

SOCIETY

ECONOMY

+ ENVIRONMENT

SUSTAINABILITY

“We are not lacking in the dynamic forces needed to create the future.”

Thomas Berry

| | |
|---|----|
| Letter from the Assistant Vice Chancellor | 4 |
| Letter from the Director | 4 |
| Acknowledgements | 5 |
| Executive Summary | 6 |
| Academics | 8 |
| Research | 10 |
| Buildings | 12 |
| Community & Culture | 14 |
| Energy | 16 |
| Land Use | 18 |
| Materials Management | 20 |
| Transportation | 22 |
| Waste Reduction & Recycling | 24 |
| Water | 26 |
| Events & Awards | 28 |
| Looking Forward | 30 |
| Links | 31 |



NOTE FROM THE SUSTAINABILITY OFFICER & ASSISTANT VICE CHANCELLOR FOR FACILITIES OPERATIONS

NC State is about to embark on several large planning initiatives that will guide campus sustainability decisions over the coming decade. The initiatives signify the beginning of what will be a culture change for our campus where sustainability is ingrained in our culture and cannot be separated from our identity. This culture change will expand campus' perception of true cost of our projects to include environmental and social considerations beyond the conventional up front financial costs. Individuals living this campus culture will act in ways that use our natural resources efficiently. At the forefront of this movement is the newly reformed Campus Environmental Sustainability Team (CEST) Administrative Advisory Council. Throughout the 2009-10 academic year CEST will be creating a campus wide Sustainability Strategic Plan and a Climate Action Plan. These guidance tools will be integral to the long-term success of our campus and will require the



input of our entire campus. It is imperative that these plans be representative of our unique campus needs and reflect the direction we as students, faculty and staff want to take our campus. For this reason one of our top priorities is for this planning process will be open and inclusive; allowing participation by all interested. CEST has several Working Groups that will be creating strategies and tactics for the Sustainability Strategic Plan and the Climate Action Plan. We invite you to play a role in this culture shift by joining a Working Group and helping chart our sustainable path forward.

Jack Colby, Sustainability Officer & Assistant Vice Chancellor
Facilities Operations

NOTE FROM THE SUSTAINABILITY DIRECTOR

Sustainability is becoming a core business value to our university. It is no longer just an environmental issue but one that is about efficiency and smart business decisions. In an economy where many sectors are being challenged to find new ways of operating, sustainability opportunities are growing and being seen as adding efficiencies. Through sustainability we see real impact in terms of energy and water savings, reduced solid waste and reducing NC State's carbon footprint; all of which impact the bottom line. As evidenced in NC State's Greenhouse Gas inventory, the biggest climate impact NC State will have is by conducting large infrastructure changes. However, we cannot forget the important role behavior change and education have to play in sustainability. Past individual behavior and over consumption of natural resources has presented us with the reality that sustainability can no longer be voluntary but is a necessity. As an institution of higher learning, we have a responsibility to help our campus community acquire and spread responsible behaviors that conserve natural resources and promote social responsibility. By educating our campus about the impact their choices can make, we will create permanent change that will be ingrained into future generations.

As we begin on our campus wide sustainability strategic planning and climate action planning, we want to emphasize not only the business impact sustainability can have but also the needed change in individual behavior.

Tracy Dixon, Director, University Sustainability Office



COMPILATION & EDITING BY:

Lindsay Batchelor, Program Coordinator, University Sustainability Office
Tracy Dixon, Director, University Sustainability Office
David Dean, Outreach Coordinator, University Sustainability Office

GRAPHIC DESIGN BY:

Amanda Swisher, Student Intern,
University Sustainability Office

PHOTOGRAPHY BY:

Creative Services
Contributors

CONTRIBUTORS:

Allen Boyette, Building Maintenance and Operations
Amanda Swisher, Sustainability Office
Amy Bailey, FREEDM Systems Center
Analis Fulghum, Waste Reduction and Recycling
Andrew Phelps, NC State University Alumni
Barbara Doll, Sea Grant Program
Barry Olson, University Housing
Bill Winner, Provost's Office and Department of Forestry and Environmental Resources
Brandon Vann, Office of Energy Management
Chip Watson, Men's Golf
David Dean, University Sustainability Office
David Townsend, Grounds Management
Ed Sekmistrz, Office of Energy Management
Ellen Buckner, Environmental Health and Safety
Ewan Pritchard, Advanced Transportation Energy Center
Greg Parsons, Chemical and Biomolecular Engineering
Janet Hudson, English
Jeff Hightower, Utilities and Infrastructure Planning
Jennifer Gilmore, University Dining
Jim Hansen, Materials Support
Dr. Joe DeCarolis, Civil, Construction and Environmental Engineering



Kelley McCarter, Forestry and Environmental Resources Academic Research
Lindsay Batchelor, University Sustainability Office
Lisa Currin, Research Administration
Lisa Maune, Design and Construction Services
Lisa Schabenberger, Forestry and Environmental Resources
Mark Johnson, Material Science Engineering
Michelle Schroeder- Moreno, Crop Science
Paul McConocha, Office of Energy Management
Randy Reed, University Housekeeping
Rick Hilburn, Landscape Construction Services
Sarah Kirby, 4-H Youth Development and Family and Consumer Sciences
Scott Jennings, Fleet Services
Shanna Harwell, Utilities and Engineering Services
Sharon Loosman, Purchasing Department
Stephanie Pomeroy, Student Health Services
Steve Ratzlaff, Grounds Management
Sumayya Jones-Humienny, Capital Projects Management
Tilla Fearn, College of Natural Resources
Dr. Thomas Ruffy, Crop Science
Torsha Bhattacharya, Transportation
Tracy Dixon, University Sustainability Office
Tricia Leschinger, Landscape Construction Services

EXECUTIVE SUMMARY

Integrating sustainability into the framework of the university



J C Raulston Arboretum at NC State University

Sustainability continues to be an integral part of NC State University's mission of learning, discovery and engagement. NC State has made several large sustainability-related commitments including signing the American College and University Presidents Climate Commitment¹, declaring Leadership in Energy and Efficient Design (LEED)² Silver minimum buildings and becoming an EPA Energy Star³ partner.

To meet these commitments the university is implementing a campus wide sustainability program. The new program helps ensure a unified sustainability message, produces cohesive strategic and tactical plans of action, connects the focus areas of sustainability and enables ongoing accountability toward a sustainable campus and culture.

Part of the new sustainability program structure includes a reformation of the Campus Environmental Sustainability Team (CEST)⁴. CEST has been the driving force for

sustainability initiatives on campus since 2002. The group is now an Administrative Advisory Committee whose members are appointed and represent various campus stakeholders. CEST is chaired by the Co-Sustainability Officers for the university- Jack Colby, Assistant Vice Chancellor for Facilities Operations and Bill Winner, Professor and Coordinator of Environmental Science and Natural Resource Programs. Along with having balanced leadership for the group, the new framework also creates the opportunity for sustainability decisions and policies to be accepted and supported by university leadership.

CEST includes seven voluntary working groups based on the following focus areas: Academics & Research, Buildings, Energy & Water, Land Use, Materials & Purchasing, Transportation, Waste Reduction & Recycling. The working groups provide a framework for which any person (student, staff or faculty) can participate in sustainability decisions and initiatives on campus. The flow chart to the right illustrates

the roles and decision making process for sustainability moving forward.

CEST is tasked with creating a sustainability strategic plan for the campus which will help guide decision making and policies as well as integrate sustainability into the framework of the university. Additionally, CEST will assist with the creation and implementation of the campus' Climate Action Plan, which will provide strategies for how the university will work towards climate neutrality. These projects will both utilize the working groups as an avenue for incorporating campus community involvement and input.

Along with the above efforts to over the past year, the University Sustainability Office⁵ has added two new full-time positions and one part-time intern position. David Dean joined the Sustainability Office in October 2008 as the Sustainability Outreach Coordinator to organize communications, marketing, educational events and outreach for campus. Lindsay Batchelor joined the office in January 2009 as the Sustainability Program Coordinator. In this role she works with campus partners to develop new sustainability initiatives. Mande Swisher, a senior in Parks, Recreation and Tourism joined the office in October 2008 as a student intern. Tracy Dixon, the Director of the Sustainability Office was hired in April of 2008, marking the creation of the office.

The programs and projects highlighted in this report represent the diversity and depth of sustainability efforts on campus. The students, staff and faculty at NC State are not only teaching, researching and learning about sustainability but modeling the practices as well. Though progress has been made, the efforts needed by the university are far from complete. In the face of challenging economic, environmental and social issues, NC State has a unique opportunity to be a part of the innovative solutions necessary to make a significant, positive impact through sustainability.

Campus Sustainability Program



Working towards making sustainability part of the educational experience



NC State and University of Georgia students learn about cacao production from local producer and sustainable food systems in Costa Rica

STUDENTS GAIN GLOBAL PERSPECTIVE ON SUSTAINABLE FOOD SYSTEMS IN COSTA RICA

For the third consecutive year NC State students participated in the Sustainability of Tropical Agroecosystems study abroad course in Costa Rica. The course is corroboratively taught by Dr. Michelle Schroeder-Moreno (NC State) and Dr. Wayne Parrot (University of Georgia) and brings students from various backgrounds, majors and institutions together. In summer 2008, the course was opened up to partner institutions and included students from NC State, Michigan State University and California Polytechnic State University, San Luis Obispo.

NEW COURSE - WOOD AS A SUSTAINABLE MATERIAL

A new interdisciplinary course on Wood as a Sustainability Material will be taught by Dr. Sudipta Dasmohapatra in the Department of Wood and Paper Science⁶ in the fall of 2009. This course introduces the concept of sustainability through the utilization of wood especially in design construction and renewable energy. In combination with tours of historical homes and green buildings, the students will get the opportunity to work with Habitat for Humanity⁷ on projects related to deconstruction of homes, construction and value-added manufacturing. Broad learning goals and objectives include:

1. Understand a broad perspective of sustainability and green principles focused on wood utilization (e.g. in housing, energy, composite products)
2. Learn the concepts of "Life Cycle Analysis", "Product Certification" and "Green Building"
3. Develop a broad perspective of local and global sustainability and related environmental trends

SUSTAINABLE AGRICULTURE INTERNSHIP AND FARM APPRENTICESHIP PROGRAM

Students from across the nation and the world have participated in the Center for Environmental Farming Systems (CEFS)⁸ educational opportunities. In 2008, CEFS offered the eight-week Sustainable Agriculture Research Internship Program focusing on a hands-on, research-based approach to learning for the eighth year. The dedication and expertise of participating NC State University and North Carolina Agricultural and Technical State University professors, farmers and extension agents ensures that interns are able to obtain a firm understanding of and appreciation for the broad challenges, constraints and benefits of sustainable agriculture. Through the CEFS Farm Apprenticeship Program individuals learn how to manage a small-scale diversified agriculture production system while working on the Small Farm Unit at the Research and Outreach Center for Sustainable Agriculture in Goldsboro, NC. Apprentices also work to develop and implement agriculture literacy and community-enhancing programs to benefit rural families. The apprenticeship program is designed around the March–October growing season.

ENGLISH 332 - FOCUS ON SUSTAINABILITY

The Communication for Business and Management class guides students through the conventions of professional rhetorical contexts in industrial, governmental and applied research environments. On an assignment to recommend campus or community improvements this spring, 15 of 66 students in Professor Janet Hudson's course proposed environmental topics. A student team worked with the University Sustainability Office (USO) to develop a survey, which the team then designed and distributed to the campus community. Results provided metrics on the impact of Society, Economy, Environment NC State (S.E.E. NC State)⁹ events and marketing efforts, along with overall student interest in sustainability. Another team studied feasibility of implementing a citywide recycling program for Mt. Holly's mayor. They analyzed programs in regional cities and obtained key information from NC State Waste Reduction and Recycling¹⁰ on waste diversion principles, landfill bans, grants, and recycled material markets. Projects also included marketing plans for increasing student response to the campus waste audit results and Pack N Go move-out collection. A team studying service interests found that 90% of their survey respondents indicated some degree of interest in volunteering and 60% indicated environmental efforts as their top choice for service work.

NEW FACULTY HIRE - DR. JOSEPH DECAROLIS

Dr. DeCarolis was hired in August 2008 as an Assistant Professor in the Department of Civil, Construction and Environmental Engineering¹¹. Dr. DeCarolis works on global energy issues at the intersection of engineering, economics, and public policy. The goal of his research is to promote long-term sustainability by conducting interdisciplinary, problem-driven analysis of energy technologies and systems. He is particularly interested in developing robust decision-making strategies for climate mitigation by conducting analysis with technology-rich energy system optimization models. In collaboration with others around campus, Dr. DeCarolis is also pursuing research funding on a variety of topics, including the potential effects of climate policy on solid waste management, the impact of plug-in hybrid vehicle deployment on the larger energy system, design aspects of space-based solar power, and the integration of recorded renewable energy data in classroom activities. With regard

to teaching, Dr. DeCarolis has developed a new course called Energy and Climate, which provides an overview of the global energy system, outlines the causes of climate change and examines technologies that promote effective climate change mitigation. In his spare time, Dr. DeCarolis has helped to develop a website called Home Energy Web¹², which allows people to share information, experiences, and ideas on how to make existing homes greener and more efficient.

Interdisciplinary Environmental Sustainability Course

A new course, Environmental Sustainability, was offered for the first time in 2008, attracting nearly 20 undergraduate and graduate students. The course, offered again in fall 2009, explores environmental sustainability from a range of perspectives. Concepts of environmental sustainability are discussed in terms of energy and biogeochemical cycles. Sustainable development is discussed as "people meeting their current needs without compromising the ability of future generations to meet their needs." The course is interdisciplinary, open to students from all colleges, and focused on five themes:

1. Natural Resources (agriculture, forestry, water, soil and air)
2. Energy (biofuels, nuclear power, alternative sources and conservation)
3. Sustainable NC State (sustainable energy and water)
4. Policy and economics (business, politics, sociology and law)
5. Issues of scale (regional – global, immediate – centuries)

To ensure integration of thinking across the focal areas, students attended lectures and developed interdisciplinary team projects. Examples of team projects included:

1. Parks and sustainable urban growth in Raleigh,
2. The sustainability of local food production and transport
3. Catching the wind at NC State: wind power resources for campus

Driving innovation in energy and environment

NANOTECHNOLOGY ENERGY LABORATORY CREATED

The Nanotechnology Energy Laboratory, created in July 2008 with a grant from the US Department of Energy, offers processing and materials characterization support for renewable energy technologies at NC State. The lab is a part of the NC State Nanotech Initiative¹³ which is a multi-disciplinary effort to promote nanotechnology research, education and outreach on campus and throughout the community. Located in Engineering Building I on Centennial Campus, the lab is a multi-departmental effort to (1) develop a new Photovoltaics Process and Analysis Facility cluster at NC State and (2) build research teams focusing on new inorganic and organic nanostructured surfaces and interfaces designed to exploit principles of light-harvesting and directed energy transduction. The new, specialized equipment for the lab includes an FEI Phenom scanning electron microscope, Newport solar simulator, various spectrophotometers and optical and atomic force imaging equipment.

FREEDM SYSTEMS CENTER: DEVELOPING TECHNOLOGY TO REVOLUTIONIZE THE POWER GRID

The Future Renewable Electric Energy Delivery and Management (FREEDM)¹⁴ Systems Center, headquartered on NC State's Centennial Campus, is one of the latest Gen-III Engineering Research Centers (ERC) established by the National Science Foundation (NSF) in 2008. The FREEDM Systems Center partners with universities, industry and national laboratories in 28 states and nine countries to develop technology to revolutionize the nation's power grid and speed renewable electric-energy technologies into every home and business. The center is supported by an initial five-year, \$18.5 million grant from NSF with an additional \$10 million in institutional support and industry membership fees. A large number of utility companies, electrical equipment manufacturers, alternative energy start-ups and other established and emerging firms are part of this global partnership. The vision for FREEDM Systems ERC is an efficient electric power grid integrating highly distributed and scalable alternative generating sources and storage with existing power systems to facilitate a green



Chemical and Biomolecular Engineering student researches solar cells in the Nano Energy Lab

and sustainable energy based society, mitigate the growing energy crisis and reducing the impact of carbon emissions on the environment. The FREEDM Systems Center will train a pipeline of future engineers to meet the increasing demand for green power alternatives through offering a continuum of diverse educational programs that begin at middle school level and continue through to Ph.D. level.

Research Projects Address Global Challenges

NC State's Office of Research and Graduate Studies (RGS)¹⁵ showcases numerous innovations that address local and global sustainability challenges and explore opportunities for accelerating human development towards more conscious living. Within RGS, sustainability is a core research topic generating a growing body of strategic research and "better world products." The Office of Technology Transfer, a division of RGS, manages the protection of these innovative discoveries and works with industry partners to get NC State's technology breakthroughs into the market where they can make a difference in sustaining our future. The following four projects represent RGS innovations.

FRESHER PRODUCE. GLOBALLY.

NC State researchers from the College of Agriculture and Life Sciences¹⁶ discovered the secret to keep fruits and vegetables juicy, crisp and harvest-quality-fresh during the trip to the marketplace and during storage. They uncovered how the ripening process can be managed so that fresh produce stays fresh. The secret is referred to in the research community as 1-MCP (1-methylcyclopropene). The patented technology describes a method of regulating the ripening process of fruits and vegetables and lengthening the shelf life of produce. Rohm and Hass Company recognized the commercial potential of NC State's discovery and worked with the Office of Technology Transfer to license the technology. Rohm and Hass formed AgroFresh to develop its product platform. Based on this successful union, AgroFresh developed a product called SmartFresh® to revolutionize the fresh produce industry.

ENERGY FROM WOOD CHIPS IS A CLEANER CAROLINA COAL

Combustion of coal produces pollutants such as sulfur dioxide (SO₂), nitrogen oxide (NO_x), particulate matter and carbon monoxide. The Clean Air Act Amendments of 1990 instituted a cap and trade program that require power plants to meet certain targets for SO₂ and NO_x emissions. Patent-pending research from the College of Natural Resources is looking to lighten that burden by creating energy from wood chips. NC State researchers have engineered a proprietary machine called a "torrefier" that turns biomass into "CarolinaCoal." There are no current torrefaction technology implementations that are field portable and self-heated; NC State's invention is both. Significant advantages of NC State's invention are 1) the mobility of the process which lends itself to field based operations (reducing transportation costs) and; 2) the machine is largely self-powered producing a large energy return. Wood chips go into a large funnel at the top of the machine and come out as hard, dry, black "energy pellets" at the bottom. In the process, the wood chips are physically and chemically altered – through heat and pressure – to make them denser, drier and easier to crush. The pellets are lighter than wood chips but retain 90 percent of their original energy content. That makes them an ideal feedstock for electric power plants that traditionally use coal to generate energy for businesses and residential neighborhoods.

CLEAN ENERGY FROM HYDROGEN-PRODUCING BACTERIA

A new green technology developed cooperatively by scientists from NC State and the Agricultural Research Service (ARS) shows promise as a renewable energy resource. The technology describes the production of hydrogen from nitrogen-fixing bacteria. Renewable sources of energy, such as hydrogen, that don't produce greenhouse gases are needed to solve global energy shortages. The invention explores hydrogen produced by nitrogen-fixing bacteria for use in fuel cell technology. Unlike batteries, fuel cell devices combine hydrogen and oxygen to produce electricity and water, and are considered efficient, quiet and pollution-free. Fuel cells are now being tested in a range of products including automobiles that release no emissions other than water vapor. NC State microbiologists Jonathan Olson and José Bruno-Bárcena, and ARS inventors Paul Bishop and Telisa Loveless developed the patent-pending technology. The researchers developed a way to identify strains of these bacteria that produce hydrogen gas. The hydrogen produced can be captured and used as a fuel whose by-product is water and heat.

AFFORDABLE BIOFUEL PRODUCTION

Ethanol is gaining in popularity as an alternative fuel and is currently primarily made from the starch field corn in kernels. However, the use of corn as a starting material for ethanol production has triggered higher prices for corn, resulting in severe food shortages around the world. Enhanced ability to breakdown and process low cost, sustainable, and renewable woody plants and trees would provide a great opportunity for the commercial production of ethanol. NC State professor Dimitris S. Argyropoulos has developed a novel technique that will overcome the pretreatment hurdle in biological hydrolysis of lignocellulosic biomass. This is anticipated to significantly reduce feedstock degradation, as well as the amount of enzyme needed, resulting in decreased cost. The success of this invention will bring invaluable economic and societal benefits while significantly reducing the overall costs of biofuel production from biomass.



Rendering of the Eastern 4H Environmental Education Center showing the rain garden

FIRST LEED PROJECT: THE EASTERN 4H ENVIRONMENTAL EDUCATION CONFERENCE CENTER

The Eastern Environmental Education Conference Center will be NC State's first Leadership in Energy and Environmental Design (LEED)² certified new building. Construction began in August 2009 and is set for an April 2010 completion. The new 19,700 square foot building is adding program space for campers including: a gymnasium, dining hall, three classrooms and an administrative office. The LEED Silver design includes the use of recycled content products, such as denim wall insulation, acoustical panel ceilings, ceramic tile and tilt-up concrete exterior panels. Other credits are being sought for using products made from rapidly renewable resources such as bamboo for the gym flooring. The design also includes a lighting control system, building commissioning, a rain garden for on-site storm water management, increased building ventilation, "low e" exterior glazing, low VOC sealants and paints, local and regional

materials and the requirement that wood meets Forest Stewardship Council certification requirements. Another design approach is to utilize a closed loop ground source heat pump system to reduce the energy consumption of the HVAC system.

FIFTEEN FACILITIES STAFF EARN LEED AP CREDENTIAL

Supporting NC State's commitment to make all new buildings and major renovations certified at the Silver level under the US Green Building Council's LEED program, Assistant Vice Chancellor for Facilities Kevin MacNaughton, provided funding for on-campus LEED training. Additional opportunities were provided for professional staff to earn the LEED Accredited Professional (AP) designation. The LEED AP credential distinguishes building professionals that have a thorough knowledge of green building practices and the LEED rating system.

15 individuals became LEED AP by passing the LEED exam. Congratulations to our new LEED AP staff: Lisa Maune, Lynn Swank and Willy Yamamoto of Design and

Construction Services as well as Carole Acquesta, Carolyn Axtman, Steve Bostian, Eric Jaskolka, Sumayya Jones-Humienny, Damian Lallathin, Rudy Lopez, Charlie Marshall, Rachel Miller, Ken Pearce, Cameron Smith and Jake Terrell of Capital Projects Management. Congratulations are also due to Joanna Browne of Capital Project Management and Angkana Bode of Design and Construction Services, who passed the exam in 2002 and 2005 respectively.

FREEDM CENTER HEADQUARTERS WILL BE A DEMONSTRATION SITE

As part of the 2008 National Science Foundation (NSF)¹⁷ grant the Future Renewable Electric Energy Delivery and Management (FREEDM)¹⁴ Systems Center headquarters will be housed in a building that demonstrates developing technologies. The new 20,000-square-foot FREEDM Engineering Research Center (ERC) headquarters will open on NC State's Centennial Campus in 2010. The center's new home will include ERC offices, computer laboratory, library, and power electronics, energy storage, and motor drive laboratories, as well as a Real Time Digital Simulator lab and the 1MW FREEDM System demonstration hub. The lab will not only demonstrate the center's developed technologies, it will also be used to showcase the third party renewable energy technologies, such as solar, wind, fuel cell, battery storage, flywheel storage and plug-in vehicles. The facility will demonstrate the plug-and-play feature of the FREEDM system while at the same time be powered with green energy. Once established, center industry partners will be allowed to use this state-of-the-art facility to conduct other research experiments related to future smart grid, smart home and distributed generations.

REPAIR & RENOVATION TRIMS THE WASTE

The Repair & Renovation (R&R) group within Facilities Operations uses the motto of "If I wouldn't accept this work at my home, I won't accept it here." They demand the best from themselves and everyone involved. This drive for excellence results in high quality construction projects and is apparent in their sustainability initiatives. This past year R&R diverted approximately 75% of their construction and demolition waste from the landfill through reuse and recycling. Other waste minimization efforts involved: refinishing rather than replacing laboratory cabinets, replacing existing lights with more efficient and fewer lights while maintaining light levels, implementing a wall protection program resulting in less

frequent painting of high traffic areas, using post-consumer recycled (and recyclable) carpet, recycling ceiling tiles and carpooling as a team to job sites. Researching other sustainable best practices is a passion that extends beyond work hours.

The Terry Center Utilizes Sustainable Design

The Randall B. Terry, Jr. Companion Animal Veterinary Medical Center¹⁸ is scheduled for completion in late 2010 and has utilized sustainable design, green architecture and recycling in its physical planning and development. This project will achieve LEED certification at a minimum. A few of the sustainable features include:

- A high degree of recycled content was incorporated into the design
- Use of recycled materials during construction and recycling of excess materials during construction
- Use of materials that are very low maintenance over the life of the building
- Daylight is used to provide a deterrent to bacterial growth and transmission of disease
- Recycling stations are placed throughout the facility to promote reduction of waste
- Use of natural and locally produced materials in the design of the building
- Lighting systems will provide cost effective energy savings and lighting fixtures and/or controls have been selected to exceed minimum efficiency requirements by 10%, or greater
- High efficiency HVAC equipment has been utilized that will provide cost effective energy savings exceeding minimum efficiency requirements by 15%, or greater
- Reduced the amount of impervious surface associated with parking
- Implementing an innovative approach to surface runoff in the client parking area which improves the quality of the water introduced back into the watershed
- Creation of a new gathering space connected to the campus path system

Creating a culture of sustainability through outreach



Farmer's Market debut at the 2009 Earth Day celebration on the brickyard

GREENTREE INITIATIVE LAUNCHED

Esprit de Coeur group of the Pathways Leadership Program launched the GreenTree Initiative¹⁹ on Earth Day 2009. The inaugural award was in memory of Facilities supervisor Joe Hoeve. The GreenTree Initiative is a quarterly award presented to a student, faculty or staff member who has developed a small scale project providing cost-savings, or is budget-friendly, to benefit the campus community and promote a more sustainable future. Award winners are recognized with a profile on the Sustainability Office website, a 'goodie' bag of small gifts and a plaque with their name engraved. Once a year a ceremonial tree planting will be held in the quarterly winners' honor.

STUDENTS START FARMER'S MARKET

Students from the Sustainability Commission of Student Government launched the NC State Farmer's Market on Earth Day 2009. Vendors from the Raleigh Farmer's Market, located near NC State's Centennial Campus, joined others from Durham and Chapel Hill on the Brickyard to sell local produce, seafood and a number of handmade items. The intent of the market was not only to provide access to fresh, local items but to educate the community on the importance of supporting local agriculture. The vision for the project is to eventually hold a weekly market on campus.

NC STATE'S OWN HOWLING COW DAIRY PRODUCTS

University Dining²⁰ serves milk and ice cream in the dining halls that is processed at NC State's dairy under the new name: Howling Cow. Using fresh milk from the local NC State research farms, the on-campus dairy plant processes the milk and delivers whole, skim and chocolate milk as well as, ice cream to University Dining locations. As an added treat, hand-dipped Howling Cow ice cream is also served at the Emporium C-Store in Talley Student Center and the Creamery located at D.H. Hill library.

STUDENTS PASS SUSTAINABILITY BILL

The Campus Sustainability Continuous Improvement Act²¹ passed the Student Government Senate with full consent in March 2009. The bill, the first of its kind for campus, was sponsored by Senators Herting, Webb, Varner, Crabtree, Clark, Robinson and Demanovich and calls for a commitment to sustainability on campus. The bill is comprised of seven actions which encourage support and development of sustainability initiatives.

SAVING MONEY THROUGH THE E-CONSERVATION PROGRAM

The E-Conservation Program reaches and teaches consumers to be proactive in reducing their home energy consumption and in saving money through no-and low-cost energy efficiency measures, behavioral changes and home retrofits. Funded by the State Energy Office²² and implemented by Cooperative Extension²³, the E-Conservation program employs a variety of educational methods to reach audiences across the state including workshops, media outreach, real time learning modules and

websites.²⁴ The program also utilizes a limited number of subsidized home energy audits consisting of a blower door test, an inspection of all-mechanical, heating and ventilation systems and a walk through home appliance inspection.

ARBOR DAY CELEBRATION ENGAGES COMMUNITY

On March 21, 2009, NC State's Department of Forestry and Environmental Resources²⁵ celebrated North Carolina's Arbor Day²⁶ with the public at an open house. The day featured a dozen exhibitors, outdoor demonstrations, tours and informational sessions about undergraduate and graduate programs. In cooperation with the Triangle Chapter of the Society of American Foresters²⁷ and the NC Division of Forest Resources' Urban and Community Forestry program, the event included giving away 2000 tree seedlings and the presentation of the award for the 2009 Arbor Day Poster Contest. The event was coordinated by Renee Strnad of Environmental Education, NC State Extension Forestry.

STUDENT HEALTH SERVICES FOCUSES ON SUSTAINABILITY

Last year, NC State Student Health Services (SHS)²⁸ added a new focus to their service to the college community: incorporating the concept of sustainability in the workplace. Recycling efforts are paramount at SHS. Recycling bins have been strategically placed throughout the building to maximize convenience for staff and patients. Many departments have put forth significant efforts to go green. While the pharmacy staff has been recycling plastics since 2000, they recently added all paper and paperboard to the mix. They are generating 75 percent less trash on a daily basis compared to just one year ago and were featured on a WRAL TV segment in February 2009 for their sustainability efforts. The Medical Records department is using MyFax, which allows them to receive paperless faxes and import the data directly into a patient's electronic medical record. An electronic medical records (EMR) system was also implemented with great success. By maximizing the functionality of the system, the hope is to be paperless in the next few years. E-prescribing is one of the upcoming enhancements to the EMR system. This will eliminate many of the paper prescriptions currently being printed out in our medical clinics. With education for the staff and the convenience of recycling bins they have been able to successfully launch a recycling program that benefits the environment and the budget. Additionally,

SHS is planning a building addition and renovation to start in Spring 2010. Many green considerations are planned, budget permitting, and the building is on track to obtain LEED silver certification.

S.E.E. NC STATE COORDINATES SPRING EVENTS

In order to better encapsulate the breadth of sustainable-minded activities occurring on campus throughout the year, the planning team for Earth Day voted to launch Society, Economy, Environment (S.E.E.)⁹ NC State in order to have one over-arching title for all of these events. S.E.E. NC State helps provide a single resource for the campus and community regarding sustainability events. Additionally, the program helps to educate event attendees that sustainability focuses on the not only the environment but also impacts on society and the economy. Spring 2009 was the first semester of S.E.E. and it was a huge success. A logo design competition was held with the winning designer coming out of the College of Design. A web site was launched during the spring semester and a myriad of events were showcased on the site. The program will continue in 2010.

Release of Inaugural Greenhouse Gas Inventory

NC State University has taken a proactive step in addressing its impact on climate change by releasing its inaugural Greenhouse Gas (GHG)²⁹ Inventory for 2008. This Inventory serves as a benchmark of emissions associated with the main, Centennial and Centennial Biomedical campuses, as well as some satellite offices. The major sources of emissions include electricity, fuel use, refrigerants and commuting. Among peer institutions, the inventory found that NC State's emissions were comparable with some of the environmentally conscious East Coast schools and are in line with current trends. The inventory provides direction for reducing the university's impact on the environment. For example, NC State has proposed a combined heat and power plant that will help reduce GHG emissions. Another project underway is a performance contract that is designed to install energy conservation measures in 13 buildings across the NC State campus. This report is the first step in developing a Climate Action Plan (CAP) which will help guide the institution towards a sustainable future.

Promoting sustainability through the managed use of energy



Before



After

The Dan Allen Parking Deck LED lighting pilot project

UPGRADING LIGHTING FOR EFFICIENCY

The Office of Energy Management (OEM)³⁰ initiated lighting efficiency upgrades in Mann Hall, Bragaw Hall, the Main Vet School Building and the Dan Allen Parking Deck. The use of the following technologies was implemented:

- 25 watt T8 lamps replaced T12 fluorescent lamps in Mann Hall
- Low wattage T8 ballasts were installed in Mann Hall
- 277 Volt 27 watt CFL replaced 150 watt metal halide lamps in the Main Vet School Building
- LED lighting replaced fluorescent lighting in Bragaw Hall
- LED lighting replaced metal halide lighting in the Dan Allen parking deck

Facilities' Design and Construction Services and Building Maintenance and Operations (BM&O) have collaborated on a couple of projects to reduce the cost of operating the lighting in the common areas (hallways, cubicle areas, bathrooms) and the exterior lighting of the Administrative Services Building III. These projects have given the ability to schedule the amount of hours during the week that this lighting operates, thus reducing the annual cost associated with operating these lights by 41% which amounts to an annual savings of \$5,800.

RETROCOMMISSIONING CONSERVES ENERGY

With funding from the North Carolina State Energy Office²², Facilities utilized a consultant to assist BM&O in conducting a pilot study for retrocommissioning Partners III and Schaub Hall, both high energy consuming laboratory buildings. In Partners III, four labs and the HVAC system infrastructure were retrocommissioned which resulted in a 15% reduction of air flow requirements and improved system operations. In Schaub Hall, three labs and a lecture space were retrocommissioned which led to lower air change rates. The total estimated savings from the pilot project is \$12,000 per year. The next phase of the project will encompass a much larger percentage of the building spaces with the expectation of proportional energy savings on a larger scale. The BM&O department also completed a retrocommissioning project for the Robertson Wing of Biltmore Hall and the Student Health building. The Robertson project included replacement of the chilled water pump and installation of a variable frequency drive, calibration of all air flow sensors, temperature sensors and thermostats, as well as replacement of several non-operational hot water re-heat valves. The Student Health project entailed re-calibrating all of the temperature and flow sensors along with repairing all of the HVAC control valves. Additionally, technicians calibrated the variable air volume supply boxes and tested every thermostat. The aforementioned efforts resulted in a significant improvement to indoor air quality and customer satisfaction, as well as, reduction in energy consumption.

ENERGY COUNCIL CONTINUES

The NC State Energy Council³¹ continued working through 2008-09 to coordinate energy related activities on campus. While the council does not take credit for any specific activities, it does contribute large and small parts to many efforts. The council developed, in a joint effort with the NC State News Services, a web portal to all university academic, research and engagement programs related to energy. In addition, the Energy Council promoted the Year of Energy throughout the year and supported the Energy Fair presented on Earth Day 2009. The Energy Council produced and updated inventories of academic offerings and research in the field of energy, as well as the commitments from NC State about energy use on campus. In summary, academic activities with energy themes included events engaging all colleges with listings of more than 150 energy and energy related courses. A survey over the first six months of the 2008-09 academic year shows faculty members at NC State submitted 260 proposals requesting \$64 million. During the same period, 86 proposals were funded totaling \$19 million of support. The Energy Council is developing plans for increasing membership, scope and activity levels to reflect the increasing importance of energy as a vital component of becoming a more sustainable university.

13 Building Performance Contracts Save Money and Energy

NC State is currently in the Investment Grade Audit phase of a Performance Contract. Performance Contracting is a process in which the cost to implement energy conservation measures is paid for via the dollars saved from the conservation of energy. A qualified contractor implements the energy conservation measures and guarantees the dollars to be saved. Thirteen buildings were selected to undergo this process based on their current energy usage and potential for savings: Cox, Poe, Tompkins, Caldwell, Winston, College of Textiles, McKimmon, Carmichael, Monteith Research Center, Monteith Parking Deck, Research I, Dabney, Structures Lab. Once the Investment Grade Audit is complete, NC State will select the energy conservation measures to be implemented. Implementation is currently planned to be a two year process.

EFFORTS FOR SB 668/SL 2007-546 UNDERWAY

BM&O has initiated efforts to inventory, upgrade and report status of compliance of existing buildings in accordance with requirements of Senate Bill 668/Session Law 2007-546. Initial efforts thus far include installing low-flow aerators in all faucets on campus, the installation of 420 LED Exit Signs and installation of several hundred compact fluorescent lights to replace incandescent bulbs in mechanical and electrical rooms.

INSTALLATION OF NEW ENERGY DATA MANAGEMENT EQUIPMENT

The addition of sixteen "state of the art" Nexus electrical meters this fiscal year is providing real-time monitoring of electrical demand and continuous tracking of energy use. The Nexus metering also supplies advanced tools for evaluation of building loads and contributing elements tied to building circuitry. As part of the ongoing mission of the Office of Energy Management, additional real-time metering is being added to the campus infrastructure whenever opportunities arise.

OFFICE OF ENERGY MANAGEMENT WORKS TOWARDS MISSION

The Office of Energy Management in Facilities Operations is charged with the responsibility to manage the energy and water resources purchased and consumed by NC State. The mission of the group includes maintaining a quality environment while reducing consumption and controlling costs. The mission is accomplished by creating a culture that is dedicated to achieving environmental sustainability by supporting conservation objectives and recognizing and eliminating waste. OEM recently created a Program Manager position to help the office achieve the goals of their mission. OEM also has a Strategic Energy and Water Plan that guides their activities in five focus areas:

- Energy Data Management
- Energy Supply Management
- Energy Use in Facilities
- Equipment Efficiencies
- Campus Integration

Planning towards a campus of neighborhoods and paths



Rocky Branch Restoration Phase III - Progress from steep walls to the new floodplain for the creek

ROCKY BRANCH RESTORATION- PHASE III IS UNDERWAY

NC State's highly degraded campus creek, Rocky Branch³², is being transformed into a healthy aquatic environment that serves as a sustainable outdoor living laboratory for teaching, extension and research. To date, 4500 feet of stream have been restored, three road crossing culverts have been replaced and upgraded, 4000 feet of greenway trail has been installed, riparian buffers have been enhanced and storm water controls have been installed in the watershed. Rocky Branch continues to serve as a keystone outdoor natural resource education feature for training and education of both students and professionals. Numerous tours and educational activities (water quality sampling and assessment) have occurred at the creek this year including K-12 school children in addition to, numerous college laboratory and class activities. The creek was also included as a tour stop for the Association for the Advancement of Sustainability in Higher Education's³³ annual conference.

The final phase of restoration broke ground this year. NC State and NC Sea Grant³⁴ were awarded an additional \$923,260 in supplemental funding for the project to cover

cost overruns including \$309,532 from NC Division of Water Resources, \$25,000 from the NC State Storm water Fund, \$378,614 from the NC Clean Water Management Trust Fund and \$210,114 from the City of Raleigh's storm water program. Subsequently, NC Sea Grant, NC State Facilities Department³⁵ and EarthTech worked together to initiate construction on the third and final phase of the Rocky Branch restoration and greenway project. The contractor began work in February 2009. Phase III will "daylight" 253 feet of buried stream behind NC State's Carmichael Gymnasium. The stream will be removed from culvert pipes and re-created with a streambed and a small floodplain. This unearthing will continue to help reduce nutrients and other pollutants from entering the waterway, as well as further increase visibility and public access to the creek.

W.K. KELLOGG ENDOWMENT SUPPORTS CEFS EFFORTS

In support of the Center for Environmental Farming Systems (CEFS)³⁶ and its efforts to build a sustainable, community-based food economy statewide, the W.K. Kellogg Foundation awarded a \$3.15 million endowment. CEFS is a partnership between NC State, North Carolina Agricultural and Technical State University, as well as the NC Department of Agriculture and Consumer Services³⁷. The dual endowment is the first of its kind in the University of North Carolina system³⁸.

The endowment will create two endowed chairs – one at NC State and one at NC A&T State University – and award \$1.575 million to each institution, as well as support CEFS efforts to increase production, processing, distribution and consumption of local, sustainably-raised foods in North Carolina.

MANAGING SEDIMENT EROSION AND CONTROL

In accordance with the requirements and conditions of the university's permit to discharge storm water under the National Pollutant Discharge Elimination System³⁹, the university requires all construction site operators to implement appropriate erosion and sediment control practices. The permit requirements that must be developed and implemented include, at a minimum, the following eight management measures:

1. Construction site erosion and sedimentation control for disturbing one or more acres
2. Sediment and erosion control plans (sites greater than one acre)
3. Construction site erosion and sedimentation control for disturbing less than one acre
4. Sediment and erosion control guidelines
5. Site evaluations by the Division of Land Quality
6. Public involvement
7. Records of inspections and corrective actions
8. Environmental Affairs staff members and university project managers shall obtain annual training

LANDSCAPE CONSTRUCTION SERVICES PERFORMS SUSTAINABLE PROJECTS

The Landscape Construction Services unit within Grounds Management is tasked with capital and non-capital landscape installations. The work this group performs has a large impact on the campus, and they are dedicated to performing and implementing sustainable initiatives. The following is a list of some of the projects that are helping to create a more environmentally responsible landscape:

- Working with contractors to ensure proper site transformation through a seeding process to establish erosion control
- Eliminating the use of synthetic fertilizers and implementing the use of organic fertilizers
- Planting whips and various seed mixes throughout campus Best Management Practices (BMP) and retention areas to re-establish and sustain wetland environments

- Renewing the various local BMP and storm water sites throughout campus
- Helping to impact all existing greenways by controlling the spread of invasive plant material and implementing non-invasive installations
- Working with Environmental Health and Safety (EHS) to ensure sediment remains contained on site through the use of non-invasive seed applications, therefore eliminating the use of any chemical control

Lonnie Poole Golf Course Serves As An Environmentally Friendly Research Site

Opened in summer 2009, the Lonnie Poole Golf Course⁴⁰ boasts environmental responsibility and research among its aims. This 18-hole, 7,358-yard, par 71, Arnold Palmer signature public course was designed not only as a golfer's destination but also as a research and teaching facility, which is fitting for a land-grant university. Prior to the course construction, much of the site was overrun by invasive plants. NC State faculty researchers are recreating a natural recreation area using native plants, establishing and improving wetland areas and maintaining vegetation buffers that protect water quality. Over 2,500 plants have been placed within the course and 95% are native to North Carolina. Projections are that these plant choices will reduce irrigation demand by 15%. Over 90% of the irrigation water for the course will be supplied by reclaimed (gray) water and the remainder from Lake Raleigh. Ongoing monitoring will ensure that pesticide and fertilizer runoff is minimal and does not harm adjacent streams. Faculty are designing studies that evaluate the use of natural, geographic-specific grasses that reduce the demand for irrigation and maintenance. Other research projects will investigate the efficacy of using turfgrass for carbon sequestration and cataloging and monitoring plant and wildlife biodiversity. The course is qualifying for Audubon Certification, a designation that reflects high level protection of the environment and preservation of golf's natural heritage. Construction of the course was made possible by financial and in-kind donations from NC State alumni and supporters. No public funds have been used for the project.

MATERIALS & PURCHASING

Making an impact through sustainable procurement

DEPARTMENTS COLLABORATE TO RECLAIM FURNITURE

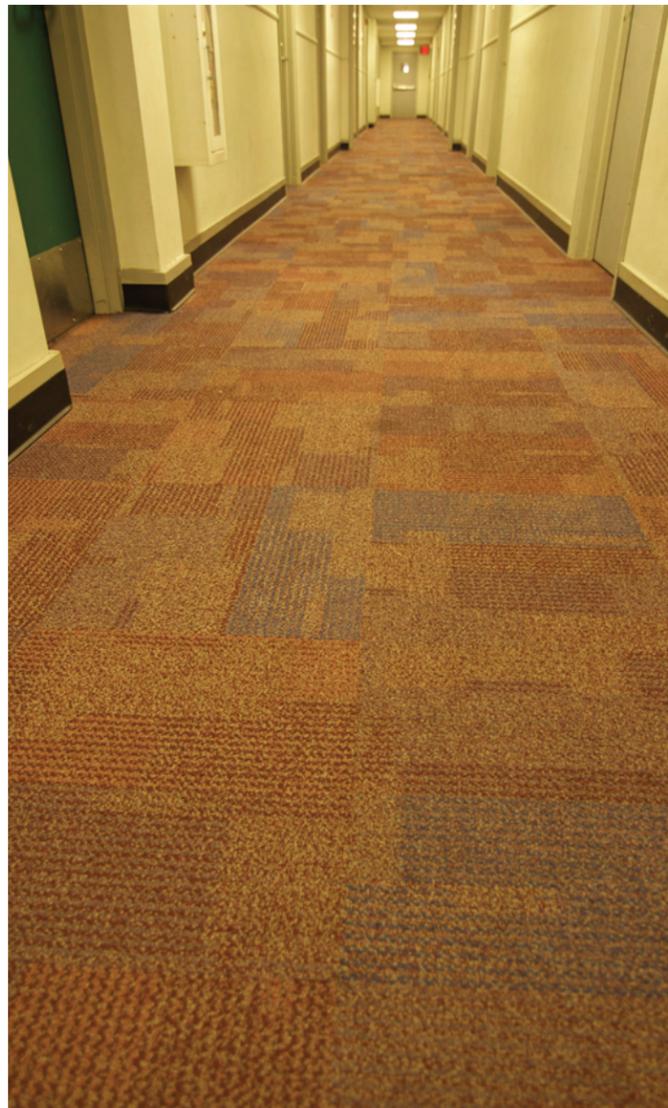
University Housing⁴¹ and Materials Support⁴² collaborated to surplus six buildings worth of residence hall furniture. Planning started in August 2008 for the bidding and move out process but due to construction demands the rooms had to be emptied five weeks after the end of classes. The furniture could have ended up in the landfill but effective planning by Jim Hansen, Assistant Director of Materials Support and Barry Olson, Assistant Director of Housing resulted in the diversion of the following:

- 538,000 total pounds of furniture
- 93,000 cubic feet of furniture
- 5400 pieces (beds, chest of drawers, desks, book carrels)
- Equivalent of 23 tractor trailer loads
- 18 different organizations took possession
- Thousands of labor hours saved
- Only 15 (badly damaged) desks went to the landfill

SAVING THE UNIVERSITY MONEY THROUGH ELECTRONIC TRANSACTIONS

In Fiscal year 08-09, the university conducted 11 million dollars in general supply purchases through the electronic purchasing portal called the MarketPlace. Electronic ordering and payment saves energy, time, paper and money. With over 500,000 electronic transactions, the MarketPlace order process saved the university close to \$1.5 million. Additionally, each of the suppliers selected for the MarketPlace have green initiatives of their own. By supporting these suppliers the university expands support for sustainability efforts beyond the campus. Some of the programs in place include:

- Distribution centers and offices equipped with automated control systems
- Enhanced recycling programs



Sustainable carpet tiles in the hallway of Tucker Residence Hall

- Energy efficient lighting
- Post consumer recycled material shipping containers
- Packing material is 100% recyclable
- Thousands of green products
- Active partners in the US Green Building Council
- Customer Specific Green Reporting to document progress towards green initiatives

University Housing Makes Sustainable Purchasing Commitment

University Housing has made a significant commitment to green purchasing. Utilizing methods such as life cycle cost analysis, they have been able to make the business case for investing in sustainable products and technologies.

- A significant number of LED lights were purchased and installed in campus residence halls. Current research on Bragaw Hall indicates a savings of roughly 63% on energy used for lighting.
- Purchased and installed low flow toilets in campus residence halls. Roughly 50% of all toilets were replaced which has resulted in nearly a 40% average water savings.
- Completely sustainable carpeting was installed in Tucker Hall. The carpet is 100% recyclable, and uses no glues, which means no chemicals and no odor.
- A project was completed which uses new and innovative floor tiling. 410 square feet of Bio-Based Tile (BBT) was installed in ES King Village. This tile is resilient, attractive and made primarily from ingredients such as corn.

SAVING PAPER THROUGH THE INTRA MAIL NETWORK

University Mail Services began utilizing a new program this year that reduces paper waste. The Intra Mail Network (IMN) is a company that helps commercial mailers properly sort and sequence mail sent to colleges and universities. The service works collaboratively with commercial mailers and the university to eliminate mailings to individuals who are no longer at the university and duplicate mailings. Therefore, less unwanted mail ends up on campus which lessens the amount of waste and/or material to be recycled. Additionally, the university receives a small rebate each quarter and the companies who utilize the service save money and resources by not printing or mailing the materials. During the third and fourth quarter of 2008, IMN reduced paper waste at NC State by 2,543 pounds.

UNIVERSITY HOUSEKEEPING FURTHERS GREEN CLEANING EFFORTS

Thanks to the initiative of University Housekeeping, NC State is leading the way in green cleaning⁴³. Housekeeping staff undergo regular training to ensure continuous delivery of a clean, healthy environment for building occupants. When compared to other universities, NC State has undertaken a comprehensive approach to green cleaning that includes:

- Saving energy & water
- Improving indoor air quality
- Furthering recycling efforts
- Increasing occupant productivity
- Purchasing environmentally-friendly products

The housekeeping staff engage in practices such as: HEPA filtration vacuum system, energy efficient light bulbs, GreenSeal cleaning products, lights out walk throughs, microfiber mops, recycled content paper products and catch and release pest control.



Touch free cleaning machine provides a more effective, efficient and hygienic system for the campus

Progressing towards a 20% increase in Wolftrails participants every year



The NC Future Fuels team consists of Bill Knight, an electrical engineer, BJ Ward, a chemical engineer, Andrew Canton, a chemical engineer, Jessica Kitzmiller, an environmental scientist, and Andrew Phelps, an electrical engineer

NC FUTURE FUELS PROJECT CREATES EFFICIENT BIODIESEL PRODUCTION

NC Future Fuels is a biodiesel reactor project started as a part of a senior design project for the Engineering Entrepreneurs Program (EEP)⁴⁴. After conducting research, the team set out to design a prototype biodiesel reactor that could convert high free fatty acid (FFA) waste grease, or brown grease, into biodiesel. The business model is based off waste grease being too high in FFA content for normal biodiesel producers to process. Currently, there is no market for brown grease even though large quantities are available for free. Virgin oils and low FFA grease, or yellow grease, can cost over \$2 a gallon. This has resulted in biodiesel costing up to \$3.50 per gallon, much higher than the cost of regular diesel, which has also slowed public adoption of biodiesel. This process can create biodiesel for \$3 a gallon or less, being much more competitive with other biodiesel bands and closer to the price of petrol-diesel. The reactor is a continuous reactor, where brown grease is converted to biodiesel without having to resort to the time-consuming traditional batch reactor process. Lab testing was complete

in February of 2009 and the reactor prototype was finished in April of 2009. The project won first place in the Apollo business plan competition of the Entrepreneurship Games (E-Games)⁴⁵ and is currently competing in the Ignite Clean Energy business plan competition at the Massachusetts Institute of Technology. NC Future Fuels is working with a few serial entrepreneurs in moving along the business process and is in the process of getting the reactor out of the university through the Tech Transfer Process with hopes to eventually scale up the reactor.

WOLFLINE TRANSIT RIDERSHIP INCREASES

The annual NC State Wolfline⁴⁶ transit ridership continues to increase (2,027,568 in 2008-2009). As an incentive, the GoPass program allows current NC State students, staff and faculty to ride the Triangle Transit⁴⁷ and CAT buses for free with a free annual swipe card. This program is funded by NC State Transportation⁴⁸ with assistance from the NC Department of Transportation⁴⁹.

Advanced Transportation Energy Center Created

Advanced Transportation Energy Center (ATEC)⁵⁰ was formed in 2008 to develop advanced electric drive system technology, grid interface systems for Plug-in Hybrid Electric Vehicles (PHEVs) and to work with other automotive researchers within the university to engage government and industry stakeholders to address the infrastructure, technology and regional issues in the electrification of the transportation sector. Soon after the founding of ATEC, the university was awarded a prestigious Engineering Research Center grant from the National Science Foundation (NSF)¹⁷ to establish the Future Renewable Electric Energy Delivery and Management (FREEDM)¹⁴ Systems Center to develop next generation grid technology. ATEC was brought into FREEDM to support development of grid connected vehicle technology and test hardware.

ATEC has been successful in its first year, making progress in several endeavors. Four research projects have been initiated and promising results have been published and presented at technical conferences. The Center has also reached out to the technical community and formed successful alliances with important stakeholders in the energy storage, vehicle testing and lightweight materials industries. Additionally, ATEC has teamed with companies and universities to compete for additional funding support from the Department of Energy, Advanced Research Projects-Energy, the state, and a heavy truck company.

WOLFTRAILS CONTINUES TO PROMOTE ALTERNATIVE TRANSPORTATION

The mission of NC State Transportation is to improve the quality of life for the community by providing seamless and sustainable transportation systems with excellent customer service. As a university, we encourage alternatives to single occupancy vehicles. Wolftrails⁵¹ is a program that is providing transportation alternatives for getting to, from and around NC State. The Wolftrails program provides incentives for carpooling, vanpooling, biking, walking and bussing. Persons registered with the Wolftrails program are also eligible for Emergency Ride Home Assistance⁵² provided by Triangle Transit.

E85 FUEL TANK INSTALLED ON CAMPUS

Through a NC State Fleet Services⁵³ and North Carolina Department of Environment and Natural Resources (DENR)⁵⁴ partnership, the university is now approved to dispense an 85% ethanol fuel which can be used in flex fuel, or alternative fuel vehicles. All alternative fuel vehicles that utilize the fuel station on Sullivan Drive will have their fuel keys reprogrammed to allow the purchase of the E85 fuel.



Newly installed E85 tank offers alternative fuel to campus

WASTE REDUCTION & RECYCLING

Recycling enough fiber per year to power Bagwell Residence Hall for 9.5 years

RAISING AWARENESS THROUGH EDUCATION AND OUTREACH

Waste Reduction and Recycling (WRR)¹⁰ hosts many events around campus throughout the year to raise recycling awareness. They also raise awareness through presentations to students and departments throughout the year. A few programs this year included:

- Waste Audit on Residence Hall Dumpsters - This event, also known as "Landfill on the Lawn", involves emptying a campus dumpster and separating out the material to educate students about the items that can be re-used or recycled. Approximately 25 students came out to separate the dumpsters from Lee Hall and Honors Village Commons. The results were that 60% of dumpster content could have been recycled or reused in Lee Residence Hall and 50% of dumpster waste in Honors Village.
- Material Reclamation Facility (MRF) Tour- WRR hosted a tour of the local recycling collections facility to educate the campus on the recycling process after the material leaves the campus. The tour provides a detailed look at how the different recycling commodities are separated and prepared for being remade into new products. Twenty faculty, staff, and students toured the local MRF.
- Web-based Education- WRR has developed and launched a new website to make WRR resources and information easy to access. This site also provides opportunities to get involved in programs and events. Additionally, the website is used to submit service requests for waste and recycling across campus. The NC State Recycles Facebook⁵⁵ page has been launched as a way to communicate with the public and campus on up-to-date recycling information and events.

WE RECYCLE PROGRAM EXPANDS

WE Recycle⁵⁶ is NC State's stadium tailgate recycling program. Started in 2003 as "Chuck It" Recycling, the program recycles nearly 40,000 pounds of beverage containers each season, making it one of the nation's most productive stadium recycling efforts. The program relies



Landfill on the Lawn volunteers sort trash from recyclables

on volunteers, engaging the tailgaters in the hours before the game to stress the importance of recycling to the whole NC State community. This program is a collaboration between WRR, Athletics⁵⁷, Wolfpack Sports Marketing⁵⁸ and Waste Industries. The recycling effort at Carter-Finley Stadium⁵⁹ reclaimed 45,620 pounds of beverage containers in the 2008 season. WE Recycle was expanded to Vaughn Towers, which connected more stadium attendees with access to recycling. Additionally, WE Recycle prevented the equivalent of 158,000 pounds of green house gas emissions in 2008.

Electronic Waste Recycling Events Involve the Community

Waste Reduction and Recycling (WRR) and University Surplus worked together to find an environmentally responsible recycler who also provides the total weight of recycled Electronic Waste (e-waste)⁶⁰. WRR worked to raise awareness around the importance of recycling e-waste with the campus and surrounding community by offering two e-waste recycling events. These events allowed the public to drop off their electronics at a designated location. The combined events recycled 17,077 pounds last year.

PACK-N-GO SALE REALIZES INCREASED DIVERSION

WRR and University Housing⁴¹ paired up to host the 4th Annual Pack N Go Sale⁶¹. At the end of the academic year, when students are moving out of the residence halls, campus waste is reduced by collecting unwanted items for re-use and recycling. Everything from clothes and room supplies to food and loft wood are collected from campus residents and sold with proceeds benefiting environmental education initiatives on campus. The event diverted 15,000 pounds of waste from going into the landfill, which raised nearly \$1500 for campus environmental education initiatives; a 41% increase over the previous year.

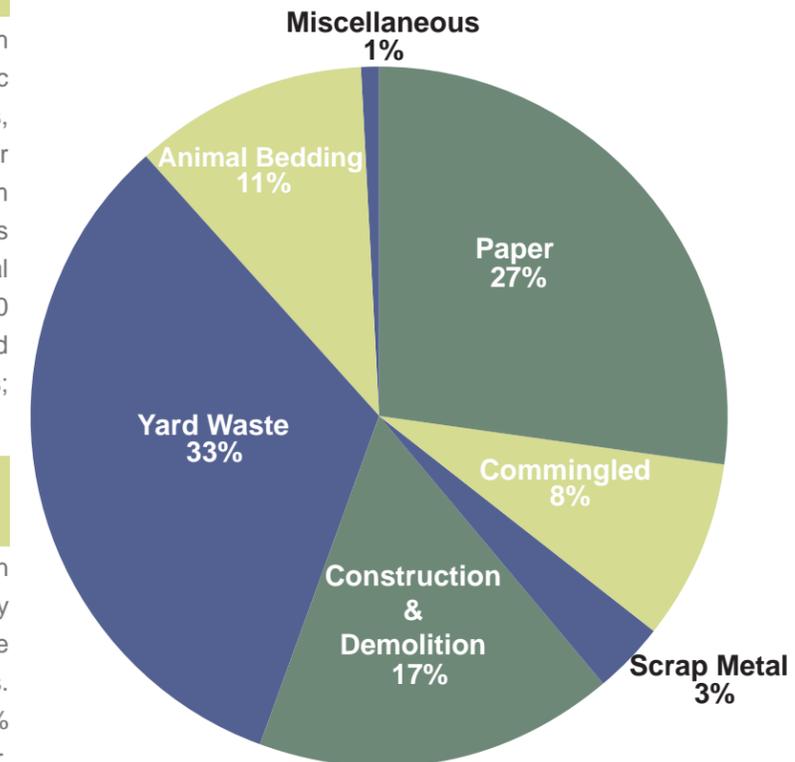
RECYCLEMANIA SPURS INCREASED BEVERAGE CONTAINER RECYCLING

RecycleMania⁶² is a 10-week long recycling competition among colleges and universities across the country designed to raise awareness about the importance of waste reduction. NC State ranked 23rd amongst 200 US Colleges. By the end of the competition, the university realized a 76% increase in beverage containers collected. New this year, WRR created an interactive RecycleMania dashboard⁶³ which details the competition comparison from the previous year.

AMERICA RECYCLES DAY ENGAGES THE PUBLIC

WRR held a recycling event in November for America Recycles Day⁶⁴, where students and the public could learn about recycling both on and off campus. WRR, the RE3⁶⁵ program of the North Carolina Department of Environment and Natural Resources' Division of Pollution Prevention and Environmental Assistance⁶⁶, City of Raleigh Recycling⁶⁷, Sonoco⁶⁸ and the University Sustainability Office collaborated to educate the public about recycling as a contribution towards a sustainable future. Creative Recycling and Iron Mountain sponsored the event by collecting e-waste and confidential materials to be shredded.

Tons Recycled 2008 - 2009



INCREASED DIVERSION SAVES UNIVERSITY MONEY

Since 2007-08 there has been a 24.8% increase in recycling and yard waste collection combined. In 2008-09, NC State diverted over 6 million pounds of recyclables from the waste stream which saved \$119,595 in landfill fees. As a result, \$111,339 of total revenue from sales of recyclable materials was realized. By recycling just under 2 million pounds of paper, NC State also saved over 6 million gallons of water.

COOKING OIL RECYCLED INTO BIODIESEL

Previously, University Dining²⁰ paid a company to collect and dispose of used cooking oil from the dining facilities. In 2008, the university began working with a local cooperative to collect oil waste on campus. The approximate 1000 gallons per month of used cooking oil collected is converted into biodiesel fuel. Not only is the oil being re-used, but it also is collected at no cost, saving NC State thousands of dollars each year.⁶⁹

Conserving water through diverse methods



Students conserving water through trayless dining

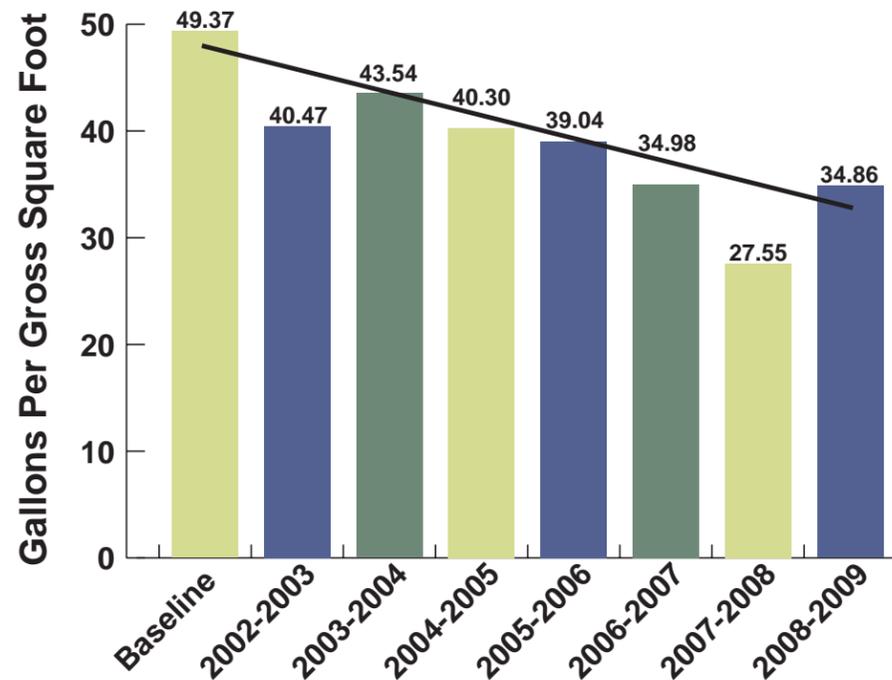
GOING TRAYLESS MAKES A LARGE IMPACT

While drought conditions in early 2008 prompted NC State to conserve water by removing trays from the three dining halls, University Dining²⁰ decided to make the change permanent. Since then, trayless dining has conserved an average of 51,000 gallons of water weekly. As an added bonus, food waste and energy usage are also down.

UNIVERSITY CONTINUES TO WORK TOWARDS REDUCING WATER CONSUMPTION

Although NC State saw an increase in water consumption last year, overall consumption has been reduced by 29.4% from the 2001-02 baseline as shown in the graph below. Water conservation practices were implemented and expanded in response to the severe drought and have been maintained into the first part of 2008-09. This is all due to improved irrigation control, operation of central chilled water plants, installation of water saving fixtures (i.e. showers, faucets, laundry machines, etc.) and changes in awareness and behaviors.

Water Use by Gross Square Foot



Condensate piping from Air Handling Unit at Flex Building

LOW FLOW FIXTURES AID IN WATER CONSERVATION EFFORTS

The Building Maintenance and Operations (BM&O) and the Repair and Renovation departments are in the process of replacing seventeen water fixtures in the men's and women's locker rooms at Carmichael Gym⁷⁰. The existing plumbing installation in the facility made this renovation more difficult due to the fixture wall mounting design (3-bolt) and unusual waste piping layout. Engineers in BM&O determined an acceptable retrofit solution and 1.6 gallon per flush toilets are being installed. Based on 10 flushes per day, 300 days per year, BM&O estimates a savings of over 100,000 gallons of water per year.

BM&O and the Repair and Renovation department are in the process of renovating four bathrooms in the College of Veterinary Medicine Building⁷¹. The renovation will include replacing 14 toilets and 8 urinals with low-flow fixtures. Based on 10 flushes per day, 300 days per year, estimated savings are over 60,000 gallons of water per year. Additionally, we are installing security lighting such that general lighting can be switched off when not in use, which will result in additional energy savings for the university.

Condensate Collection Reduces Water Consumption

The Building Maintenance and Operations department installed a piping system to collect the condensate from five 100% outside air rooftop air handling units at the Flex Lab Building. The condensate is collected and gravity drains to the cooling tower that removes heat from the building chilled water system. The project reduces water consumption by approximately 218,000 gallons of water per year.

IRRIGATION SYSTEMS IMPROVE ABILITY TO MONITOR WATER USE

The irrigation program at NC State continues to work towards water conservation. The Irrigation Manager for campus is a Certified Irrigation Auditor, the only one in all 16 University of North Carolina system schools. The program has continued to install central irrigation systems on Centennial Campus, which now totals 25 campus wide. The MAXICOM systems provide information for monitoring, show water usage and savings and allow adjustments to be made completely online. The systems save roughly 20% on water usage and 40% on labor.

EVENTS AND AWARDS



S.E.E. NC STATE EVENTS

Recyclemania, coordinated by Waste Reduction and Recycling, January-March 2009

The Big Event - Reynolds Coliseum (Men's basketball- NC State vs. UNC-CH), February 2009

Heart Health Week, sponsored by Student Health Services, February 2009

E-Waste Recycling Event, hosted by Waste Reduction and Recycling, March 2009

EnviroMovie Series- King Corn, The Greening of Southie, Flow, Blue Vinyl; sponsored by the Campus Cinema, March and April 2009

S.E.E. NC State Series Kickoff: Sustainability Overview, hosted by the Sustainability Office, March 2009

Sustainable Food Sampling and Cookbooks, hosted by the Wolfpack Environmental Student Association, April 2009

S.E.E. Webinar- Vermicomposting Presentation by Rhonda Sherman, April 2009

Making Business Work for People, Planet and Profit, hosted by Net Impact, April 2008

Lake Raleigh Clean Up, hosted by Campus Recreation and Centennial Campus, April 2009

Symposium on Biomass, hosted by the International Society of Tropical Foresters, April 2009

Planet Earth Celebration, hosted by Burt's Bees and the NC Museum of Natural Sciences, April 2009

Earth Feast, hosted by University Dining, April 2009

Earth Day on the Brickyard (including Friends of Library Book Sale, Energy Fair, CNR Plant Sale and Farmer's Market), April 2009

Art to Wear, hosted by the College of Textiles, April 2009

Earth Day Concert, hosted by the Sustainability Office and Campus Activities, April 2009

Science Olympiad, April 2009

Nano Days, hosted by the College of Education, April 2009

E-games, hosted by the Entrepreneurship Initiative, April 2009

Earthwise Awards, hosted by the Sustainability Office, April 2009

SPECIAL EVENTS

Materials Recovery Facility tour, hosted by Waste Reduction and Recycling, September 2008

America Recycles Day, hosted by Waste Reduction and Recycling, November 2008

North Carolina's Arbor Day, hosted by the College of Natural Resources, March 2009

Employee Appreciation Week, March 2009

8th Annual Fun Run & Fitness Walk, March 2009

Center for Environmental Farming Systems Spring Farm Festival, April 2009

Pack N Go Sale, hosted by Waste Reduction and Recycling and University Housing, May 2009

AWARDS

Bayer Crop Science Professor of Sustainable Development, presented to Dr. Tom Rufty, January 2009

Earthwise Awards, presented to Dr. H. Christopher Frey (faculty), Marcus Wade Fulghum (staff), Natalie Bunch (student) April 2009

Greentree Initiative, inaugural award presented to Joe Hoeve, April 2009

Go Triangle Commuter Award, presented to the Sustainability Office, June 2009

CONFERENCES & WORKSHOPS

Seminar and Panel Discussion: Jay Hakes, hosted by the Energy Council, August 2008

Green NC: Building for a Sustainable Future, hosted by the NC Solar Center, September 2008

Annual Sustainable Agriculture Lecture: Judy Wicks, hosted by the Center for Environmental Farming Systems, September 2008

Energy Symposium, hosted by the College of Humanities and Social Sciences, October 2008

Green Building III: Design & Implementation Strategies for Community Buildings, hosted by the Office of Professional Development, October 2008

Association for the Advancement of Sustainability in Higher Education (AASHE) Annual Conference, NC State as a host institution, November 2008

Seasons of Sustainable Agriculture Workshop Series, hosted by the Center for Environmental Farming Systems, February-November 2008

2008 Henry Darcy Distinguished Lecture Series: Dr. Michael Celia, hosted by the Department of Marine, Earth and Atmospheric Sciences, November 2008

Transportation Luncheon, hosted by the NC Solar Center

Stewards of the Future, hosted by the College of Agriculture and Life Sciences, January 2009

Green Engineering at NC State Presentations, hosted by the College of Engineering, February 2009

Institute for Emerging Issues Forum, February 2009

FREEDM Systems Center Annual Conference, May 2009

Electrifying Transportation Conference, hosted by the NC Solar Center, May 2009

Future Drive: Electric Vehicles & Sustainable Transportation Luncheon, hosted by the NC Solar Center, May 2009

Bottle Ban

Interdepartmental collaboration to educate and look for ways to minimize the contamination of bottles in the waste stream

Car & Bicycle Sharing

Exploring options for introducing carsharing and bikesharing programs on campus

Chemical Cellulose from Recycled Paper Products

Develop method for the production of chemical cellulose from recycled paper products

Climate Action Plan

Participatory process in which the university will set a target date for achieving climate neutrality and develop a plan for how to reach this goal

Community-based Food Systems

Development of a statewide action plan for building a local food economy for North Carolina

Completion of the Deskside recycling upgrade

Waste Reduction and Recycling and University Housekeeping to complete the remaining zones

English 332

Students will collaborate with USO and the Inter-Residence Council to produce a Green Living Guide for on-campus students

Green Information Technology (IT)

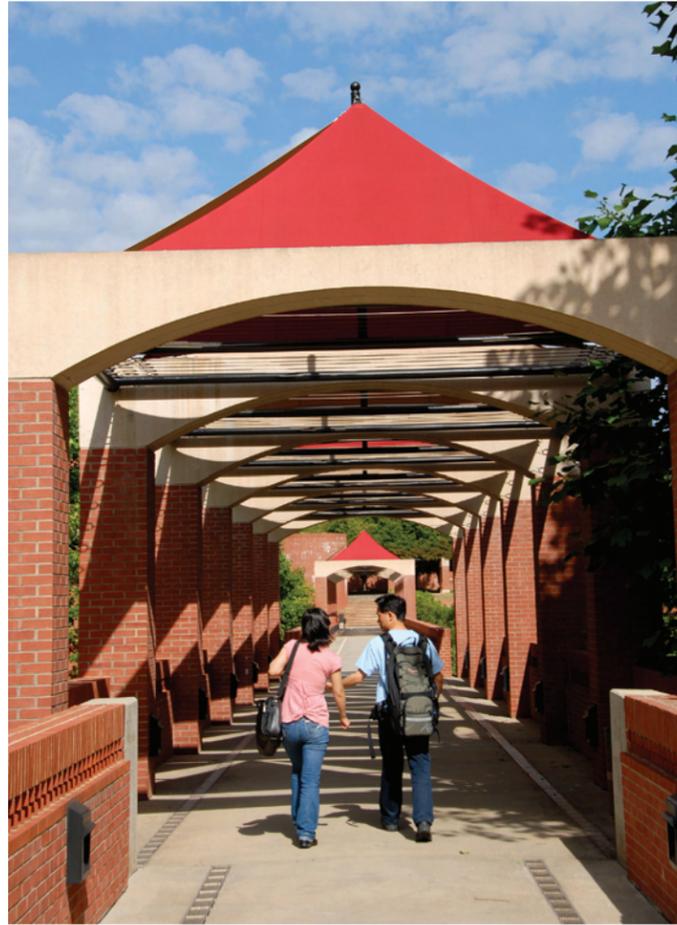
Laying the groundwork for improving sustainable IT practices

“Green” Organic Photovoltaics

Development of a technology that allows the creation of organic solar cells without the use of toxic or expensive organic solvent

Green Purchasing

Develop a process for more sustainable purchasing options on campus



Landscape Construction Services

Projects including Rocky Branch restoration, a green roof and Centennial Biomedical Campus native plantings

Recyclemania

The university will participate in the waste minimization category for the first time in the 2010 competition

Recycling Data Collection System

Provide the campus with a data collection system for all internal departments that use outside vendors for their recycling collections

Research Composting Program

Researching and discussing the options for a comprehensive composting program on campus

Sustainability Strategic Plan

Develop a strategic plan to help guide decision making and policies regarding sustainability on campus

Executive Summary

1. **American College and University Presidents Climate Commitment** - <http://www.presidentsclimatecommitment.org/>
2. **Leadership in Energy and Efficient Design (LEED)** - <http://www.usgbc.org/DisplayPage.aspx?CategoryID=19>
3. **EPA Energy Star** - <http://www.energystar.gov/>
4. **Campus Environmental Sustainability Team (CEST)** - <http://www.ncsu.edu/sustainability/cest.php>
5. **University Sustainability Office** – <http://www.ncsu.edu/sustainability>

Academics

6. **Department of Wood and Paper Science** - <http://cnr.ncsu.edu/wps/>
7. **Habitat for Humanity** - <http://www.habitat.org/>
8. **Sustainable Agriculture Internship (Center for Environmental Farming Systems)** - <http://www.cefs.ncsu.edu/>
9. **S.E.E. NC State** – <http://www.ncsu.edu/see>
10. **NC State Waste Reduction and Recycling** - <http://www.ncsu.edu/facilities/recycling>
11. **NC State Department of Civil, Construction and Environmental Engineering** - <http://www.ce.ncsu.edu/>
12. **Home Energy Web (HEW)** - <http://www.homeenergyweb.com/hew/>

Research

13. **NC State Nanotech Initiative** - www.ncsu.edu/nano
14. **Future Renewable Electric Energy Delivery and Management (FREEDM) Systems Center** - <http://www.freedm.ncsu.edu/>
15. **Research and Graduate Studies** - <http://www.ncsu.edu/research/research-grad-studies.php>
16. **College of Agriculture and Life Sciences** - <http://harvest.cals.ncsu.edu/indexmain.cfm>

Buildings

17. **National Science Foundation (NSF)** - <http://www.nsf.gov/>
18. **Randall B. Terry, Jr. Companion Animal Veterinary Medical Center** - <http://www.cvm.ncsu.edu/construction/>

Community and Culture

19. **Greentree Initiative**- <http://www.ncsu.edu/sustainability/greentree/index.php>
20. **University Dining**- <http://www.ncsudining.com/dining/sustainability.html>
21. **Campus Sustainability Continuous Improvement Act** - <http://students.ncsu.edu/sgims/archive-88/bill/campus-sustainability-continuous-improvement-act-1166.html>
22. **State Energy Office** - <http://www.energync.net/>
23. **NC State Cooperative Extension** - <http://www.ces.ncsu.edu/>
24. **Saving Money Through the E-Conservation Program** – (real time learning modules and websites) <http://www.e-conservation.net>
25. **NC State’s Department of Forestry and Environmental Resources** - <http://cnr.ncsu.edu/fer/>
26. **Arbor Day** - <http://www.ces.ncsu.edu/forestry/arborday.html>
27. **Triangle Chapter of the Society of American Foresters** - <http://www.apsaf.org/nc/index.php>
28. **Student Health** - http://ncsu.edu/student_health/index.html
29. **GHG Inventory** - www.ncsu.edu/sustainability/climate_impact

Energy

30. **Office of Energy Management** – <http://www.ncsu.edu/energy/2008/index.php>
31. **Energy Council**- <http://energy.ncsu.edu/>

Land Use

32. **Rocky Branch**- http://www.bae.ncsu.edu/programs/extension/wqg/srp/rocky_branch.html
33. **Association for the Advancement of Sustainability in Higher Education (AASHE)** - <http://www.aashe.org/>

LINKS

34. **NC Sea Grant** - <http://www.ncseagrant.org/>
35. **NC State Facilities Division** - <http://www.ncsu.edu/facilities/>
36. **Center for Environmental Farming Systems (CEFS)** - <http://www.cefs.ncsu.edu/>
37. **NC Department of Agriculture and Consumer Service** - <http://www.ncagr.gov/>
38. **University of North Carolina system** - <http://www.northcarolina.edu/>
39. **National Pollutant Discharge Elimination System** - <http://www.epa.gov/compliance/monitoring/programs/cwa/npdes.html>
40. **Lonnie Poole Golf Course**- <http://www.lonniepoolegolfcourse.com/>

Materials & Purchasing

41. **University Housing**- <http://www.ncsu.edu/housing/>
42. **Materials Support** - <http://www7.acs.ncsu.edu/materialsmgmt/materialssupport/subs/default.asp>
43. **Green Cleaning**- <http://www.ncsu.edu/sustainability/greencleaning.php>

Transportation

44. **NC State Engineering Entrepreneurs Program** - <http://www.engr.ncsu.edu/eep/>
45. **E-Games** - <http://www.ncsu.edu/ei/EI%20eGames/eGames.html>
46. **NC State Wolfline** - <http://www2.acs.ncsu.edu/trans/transportation/wolfline/index.html>
47. **Triangle Transit Authority** - <http://www.triangletransit.org/>
48. **NC State Transportation** - <http://www2.acs.ncsu.edu/trans/index.html>
49. **NC Department of Transportation** - <http://www.ncdot.org/>
50. **Advanced Transportation Energy Center** - <http://www.atec.ncsu.edu/>
51. **Wolftrails** - <http://www2.acs.ncsu.edu/trans/transportation/wolftrails/index.html>
52. **Emergency Ride Home Assistance** – <http://www2.acs.ncsu.edu/trans/transportation/wolftrails/emergencyRideHome.html>
53. **NC State Fleet Services** - <http://www.ncsu.edu/facilities/fac-ops/mp/contact.php>
54. **North Carolina Department of Environment and Natural Resources (DENR)** - <http://www.enr.state.nc.us/>

Waste Reduction & Recycling

55. **NC State Recycles Facebook** - <http://www.facebook.com/home.php?#/pages/Raleigh-NC/NC-State-Recycles/78141186268?ref=ts>
56. **WE Recycle 2008** - <http://www.ncsu.edu/facilities/recycling/werecycle.php>
57. **NC State Athletics** - <http://www.gopack.com/>
58. **Wolfpack Sports Marketing** - http://www.gopack.com/ViewArticle.dbml?DB_OEM_ID=9200&ATCLID=518242
59. **Carter-Finley Stadium** - <http://www.ncsu.edu/facilities/buildings/carter-finley.html>
60. **E-Waste Recycling** - <http://www.ncsu.edu/facilities/recycling/e-waste.php>
61. **Pack N Go Sale** - http://www.ncsu.edu/facilities/recycling/pack_n_go.php
62. **Recyclemania** - <http://www.ncsu.edu/facilities/recycling/recyclemania.php>
63. **Recyclemania Dashboard** - http://www.ncsu.edu/facilities/recycling/recyclemania_ncsu_2009.html
64. **America Recycles Day** - http://www.ncsu.edu/facilities/recycling/america_recycles_day.php
65. **RE3** - <http://www.re3.org/>
66. **North Carolina Department of Environment and Natural Resources' Division of Pollution Prevention and Environmental Assistance** - <http://www.p2pays.org/>
67. **City of Raleigh Recycling** - <http://www.raleighnc.gov/recycling>
68. **Sonoco** - <http://www.sonoco.com/sonoco>
69. **Recycled cooking oil – (Piedmont Biofuels)** - <http://www.biofuels.coop/>

Water

70. **Carmichael Complex** - <http://www.ncsu.edu/carmichael/>
71. **NC State College of Veterinary Medicine** - <http://www.cvm.ncsu.edu/>



CONTACT US

NC State Co-Sustainability Officer: Jack Colby, Assistant Vice Chancellor, Facilities Operations
NC State University Sustainability Office Director: Tracy Dixon

MAILING ADDRESS

NC State University Sustainability Office
Campus Box 7536
Raleigh, NC 27695-7536

PHYSICAL ADDRESS

NC State University Sustainability Office
Administrative Services III
2701 Sullivan Drive, Suite 108
Raleigh, NC 27695-78536

sustainability@ncsu.edu
ncsu.edu/sustainability

ELECTRONIC AVAILABILITY

This document is available online at ncsu.edu/sustainability. Please consider the impact of printing before doing so.

FEEDBACK

We encourage readers of this report to provide us with their own insight into how we are progressing as a model of sustainability. Please provide your suggestions to the University Sustainability Office at ncsu.edu/sustainability.

EQUAL OPPORTUNITY STATEMENT

NC State University is dedicated to equality of opportunity. The university does not condone discrimination against students, employees or applicants in any form. NC State University commits itself to positive action to secure equal opportunity regardless of race, color, creed, national origin, religion, sex, age or disability. In addition, NC State University welcomes all persons without regard to sexual orientation.