resources and grants we try to channel social responsibility into actions," said Jordyn Wells, director of clubs and grants at Do Something. "But at the end of the day, we aren't the ones designing and implementing the projects, the teens are."[xiv]

Online Learning

A brontosaurus in the room

Not so long ago, the only way for students to examine the brontosaurus bones in New York's American Museum of Natural History or the paintings of Frida Kahlo at the San Francisco Museum of Modern Art was to visit these locations, traveling by bus or airplane.

But with the arrival of virtual field trips, some of this larger-than-life material can be brought straight into the classroom.

A middle school history lesson on North Atlantic Vikings could be enhanced with the American Museum of Natural History's "Vikings Virtual Tour." Students will learn what it means to be "going viking"[xvi] and see images of a limestone picture stone from A.D. 500. In addition to broadening students' concepts of history as well as the current world around them, these virtual field trips do not require a carbon-emitting trip by bus or airplane.

And for educators searching for a totally interactive virtual experience, there are plenty of field trips that use real-time video technology. At the Hands-On Museum in Ann Arbor, Mich., — named Best Museum by the Detroit Free Press in 2003[xvii] — there are many class-enhancing trips to choose from: Water Wonders, Eyes and Optics, and Owls from the Inside Out, to name a few.

While some of the virtual field trips charge a nominal fee — $125 for the Water Wonders trip — they include a kit with materials for 30 students, extension activities and resources for further exploration, and a teacher's guide for pre-trip preparation. As the Hands-On Museum Web site says, "You can come to us, or we can come to you!"

As virtual field trips grow in use and popularity, so does their range of quality and availability. However, there are some resources that vet out information for educators. For example, the nonprofit Center for Interactive Learning and Collaboration houses credible virtual field trip providers such as Ann Arbor's Hands-On Museum, the Center for Puppetry Arts and the Smithsonian National Air and Space Museum.

"Content providers who have developed (virtual field trips) and need a way to market their availability post on our Web site," said Ruth Blankenbaker, executive director for the CILC.[xviii]

As to the increasing popularity of virtual field trips, Blankenbaker says that CILC's membership has grown steadily over the past four years with about 250 new memberships and three to five new content providers every month.

Hip-Hop Technology: From Turntables to Computers

Schools know that turning on students' interest sometimes means looking to pop culture. One company that specializes in education is allowing kids to let the beat drop with a hip-hop technology virtual field trip. Cadence on the computer may just be the motivator that students need to learn.[xv]

"Well done virtual field trips also benefit teachers," said Karen Foley, co-founder of a Web site specializing in virtual field trips. "If (the teacher) can go to an existing virtual field trip on a topic the students are learning about, it can be almost as exciting as finding buried treasure."[xix]

Virtual field trip at Fort Worth Museum of Science and Industry in Fort Worth, Texas.

Simulated learning

"There has been much talk in recent years about the use of simulations and gaming in education, both for children and adults. They … provide a safe environment for testing problem-solving techniques without the risks that we encounter in the 'real' world." [xx]

~Ulises Mejias, assistant professor, SUNY Oswego

The old adage, "practice makes perfect," is a great argument for e-learning and educational simulations. People learn best by doing — driving, flying, or designing a bridge — and simulation is a great way to get hands-on practice before ever getting behind the wheel — literally. Students using simulations don't have to drive anywhere to take traditional lessons.

At Yale University, students are using simulations in a whole new way. Over the past 20 years, thermal airflow and air quality performance simulations have played a significant role in the design and development of high-performance buildings, campuses and universities. Yale offers a Simulations and High-Performance Green Design course that introduces students to design simulations that help advance high-performance buildings and landscapes.

The Simulations and High-Performance Green Design course at Yale University:

- reviews the scope, development, applications, and limitations of airflow simulation tools;
- considers case studies of larger projects that have relied on these tools;
- introduces students to the underlying theory of these tools through the guided development of their own simulation tools; and
- engages students in the application of these tools to their own design projects.[xxi]

However, simulations are not just being used in Ivy League schools. For example, at the Maryland Virtual High School of Science and Mathematics, there is a collaborative earthquake simulation program that allows students to learn about Earth's vibrations. The students use synthetic seismograms and a network of computers to compile simulated data from multiple sites. The school uses the same team problem solving and technology-rich approaches used in research and business, according to the National Science Foundation.[xxii]

Podcasting for teachers

Ask any teacher what they would like to have more of, and the answer will most likely be "time." The day-to-day tasks of preparing lesson plans, grading papers and instructing students leaves little room for teacher training conferences.

Web sites for professional development help solve this problem by bringing the instruction to the teachers on-demand, allowing them to work it into their busy schedules. It's also helpful in reducing teachers' carbon footprints, letting them stay home instead of traveling to conferences.

In addition to Web sites, podcasting is also bringing teachers around the globe together to share ideas. Podcasting isn't a new term; it began to catch on in 2004 and has been growing in popularity ever since. What's relatively new is using podcasting as an additional tool in professional development.

One such podcast is "Teachers Teaching Teachers," where a group of teachers collaborate with their ideas over online calling software and later post these conversations to the Internet for more learning opportunities.[xxiv] Lee Baber, one of the creators of the podcast, describes it as a "faculty meeting that doesn't end."[xxv] It seems that teachers are appreciative of getting help for their classrooms without having to spend the time to travel. The site saw almost 120,000 visitors between September 2007 and November 2007.[xxvi]

In the Moodle for Professional Development?

Moodle is an open-source software package designed for educators. It can be downloaded for free on any computer and can create an environment for teachers to collaborate via podcast or vodcast (video podcast). Some of the useful features available through Moodle are:

Choice Module: This is like a poll and can be used to vote on something or to get feedback from students.

Forum Module: Forums can be used for specific audiences, with the teacher-only option available for professional development courses.

Wiki Module: An area that anyone can edit. Supportive of collaboration between teachers or in the classroom.[xxiii]

Another podcast for teacher professional development is "The Teachers' Podcast," put on by Mark Gura and Kathy King. This podcast has had over 3.8 million downloads since its inception more than two years ago. Gura says that podcasting may not replace conferences, but if planned carefully, should free up conferences so more ground can be covered. He says a level of synergy can be obtained between the two.[xxvii]

Wikis and gaming

In the professional world, wikis and other collaborative tools are becoming commonplace. A new report by Forrester Research says that enterprise spending on Web 2.0 technologies will surge over the next five years, growing 43 percent each year to reach $4.6 billion globally by 2013.[xxviii] As the influence of wikis, blogs and discussion boards becomes more prevalent in the adult world, the ability to use them must begin with students, both postsecondary and the younger set in middle and elementary schools.[xxix]

One example of a school-based collaborative project is the Many Voices for Darfur wiki and blog started by George Mayo and Wendy Drexler with their eighth and third-grade students. The mission of the project was to spread awareness about the genocide taking place in the Darfur region in Sudan.[xxx] What resulted is a potpourri of video messages, written comments, and audio files — one teacher and his 80 sixth-grade students put together a protest video and song — all from school-aged students.

"We started (the Many Voices for Darfur project) and we didn't know where it was going to go," said Mayo.[xxxi]

The Many Voices for Darfur wiki and blog project received 677 comments — mostly from U.S. and Canadian students — and was given the Highly Commended Award from the 2008 SIGTel Online Learning Awards.[xxiii]

Getting at moral and societal issues is often a main goal in citizen journalism[xxxiii] as exemplified in The Great Lakes Wiki started by students at Michigan State University. This wiki identifies areas of concern — or specific geographic regions that particularly impair aquatic life — on the Great Lakes.[xxxiv] The site has information on the geography of the region, links to current area news and even hosts a training section on the wiki format.

Like wikis and blogs, online gaming is an emerging tool that allows for student collaboration without carbon dioxide-emitting travel. According to Project Tomorrow's fifth annual Speak up Survey [xxxv], online or electronic gaming is one of the technologies that students use most frequently. Also the survey found that of emerging technologies, educational gaming is one that students would most like to see used in their schools.[xxxvi]

One online game that is advancing in the classroom is Quest Atlantis, a 3-D virtual environment where students complete "quests" — curricular tasks designed to be educational and entertaining.[xxxvii] Quest Atlantis was created by the Indiana University School of Education and includes a mandatory professional development course for teachers.

"The teacher's role is incredibly necessary," said Sasha Barab, associate professor at Indiana University, by way of YouTube video. "What teachers do is they really get kids to think deeply about what they are doing … to ask about what science is necessary to make sense of (the game)."[xxxviii]

Some of the game quests have students delve into environmental issues and moral issues, says Allison Powell, vice president of the North American Council for Online Learning. "Online gaming is starting to take off," she added.[xxxix]

The numbers represent areas of concern to the enviromental health of the Great Lakes and are a major focus of the Grat Lakes Wiki

Created by Karl Gude

Schools and the Environment

"Let every individual and institution now think and act as a responsible trustee of Earth, seeking choices in ecology, economics and ethics that will provide a sustainable future, eliminate pollution, poverty and violence, awaken the wonder of life and foster peaceful progress in the human adventure."[xi]

- John McConnell, founder of International Earth Day

While inspiring and teaching the next generation ways to heal the damage is of awesome importance, the other key objective of this paper is of a more tangible nature: the changes in the buildings where our children are taught, the means with which they get there and how it will all get paid for.

Small steps toward a huge impact

With the need for sustainable design increasing, there are a number of easy, relatively inexpensive ways for existing schools to save money, cut carbon dioxide emissions and teach students about the importance of sustainable design.

Shutting off electronics: For schools that want to reduce costs and conserve energy, one simple and effective solution is to power down all electronics at night. A recent survey by the Green Technology Initiative found that more than one in five IT directors did not know whether machines were switched off at night, and a further 27 percent thought less than half of their equipment was being switched off.[xli] And schools use a lot of electronics — computers, printers, digital projectors, copiers, telephone systems and the like. Imagine the savings that would accrue if each electronic device, which usually runs 24 hours a day, were only powered up during normal hours of operation. Using automated power management software — software that automatically shuts down and powers on electronics devices — gives IT administrators the ability to schedule specific managed systems to remotely power on or off at specified times, seven days per week.

Such software helped Region 12 School District in Connecticut realize more than $25,000 per year in energy savings.

"Our school district would rely on the employees to manually shut down every computer system at night and then power them on again each morning in order to save money and energy," said Robert Giesen, business manager for Region 12 School District. "However, this was not efficient and inevitably many systems were forgotten and left on. At times machines were left on even over weeklong school breaks. We needed something with the ability to power systems off but without any user intervention. It helps us save energy while allowing us to configure exactly when we want systems to be powered off at night, seven days a week. So even on weekends or weeklong school breaks we don't need to worry about wasting our district energy budget."[xlii]

Waterless urinals: While it's not the most conversation-friendly of topics, the argument for waterless urinals is making a splash in schools around the country, and for good reason. Most of today's waterless systems save anywhere between 15,000 and 45,000 gallons of water per urinal per year, which amounts to considerable savings for schools.[xliv]

Automated power management savings calculator[xliii]

Number of computers	500
Regional energy rate (per kilowatt-hour)	$0.14
Total PC wattage	200
Current daily hours on	24
Projected daily weekday hours off	12
Projected daily weekend hours off	24
ANNUAL KILOWATT-HOURS SAVED	562,800
ANNUAL ENERGY SAVINGS	$78,792

In 2001, the University of South Maine installed four waterless urinals as test units as part of its mission to "green" the campus. After weighing the pros and cons, the university decided that waterless urinals were not only eco-friendly, but also budget-friendly. By 2005, the school had expanded its use of waterless systems to 40 units in 10 buildings across the campus. And while environmental friendliness was among the top reasons to install the waterless urinals, the university hopes the new units will provide other benefits as well, including ease of maintenance.[xlv]

Waterless urinals, not surprisingly, don't use any water. What might be somewhat surprising is that they are actually more hygienic than their water-flush counterparts because germs are less likely to multiply in dry environments. The waterless urinal also costs less when it comes to installation and maintenance.[xlvi]

Daylighting: Schools and universities with plans to upgrade their facilities have the opportunity to choose designs that significantly increase the amount of natural light that enters the building. Daylighting is the practice of placing windows — or other transparent media and reflective surfaces — in a manner so that during the day natural light provides effective internal lighting.[xlvii] According to the U.S. Department of Energy, daylighting not only provides energy savings, but generally improves occupant satisfaction and comfort. Additionally, recent studies are implying improvements in productivity and health in daylighted schools and offices.[xlviii]

To achieve effective daylighting in schools, administrators should keep six principles in mind:

- Prevent direct sunlight from penetrating into glare-sensitive teaching spaces
- Provide gentle, uniform light
- Avoid creating sources of glare
- Allow teachers to control daylighting with blinds
- Have an electrical system that complements daylight and conserves energy
- Plan interior layouts to take advantage of daylight[xlix]

Solar Panels: Equipping building rooftops and parking structures with solar panels is another great way to stretch budgets and eliminate carbon dioxide emissions. Solar panels collect and convert solar energy into electricity or heat that can then be used in nearby buildings. Solar panel systems produce electric power with no carbon dioxide (CO2) emissions, which accounts for the reduction of approximately six tons of CO2 over the average 20-year life of one solar system.[li]

At San Jose Unified School District in California, a $40 million agreement with Chevron Energy Solutions and Bank of America has equipped the school district with nearly 70,000 solar panels, which is reportedly the largest K-12 solar project in the United States. The program, which includes installation of five megawatts of solar power, is expected to provide the following benefits:

- The district will see over $25 million in energy cost savings over the 20-year life of the system.
- The district will reduce its demand for utility power by 25 percent.
- The system will reduce CO2 emissions by 37,500 tons over the life of the system, which equates to planting nearly 400 acres of trees.[lii]

Sun Benefits

Daylighting is both knowledge and budget-friendly. Consider the following numbers:

20 to 60

Estimated percentage of energy savings when electrical lights are dimmed or turned off during daylight hours in schools with daylighting.

7 to 37

Range of percentage increase in student performance associated with the availability of daylight in classrooms.

11

Expected percentage increase in performance for a student moved from a classroom with average daylight to one with maximum daylight.[l]

High-Efficiency Lighting: High-efficiency lighting provides maximum illumination while expending minimal energy. These lights and light fixtures offer ultra-bright lighting with expanded bulb life, so schools can save money while helping the environment.

The most popular of high-efficiently lighting is the "spiral" or "corkscrew" bulb, which is a compact fluorescent light bulb (CFL) designed to replace standard incandescent light bulbs. These bulbs, which are compatible with existing light fixtures designed

for standard bulbs, use less power and have a longer life. Most CFLs have been rated and approved by Energy Star, and those with Energy Star ratings boast the following benefits:

- Energy Star-approved CFLs use about 75 percent less energy than standard incandescent bulbs and last up to 10 times longer.
- Each bulb can save $30 or more in electricity costs over the life of the bulb.
- Qualified CFLs produce about 75 percent less heat, so they're safer to operate and can cut energy costs associated with cooling.

If every American home replaced just one light bulb with an Energy Star-qualified bulb, the U.S. could:

- save enough energy to light more than 3 million homes for a year;
- save more than $600 million in annual energy costs, and;
- prevent greenhouse gases equivalent to the emissions of more than 800,000 cars.[liii]

Just imagine the benefits if every light bulb in every school in America were changed, too.

"Solid wastes" are the discarded leftovers of our advanced consumer society. This growing mountain of garbage and trash represents not only an attitude of indifference toward valuable natural resources, but also a serious economic and public health problem.

~ Jimmy Carter[liv]

Waste Free Lunches: In 2006, the United States Department of Agriculture provided about 30 million students with lunch through the federal School Lunch Program.[lv]

Multiply that 30 million by the estimated 67 pounds of lunch waste produced per year per student and you get over 2 billion pounds of waste.[lvi] The average elementary school alone produces an estimated 18,760 pounds of lunch waste per year.[lvii] To offset its share of food waste, many schools have begun to promote Waste Free Lunch programs which entail:

- Main dishes in a reusable lunch container
- Cloth napkins
- Stainless-steel utensils
- Thermoses and reusable lunchboxes[lviii]

Prius or PriBUS?

As both the cost of gas and carbon emissions continue to rise, practices that eliminate the need for the transporting of children and teachers to and from schools and school administrative offices will be more and more important. Along with e-learning and virtual schooling, distance learning is being seen as a way to save on transportation costs while linking students to resources they might not have access to otherwise.

While distance learning is making its way into schools — research suggests about 25 percent of U.S. schools have adopted videoconferencing technology[lix] — some states, such as Arkansas and Alabama, are wholeheartedly embracing the idea. For its part, Arkansas, through state-awarded funding,[lx] was able to install interactive video equipment into the majority of its high schools as well as fund teachers, classroom facilitators and field support.

The Distance Learning Initiative in Arkansas works by providing real-time instruction to students statewide. This means that schools who do not offer Latin, French or advanced placement literature, among others, can allow students to take these classes remotely. The teachers broadcast from five centers across the state where they cover an area of up to four school districts during one class period.

The interactive technology used in distance learning can bode well for courses such as algebra and geometry, according to Pat Laster, math teacher at the Arkansas Department of Education Distance Learning Center in Maumelle, Ark.

"The distance learning department is providing a service that is badly needed all over Arkansas," said Laster. "A lot of these schools would not be doing these classes (without distance learning)."

Laster teaches students from around the state by way of interactive video and they are able to not only see and hear her but they can also contribute to class in real time. On the other end, Laster can watch students work out equations as the technology allows for many people to manipulate the "board" at the same time. Students also have a digital writing pad, connectable via USB port, that lets them write out problems without having to use the keyboard and mouse, something that can be a big plus in learning to work out math equations.[lxi]

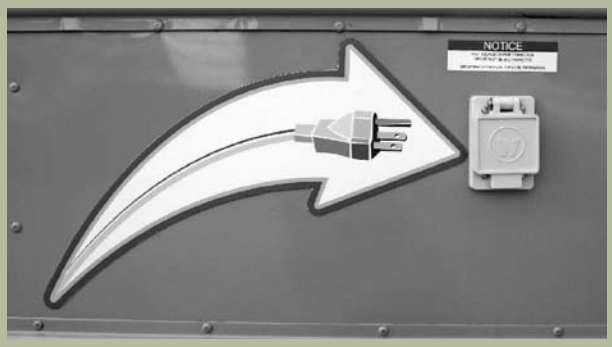
However, even as the tools of remote learning grow in viability, most students are still going to be traveling to and from the physical school building. For students and the institutions that serve them, improvements in transportation will be required to meet sustainability goals and manage rising costs. Bus fleets will require more fuel efficient vehicles that make use of cleaner, renewable energy sources. Already, some schools are deploying hybrid-electric buses that use 40 percent less fuel and emit 90 percent less pollution than conventional buses.

Decisions by schools about building and campus location and design have implications for transportation systems that reach far beyond the edge of their property. Unlike buildings, much of the operation of the transportation system and its effects on the health and quality of life of the larger community are outside of the direct control of the educational institutions. But, "communities are increasingly concerned about congestion, air pollution, school transportation budgets, and children's health and obesity,"[lxii] and expect that decisions made by educational institutions will take their concerns into account.

Transportation by bus and car every day is a major health and mortality risk for students. Contrary to the perception of many families, for students traveling to and from school, a car is the most dangerous place to be. A study on school transportation safety concluded that 75 percent of the deaths and 84 percent of the injuries to students traveling to and from school are a result of car accidents.[lxiii]

Cars are also a significant source of air pollution and there is overwhelming evidence linking ozone and other air pollutants to respiratory ailments in children, including upper respiratory infections and asthma.[lxiv]

One State Goes Green, Converts Bus to Hybrid-Electric



As part of Indiana's Learn Green, Live Green initiative, a yearlong program aimed at making the public school system greener, a hybrid-electric school bus rolled out in January 2008.

This eco-friendly bus was converted from a standard school bus using new hybrid-electric technology. The new design includes an electric motor, a controller, and an ultracapacitor that fit directly into the existing drive shaft. When the bus operates at or below 35 mph, it is propelled by the electric motor with a "boost" installed from the diesel engine when needed. The diesel engine takes over and propels the bus once the speed of the bus exceeds 35 mph. By eliminating the use of the diesel engine during start and stop speeds, the bus conserves fuel. Additionally, harmful exhaust emissions are reduced by the same amount as the fuel savings. Therefore, if fuel savings equal 25 percent, emissions are reduced by 25 percent as well.

New hybrid buses can cost anywhere from $250,000 to $350,000, while retrofitting an existing bus with a hybrid system will cost only $40,000 to $50,000, according to Cathy Stephen, superintendent of Randolph Easter School Corporation. The total conversion cost of the state's first hybrid school bus totaled $32,800.

"This is the right thing to do," said Stephen. "Schools need to lead in helping our problems with the environment, with our dependence on oil and in providing safe and healthy riding conditions for our students. This system has the potential to address all of these issues." [lxviii]

School-related car transportation is also a major contributor to traffic congestion and the number of those traveling to school by car is increasing. In 1969, a whopping 48 percent of K-12 students walked or biked to school[lxv] Today, only 3 to 4 percent of students walk or bike to school, with almost 50 percent traveling in cars.[lxvi]

Like most modes of travel, education-related transport consumes significant quantities of imported fossil fuels and emits greenhouse gases into the atmosphere. The routes traveled by public school buses alone account for over 7 billion miles per year in the United States. The total greenhouse gas emissions of all transportation directly and indirectly attributable to education-related travel is unknown. But one study suggests that "neighborhood schools would reduce traffic … (and) produce … a reduction of at least 15 percent in emissions of concern."[lxvii]

Schools will also need to employ new technologies and transportation concepts. Advanced traffic management software and real-time communications with passengers for improved logistics and convenience can create new types of shared services that aren't private cars or school buses. Flexible, on-demand bus services are already in use in Sweden.[lxix] A 2007 Australian study, "Towards a High-Bandwidth Low-Carbon Future," includes "Personalized Public Transport" as one of seven major innovations with great potential for reducing greenhouse gas emissions, along with a "De-Centralized Business District" and "'On-Live' High Definition Video Conferencing."[lxx]

For school administrators, high school students, and students at higher-education commuter schools, institutions may need to subsidize transit passes and van pools or give carpooling incentives such as preferred parking. They may also need to eliminate free parking to discourage the one-person-per-car trend.

Some schools already use parking and driving privileges for students as either negative or positive reinforcement. Those kinds of programs can be expanded to reward eco-responsible behavior as well.

Walk this Way

The National Center for Safe Routes to School assists communities in enabling and encouraging children to safely walk and bicycle to school. Established in May 2006, the Center strives to equip Safe Routes to School programs with the knowledge and technical information to implement safe and successful strategies. The Center is maintained by the University of North Carolina Highway Safety Research Center with funding from the U.S. Department of Transportation Federal Highway Administration.[lxxii]

Ultimately, the decisions that will have the longest lasting effects on sustainable modes of transportation for education are the locations of school buildings. "Schools can and do have multiple roles and influences in the community," according to a report by the Environmental Protection Agency. "Schools can anchor neighborhoods, and be centers of learning and community. They drive home-buying decisions and traffic patterns. School size, location, and the design of the school's neighborhood affect most of these roles and influences."[lxxi]

Walking is the least expensive, safest, healthiest, and most environmentally responsible form of human transport. Decision-makers will need to fully integrate that reality when deciding size and location of school buildings in the carbon-constrained world of the 21st century.

Technology planning

The integration of technology planning into institutional strategies, particularly for facilities, is also critical to achieving sustainability goals. Technology vendors are beginning to promote their products with claims of environmental benefits from reduced transportation, building space, use of paper and "dematerialization." All of these benefits are possible, but have their own environmental costs.

Many technology components may be small, but have a large environmental footprint. "Electronics is one of the world's largest manufacturing sectors, with social, economic, and ecological impacts on six continents across the planet. The production of electronics and computer components contaminates the air, land, water, and human beings with nearly unrivalled intensity."[lxxiii]

The devices that make up our interconnected global networks are material and energy intensive in manufacturing and distribution. In use they consume a significant, and rapidly growing, amount of energy. At the end of short lives, our electronic tools become toxic waste.

While much attention has been paid to the "eco-footprint" of buildings and transportation, until recently, little has been given to the negative environmental effects of technology systems. Sustainability programs and environmental responsibility initiatives rarely address technology systematically as part of the overall plan for reducing carbon emissions, energy consumption, material use and toxicity, and waste volumes.

The rapidly increasing energy requirements to power electronics and the growing volumes of "e-waste" clearly indicate that greening technology systems is as important as greening the buildings in which they sit.

Educational institutions need to have environmental assessment and management master plans for technology as part of their sustainability strategy. Those plans should include:

- Environmentally Preferable Purchasing (EPP) for buying greener and creating incentives for the creation of more environmentally benign products;
- energy management plans and monitoring systems for minimizing power consumption;
- system design processes that include environmental criteria as a base requirement for specifications development for technology systems;
- collection and disposal systems for electronic waste, universal waste, and technology-related solid waste;
- criteria and systems for measuring, monitoring, and reporting on the environmental performance of technology initiatives and the organizations that support them; and
- educational programs for students, faculty, and administrators about environmentally responsible use and management of technology equipment.

Looking to the Future

The need for a sustainable future has never been more eminent, and today's college students want to help. As the interest in sustainable design and environmental management continues to gain steam among the college-bound, universities around the country are responding with degrees in sustainable design and environmental management.

Green collar degrees

At Vermont Technical College, the focus is on using technology to create a sustainable economy. In the Sustainable Design and Technology degree program, students can choose from three concentrations: Green Energy, Green Buildings and Green Sites. Green Energy focuses on both the traditional and alternative ways of producing, using and conserving energy. Green Buildings focuses on the renovation and creation of buildings that conserve energy. The goal is to design buildings that can get Leadership in Energy and Environmental Design (LEED) certification. Green Sites focuses on responsible design of roads, farms and water systems to reduce environmental impact and improve quality of life.[lxxiv]

In Fairfield, Iowa, at Maharishi University of Management, students may persue a degree in sustainable living. The degree covers seven different areas including bio-geophysiology, which looks at the foundations of ecology and geology as the model for sustainability. Students also study green business and entrepreneurship, looking at the basics of business and economics that drive sustainable communities. Equally interesting are some of the individual classes offered, like Alaskan Village Design, and Planning a Sustainable Family Farm.[lxxv]

At Yale University, students can now major in architecture and environmental management. The joint degree program links environment and architectural design. The program emphasizes and encourages the relationship between people and nature in buildings and focuses on sustainable and restorative environmental design. Students take courses in both the architecture school and the environmental school. Classes in the degree program include Environmental Law, Global Ethics and Sustainable Development, and Energy Issues in Developing Countries.

The Master of Environmental Management program at Duke University, Nicholas School of the Environment and Earth Sciences, trains students to "understand the scientific basis of environmental problems, as well as the social, political and economic factors that determine effective policy options for their solution." Students can focus on seven different areas, including environmental health and security, which emphasizes interactions among humans, environmental health and ecological processes. Environmental Economics and Policy trains those who influence policy through the political process.[lxxvi]

Many community colleges are also keeping up with the sustainability movement. Lane Community College in Eugene, Ore., has a full-time recycling coordinator and a focus on reuse — surplus property, office supplies, clothes — allowing the college system to boast a 61 percent recycling and reuse rate.[lxxvii] Lane also has a major focus on renewable energy. Wind energy accounts for 10 percent of the total energy purchased for the Eugene facilities and a ground-source heat pump is used in four small buildings.[lxxviii] What's next on the sustainability horizon for this community college system? A plan for becoming carbon neutral.[lxxix]

Cutting-edge careers

Some of the most in-demand jobs of the future will be those centered on the health of our environment. Most of these jobs will be comparable to careers available and popular today, but will require different training and schooling.

One such career is that of an organic farmer. Consumers are turning more and more to organic fruits and vegetables to avoid the use of pesticides on their food. Since 1990 the market for organic products has grown at a rapid pace, averaging 20 to 25 percent per year, and this has driven a similar increase in organically managed farmland. Approximately 306,000 square kilometers worldwide are now farmed organically.[lxxx] For organic farmers, a bachelor's degree in biology or agriculture would be helpful, with Iowa State University, Michigan State University and the University of California, Davis commonly cited as the strongest schools in that field.

Another career becoming increasingly important is that of an environmental attorney. It will require a J.D. as well as coursework in environmental issues, with top schools in the field being Lewis and Clark Law School, Pace University Law School and Tulane University.[lxxxi] Some of the career fields that are in great need of those with an environmental law degree are land use law analysts, legislative analysts or water rights specialists.

Along with the highly specialized law field, green-collar jobs are making their way into other sectors, too. However, the demand for these types of jobs is exceeding the pool of qualified applicants. According to the National Renewable Energy Lab, the shortage of skills and training is a leading barrier to renewable energy and energy efficiency growth. This labor shortage is only likely to get more severe as baby boomers skilled in current energy technologies retire.[lxxxii]

Nearly one-quarter of the current workforce will be eligible for retirement in the next five to seven years.[lxxxiii]

Amid mounting U.S. unemployment and economic downturn, this growing trend of establishing a sustainable nation presents many more employment opportunities, or green-collar jobs:

Solar panel product design engineer

This position, rooted in the field of mechanical engineering, is responsible for designing new types of solar panel products.

Ecotourism worker

Ecotourism, or tourism geared toward the environmentally conscious, involves traveling in Earth-friendly ways. Growing three times faster than the overall tourist industry, ecotourism is in need of an environmentally knowledgeable workforce to fill a number of positions.[lxxxiv]

Renewable energy electrician

With changing building standards, architectural design is one industry that has felt the influence of going green. Sustainable design, whether it be of homes, schools or business offices, is on the rise, and in need of environmentally apt construction professionals.

The demand for sustainable careers is no longer a trend but is instead a necessity. The need for environmental management, sustainability and protection has only just begun, and the years to come will be punctuated with new developments in sustainability and green careers.

Conclusion

"The ultimate test of man's conscience may be his willingness to sacrifice something today for future generations whose words of thanks will not be heard."[lxxxi]

- Gaylord Nelson, former governor of Wisconsin, co-founder of Earth Day[lxxxv]

The challenges created by environmental issues will significantly alter how people around the world think about education and change how educational services are delivered. It is the purpose of educators to prepare children for the future, however even with all of the research studies, scientist predictions and the shrugging off of naysayers, no one knows what the Earth will look like in 2060. That is why it is the job of the education system to do its best to prepare children for what may come next. Our students did not create the environment as it is today, but they must be prepared to take the helm toward a brighter, greener future.

Endnotes

i Bernstein, Lenny, Bosch, et al, "Climate Change 2007: Synthesis Report," Intergovernmental Panel on Climate Change. United Nations (2007) http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf

ii Brown vs. Board of Education. Issue: Racial Segregation in Public Schools, as detailed on PBS online. http://www.pbs.org/jefferson/enlight/brown.htm

iii Koch, James V. "An Economic Analysis of Textbook Pricing and Textbook Markets," ACSFA College Textbook Cost Study Plan Proposal, September 2006, http://www.ed.gov/about/bdscomm/list/acsfa/kochreport.pdf

iv "Book Industry Undergoing Green Transformation." Environmental Leader. March 19, 2008. See: http://www.environmentalleader.com/2008/03/19/book-industry-undergoing-green-transformation/

v Morris, Peter. "College Textbook Prices Up 186 Percent since 1986…" The Business Shrink, Jan. 22, 2008. See: http://www.businessshrink.biz/psychologyofbusiness/2008/01/22/college-textbook-prices-up-186-since-1986-enter-revolution/

vi Freeman, Sarah. "New Software to Reduce Paper Waste." *The Brown and White.* See: http://media.www.thebrownandwhite.com/media/storage/paper1233/news/2007/10/26/News/New-Software.To.Reduce.Paper.Waste-3057021.shtml

vii "Paper Waste Prevention." California Integrated Waste Management Board. See: http://www.ciwmb.ca.gov/Paper/Prevention/

viii Ibid.

ix Number of active users according to Facebook.com as of April 3, 2008.

x *Converge* Magazine. "Teen Social Networking to Benefit Society" Special Issue 2007 See: www.convergemag.com/story.php?catid=231&storyid=106524

xi TakePart.com is a self-described social action network™ where you connect actions to entertainment to make change, http://www.takepart.com/act

xii *Converge* Magazine. "Do Something.org — Teens Causing Change" Special Issue 2007. See: www.convergemag.com

xiii Ibid.

xiv Ibid.

xv Through the Tandberg Connections Program, schools are taking advantage of free virtual field trips (VFT). Some featured VFTs this semester include: Roller Coaster Science, Coral Reefs, Animals in Winter, Exploring Shakespeare, Hip-hop Technology and Puppetry Arts. See: http://www.tandberg.com/ind_focus/education/connections.jsp

xvi According to the American Museum of Natural History's Viking Virtual Tour, "going viking" meant sailing off to ransack and rob. See: http://www.amnh.org/exhibitions/vikings/homepage.html

xvii According to the Ann Arbor Hands-On Museum. See: http://www.aahom.org

xviii Phone interview with Ruth Blankenbaker on May 22, 2008.

xix Karen Foley, co-founder and site creator of Tramline.com. Interview by e-mail on April 21, 2008.

xx "Simulations, Demonstrations and Screencasting." Learning Light, e-Learning Centre. See: http://www.e-learningcentre.co.uk/eclipse/Resources/simulation.htm

xxi Simulation and High-Performance Green Design: course description. See: http://www.architecture.yale.edu/drupal/index.php?q=node/293

xxii The Maryland Virtual High School of Science and Mathematics is funded by a grant from the National Science Foundation. See: http://www.nsf.gov/news/overviews/education/interactive.jsp

xxiii These are just a few of the features described on www.moodle.org.

xxiv "Podcasting for Teachers Creates Anytime, Anywhere Teacher Conferences." Converge online. March 12, 2008. See: http://www.convergemag.com/story.php?catid=422&storyid=106727

xxv Ibid.

xxvi Ibid.

xxvii Ibid.

xxviii "Global Web 2.0 Market to Surge in Next Five Years, Says Forrester." April 21, 2008. *Government Technology* http://www.govtech.com/gt/articles/295682

xxix "Best Web 2.0 Applications for Elementary School." Langwitches *The Magic of Learning through Technology.*

xxx See the Many Voices for Darfur wiki at: http://stopgenocide.wikispaces.com/

xxxi Phone interview with George Mayo on May 1, 2008.

xxxii The SIGTel online learning awards are part of the International Society for Technology in Education. See: http://www.iste.org/

xxxiii Citizen journalism, also known as public or participatory journalism, is the act of citizens "playing an active role in the process of collecting, reporting, analyzing and disseminating news and information," according to the seminal report *We Media: How Audiences are Shaping the Future of News and Information,* by Shayne Bowman and Chris Willis. They say, "The intent of this participation is to provide independent, reliable, accurate, wide-ranging and relevant information that a democracy requires." See Wikipedia entry for citizen journalism.

xxiv The 1987 U.S.-Canada Great Lakes Water Quality Agreement lists 43 Areas of Concern. See: http://greatlakeswiki.org/index.php/Areas_of_Concern

xxxv Project Tomorrow's Speak Up Survey addresses the attitudes and opinions of K-12 students, teachers, parents and school administrators toward the use of technology in education. See www.tomorrow.org/speakup

xxxvi "Students Want More Use of Gaming Technology," Converge online. http://www.convergemag.com/story.php?catid=231&storyid=107101.

xxxvii Quest Atlantis was created by the Indiana University School of Education. For more information see: http://atlantis.crlt.indiana.edu/#44

xxxviii Learn more about Quest Atlantis at http://atlantis.crlt.indiana.edu/#44.

xxxix Phone interview with Allison Powell on April 30, 2008.

xl Quotes used as on www.BetterWorld.net. See: http://www.betterworld.net/quotes/recycling-quotes.htm

xli The Green Technology Initiative is a non-commercial entity providing the U.K. business community with free advice and information. See: http://www.greentechnologyinitiative.org/

[xlii] "Using Automated Power Shut-off Helps Conserve Energy and Reduce Costs." Converge online. See: http://www.convergemag.com/story.php?catid=420&storyid=106860

[xliii] Integrated Financial Systems, Inc. Energy and Cost Savings Calculator. See: www.i-f-s.como/powersavingscalculator.xls

[xliv] Wikipedia entry. See: http://en.wikipedia.org/wiki/Urinal#Waterless_urinals

[xlv] Hounsell, Dan. "Making Waterless Work." Maintenance Solutions. January, 2005. See: http://www.facilitiesnet.com/ms/article.asp?id=2442

[xlvi] Ibid.

[xlvii] Wikipedia entry. See: http://en.wikipedia.org/wiki/Daylighting

[xlviii] "Building Toolbox." U.S. Department of Energy. See: http://www.eere.energy.gov/buildings/info/design/integratedbuilding/passivedaylighting.html

[xlix] Kennedy, Mike. "Strategies for Success: Windows/Skylights." *American School and University.* July 1, 2006. As cited from the *Collaborative for High Performance Schools Best Practices Manual.* See: http://asumag.com/daylighting/university_windowsskylights/

[l] Heschong Mahone Group and New Buildings Institute, "Daylighting in Schools, Reanalysis Report," 2003 See: http://www.newbuildings.org/downloads/FinalAttachments/A-3_Dayltg_Schools_2.2.5.pdf

[li] Solar Electric Light Fund. "Benefits of Solar." See: http://www.self.org/shs_envir.asp

[lii] "Solar Lighting on the Way to San Jose." Converge online. See: http://www.convergemag.com/story.php?catid=232&storyid=105692

[liii] Compact Fluorescent Light Bulbs. Energy Star. See: http://www.energystar.gov/index.cfm?c=cfls.pr_cfls

[liv] http://www.betterworld.net/quotes/recycling-quotes.htm

[lv] National School Lunch Program. United States Department of Agriculture. See: http://www.fns.usda.gov/cnd/Lunch/ and http://www.fns.usda.gov/cnd/breakfast/AboutBFast/SBPFactSheet.pdf

[lvi] Waste Free Lunches organization was started http://www.wastefreelunches.org/

[lvii] Ibid.

[lviii] National School Lunch Program. United States Department of Agriculture. See: http://www.fns.usda.gov/cnd/Lunch/

[lix] The research report, Taking the Wraps off Videoconferencing in the U.S. Classroom: A State-by-State Analysis, by Wainhouse Research and Tandberg is available at http://www.wrplatinum.com/content.aspx?CID=5912

[lx] A summary of Arkansas Act 2325, which provided funding for statewide distance learning is summarized in the Arkansas K-12 Distance Learning Newsletter April 2006 edition. See: http://thor.nesc.k12.ar.us/~jwood/documents/DL%20Coordinator%20April,%202006%20Newsletter.pdf

[lxi] Phone interview with Pat Laster. May 21, 2008.

[lxii] Travel and Environmental Implications of School Siting, U.S. Environmental Protection Agency, EPA231-R-03-004, October 2003

[lxiii] The Relative Risks of School Travel , A National Perspective and Guidance for Local Community Risk Assessment, Committee on School Transportation Safety, Transportation Research Board of the National Academies, 2002

[lxiv] Travel and Environmental Implications of School Siting, U.S. Environmental Protection Agency, EPA231-R-03-004, October 2003

[lxv] Travel and Environmental Implications of School Siting, U.S. Environmental Protection Agency, EPA231-R-03-004, October 2003

[lxvi] The True Costs and Risks Of School Transportation, Jeff Tsai, Program Director, Institute for Transportation Research and Education, North Carolina State University, 2003

[lxvii] Travel and Environmental Implications of School, U.S. Environmental Protection Agency, EPA231-R-03-004, October 2003

[lxviii] *Converge* Magazine "Indiana Goes Green, Unveils Hybrid-Electric School Bus" January, 2008. See: www.convergemag.com/story.php?catid=231&storyid=106605

[lxix] CIVITAS (City-Vitality-Sustainability). Picco, Alexio. "Flexible Transport Systems." See: http://www.civitas-initiative.org/docs1/Flexible_Transport_brochure_060912_eps.pdf

[lxx] "Towards a High-Bandwidth, Low-Carbon Future: Telecommunications-based Opportunities to Reduce Greenhouse Gas Emissions," A Climate Risk Report, 2007

[lxxi] Travel and Environmental Implications of School Siting, U.S. ENVIRONMENTAL PROTECTION AGENCY, EPA231-R-03-004, OCTOBER 2003

[lxxii] National Center for Safe Routes to School, See: www.saferoutesinfo.org/index.cfm

[lxxiii] "Challenging the Chip," Silicon Valley Toxics Coalition, Temple University Press, 2006

[lxxiv] Sustainable Design and Technology degree program. Vermont Technical College. See: http://www.vtc.edu/section_academic_programs/sustainable_design/

[lxxv] Sustainable living program. Maharishi University of Management. See: http://www.mum.edu/sustainable_living/

[lxxvi] Professional Master Degrees. See: http://www.env.duke.edu/programs/professional/

[lxxvii] Marie Matsen and Jennifer Hayward. "Sustainability at Lane Community College: *Weaving Sustainability into the fabric of Lane Community College.*" April 16, 2008. See: http://lanecc.edu/sustainability/conferences/Hayward.pdf

[lxxviii] Ground-source heat pumps use the constant temperature of the earth as the exchange medium instead of the outside air temperature. Even though the installation price of a geothermal system can be several times that of an air-source system of the same heating and cooling capacity, the additional costs are returned to you in energy savings in 5 to 10 years. See Geothermal Heat Pumps on the U.S. Department of Energy Web site at: http://www.eere.energy.gov/consumer/your_home/space_heating_cooling/index.cfm/mytopic=12640

[lxxix] Marie Matsen and Jennifer Hayward. "Sustainability at Lane Community College: Weaving Sustainability into the fabric of Lane Community College." April 16, 2008. See: http://lanecc.edu/sustainability/conferences/Hayward.pdf

[lxxx] Wikipedia entry: Organic farming. Figures cited are from Organic World, an online supplement to the annual study: *The World of Organic Agriculture.* See: http://www.organic-world.net/about.asp.

[lxxxi] 2008 Top-Law-Schools.com. Environmental Law Schools

[lxxxii] "Green-Collar Jobs in America's Cities." Center for American Progress. See: http://www.americanprogress.org/issues/2008/03/green_collar_jobs.html

[lxxxiii] Ibid.

[lxxxiv] "Ecotourism Fact Sheet." The International Ecotourism Society. See: www.ecotourism.org

[lxxxv] Quotes used as on www.BetterWorld.net. See: http://www.betterworld.net/quotes/recycling-quotes.htm

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ACKNOWLEDGMENTS:

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Printed on post-consumer recycled paper