The Impacts of Campus Activities on the Environment

2006 Update

October 2007

Environmental Affairs Committee, University of Missouri-Columbia

INTRODUCTION

In April 2003, the Environmental Affairs Committee released its initial study, "The Impacts of Campus Activities on the Environment." This initial report was the Committee's first attempt to address resource use and environmental issues at the University of Missouri-Columbia (MU) in a comprehensive manner.

Each year since, questionnaires have been distributed to various campus departments in the early months of the year to collect follow up information from the initial report. Attempts have been made to collect information to compare with data collected in the initial report. In addition, survey questions have been updated to better define resource usage and impacts. This report contains the data for 2006. In some cases, data is shown for the fiscal year instead.

FINDINGS—GENERAL CAMPUS STATISTICS

There are at least two ways of interpreting environmental information. One way is to look at gross resource usage statistics. Another way is to put the information in context based on statistics such as number of students, number of employees, number of buildings, budget and other factors. General statistics for 2006 are as follows:

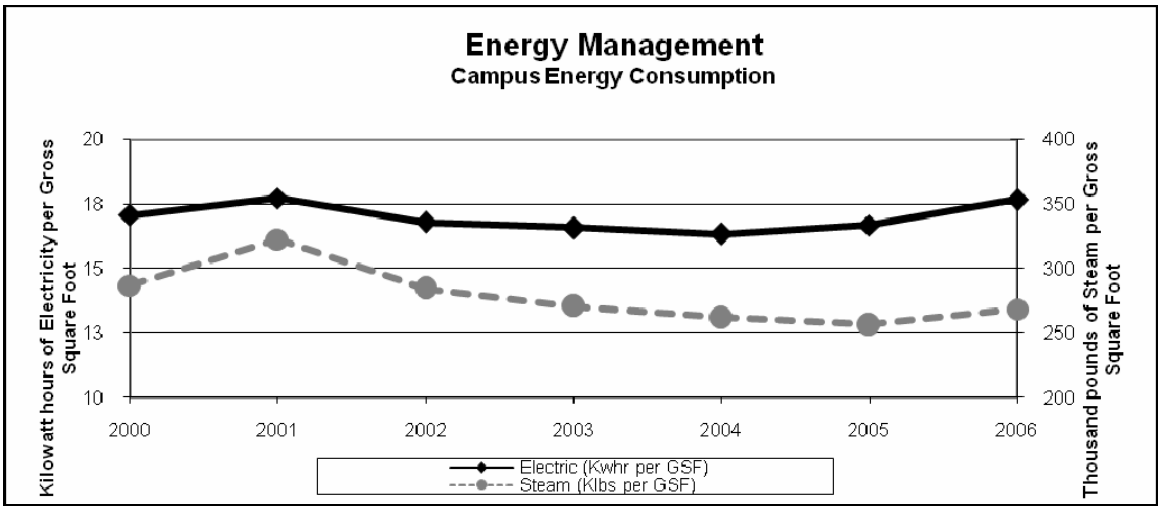
Number of student (full-time equivalents): 24,221 (10/31/06)
Number of faculty and staff (full-time equivalents): 9,912 (excludes Hospital and student workers)
Campus budget (excludes Hospital): $866,972,148
Gross square feet of buildings (excludes Hospital): 15,023,463

FINDINGS—RESOURCES

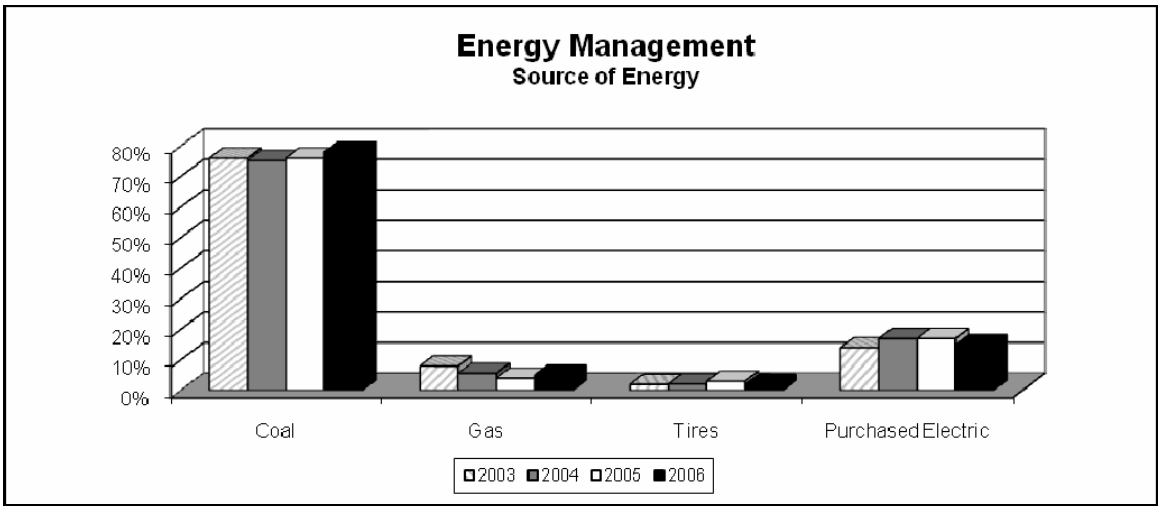
Energy

Campus Facilities, through its Energy Management department, is responsible for providing energy to campus. The service area is the Columbia campus and University Hospital and Clinics. Steam, but not electricity is provided to the VA Hospital. Ellis Fischel Cancer Center and Columbia Regional Hospital obtain energy from the City of Columbia.

In FY2006, the campus consumed 232 million kilowatt hours of electricity and 2.7 billion pounds of steam. These numbers represented increases of 7% and 9%, respectively, over the previous year. A large part of the increase was due to a 17% in cooling degree days over the previous year. Compared with FY2000, these numbers represent increases of 18% (electricity) and 4% (steam), respectively. Trends since FY2000, normalized to campus square footage, are shown in the graph below.



In FY2006, energy was provided from the following sources: coal – 78%, natural gas – 5%, tire derived fuel – 2%, and purchased electricity – 15% (see graph below).



Campus Facilities has a continuing program of energy conservation projects. In FY2006, projects were completed in Lafferre Hall, Heinkel, Gannett, Middlebush, and Agriculture. These projects included new and/or updated controls, replacement of inefficient lighting, installing occupancy sensors, and automatic setbacks for heating and cooling. Though not completed yet, Campus Facilities is also providing funds to assist in the replacement of the Veterinary Medicine Diagnostic Laboratory's pathological incinerator, which will result in a significant reduction in natural gas usage. Energy conservation efforts since 1990 were calculated to result in a $3.8 million cost savings during the past year. Energy conservation efforts have reduced the annual campus energy bill by an additional 2.7% in 2006.

Though no new energy conservation awards were received in 2006, Campus Facilities has received numerous such awards over the past 10 years. Campus Facilities has an active, varied and aggressive energy conservation program. In 2006, the Director of Energy Management chaired an Energy Conservation Task Force to identify new opportunities for reducing energy consumption.

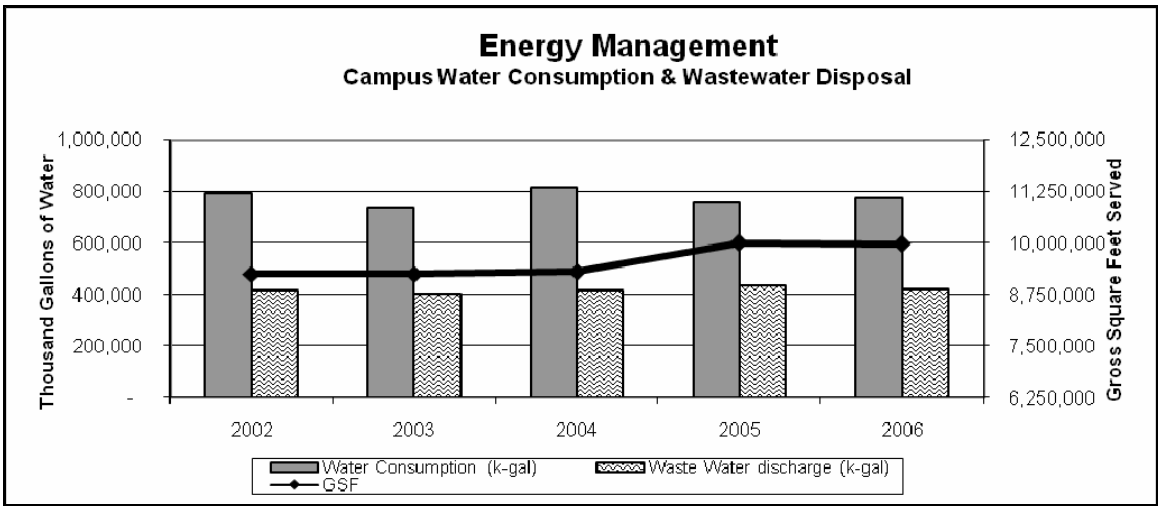
During the year, Campus Facilities calculated greenhouse gas emissions for each year going back to 1990. For calendar year 2005, power plant operations generated 404,932 metric ton equivalents of carbon dioxide. This was a slight (<1%) decrease from the previous year. Compared to the 1990 baseline, greenhouse gas emissions from power plant operations were likewise about 1% less in 2005. This decrease has occurred in spite of a 60% increase in campus building space. When measured on a square foot basis, greenhouse gas emissions have decreased by 37% since 1990. These successes have been due to the aggressive energy conservation programs and a change in fuel fix in the purchased energy.

Campus Facilities is looking at alternate sources of fuel for the power plant. One option is the possibility of increasing tire derived fuel up to 10% of the fuel load. Another option is burning biomass, such as corn cobs. Preliminary tests have been conducted with a 2-3% blend of corn cobs with coal and there are plans to increase this fraction to 10%. For departmental mobile equipment, the Campus Facilities Energy Management department has been using biodiesel. This fuel costs the same as regular fuel, burns cleaner, and helps the local economy.

Water and Wastewater

Campus Facilities, through its Energy Management department, provides water and wastewater management serves for the main MU campus and University Hospital and Clinics.

In 2006, over 772 million gallons of water were consumed by campus, a one percent increase from 2005 and a seven percent increase over 2000. Of the water consumed by campus, nearly 421 million gallons were discharged to sanitary sewer in 2006. This represents a three percent decrease in discharge from 2005, but a seven percent increase over 2000 (see graph below).



A once-through cooling system at Lafferre Hall was converted to chilled water in 2006, and Campus Facilities continues to investigate and hopes to convert other once-through cooling systems to chilled water wherever practical. A conversion is in design for research equipment in the Chemistry and Botany Greenhouse.

Looking towards the future, water/wastewater efficiencies are incorporated into the designs to reduce use and operating costs for the life of new buildings.

Food

Campus Dining Services (CDS) is the primary organization at MU for dining and food retail services. CDS operates 5 residential locations and nine retail locations. Examples of residential locations include Plaza 900 and Eva J's. Retail locations include the Union Square complex in Memorial Union, Catalyst Café in the Life Sciences Center and several convenience stores (Mizzou Markets).

CDS registered over 3.7 million transactions in the year ending June 30, 2006. The number of transactions is split between residential locations, with over 2 million transactions, and retail locations, with over 1.6 million transactions. The size and type of transaction differ. Furthermore, there are five all-you-care-to-eat options, which people may use for meals ranging from one piece of fruit to several plates of dinner. Thus, it is difficult to draw out specific impacts of a single meal, because there are many variables in a meal, from source and type of food to cooking equipment and a variety of miscellaneous factors.

CDS uses a competitive bid system to locate a supplier and then purchases items as needed from the bid winner. With the bulk of purchases from that supplier, cost of goods sold (all food and non-food items) totaled over $6.2 million for the 2005-2006 year. Item selection is based on customer needs and desires and the best values available. CDS, however, has started to look for supplies of food that satisfy customer, economic, and environmental standards.

CDS reports that is has had very few requests for organic foods and is not specifically pursuing those items. They are not aware of any items being offered in residential dining that would be considered 100% organic. There are a few protein-type bars and some cereals in the Mizzou Market convenience stores that indicate they are made with some organic ingredients. Currently, there are only two instant-type soups that claim to be 100% organic.

Another aspect of food impact to examine is transportation, as it is a user of energy in the food system. Food travels from point of production and processing to point of consumption, often with many stops in between. CDS located a source of local produce from their distributor and was able to procure 271 pounds of vegetables from a Missouri farm in the fall of 2006. In addition, CDS procured 133 boxes (100 apples each) of Missouri grown apples for the residential locations in the fall.

Vegetarian options are also available at all meals. CDS has a goal of offering vegan entrée at lunch and dinner all residential dining locations by January 2007. In addition to entrees, CDS continues to offer numerous "standard" items on a regular basis, including soy milk, tofu on salad bars, and vegan burgers. In retail, Caffé Fresco at Brady Food Court introduced a new line of vegan wraps and salads in the Spring 2006.

CDS has pursued a variety of sustainability initiatives for its operations. These include:

- The sale of almost 8,500 reusable drink and coffee mugs
- The sale of almost 6,500 additional beverage refills, resulting in no additional packaging or cups
- Use of recycled napkins at all facilities
- Elimination of Styrofoam packaging
- Purchase of several "Energy Star"-rated efficient pieces of kitchen equipment, including steamers, refrigerators, and freezers
- Waste oil from Campus Dining Services units is sold to a recycling company for re-use
- Pulper in Rollins dish room creates biodegradable pulp from napkins, paper cups, and food waste
- Institution of a variety of energy saving and recycling practices

Several trends will shape future CDS activities. These include increasing demand for more authentic global cuisine, which may give rise to healthier menu items with an emphasis on grains, legumes and vegetables. Related to health and nutrition, CDS is focusing on the elimination of trans-fats. CDS has changed the liquid frying shortening and is sampling griddle shortenings. They have also changed the daily French fry to trans-fat free and will move to other fried items and meats as they become available. Another trend for CDS is adding to its menu of vegan options (which also incorporate more grains and legumes). CDS reports using more fresh vegetables. There has also been in increase in the offering of soy milk products both in the dining halls and in our retail operations. CDS intends to continue exploring more local buying options and work on the logistics of that process, as it anticipates greater demand for locally-grown and organic products.

Solid Waste and Recycling

Solid waste and recycling services are overseen by Campus Facilities, through its Landscape Services department, for the main MU campus, University Hospital and Clinics, Ellis Fischel, and Columbia Regional Hospital. MU hired a new recycling coordinator in 2006.

A total of 7,293 tons of solid waste was generated in 2006. Because of questions about historical data, it is difficult to compare this total with previous years. The amount of material that was recycled is shown in the table below.

Recycling Data for FY2006

Item	Pounds recycled
Mixed office paper	1,037,864
Newsprint	316,048
Cardboard	857,832
Records Center—recycled paper	426,720
Printing Services—baled paper	647,064
Glass	122,428
Aluminum	26,046
Steel	202,570
Plastic Bottles	6,757
Electronics-Monitors and accessories	40,801
Grass Clippings	152,300
Batteries	1,780
Total	**3,838,210**

There was a notable increase (18.5%) in paper recycled from the Records Center from 2005. The amount of newsprint recycled diminished slightly, by less than two percent of the 2005 level. Battery recycling decreased by about 40% for the second straight year. Steel and grass clippings were not included in previous reports. Overall, 26.3 % of waste generated was recycled.

Specific projects were conducted in 2006 regarding recycling, and resulted in collecting over 870 tons of recyclables. The totals from these projects are included in the above table. For example, the Tiger Tailgate Recycling project, initiated in 2005 as a cooperative project between the Solid Waste and Recycling Coordinator, Campus Facilities, the City of Columbia, the student group Sustain Mizzou, and sponsored by Anheuser-Busch Recycling, gathered 19 tons of recyclable beverage containers at home football games, seven tons more in 2006 than in 2005. Each project's results are listed below:

Projects (Totals Included Above)	(tons)
Tiger Tailgate Recycling	19.0
Drop off Recycling	46.3
Sidewalk Recycling	25.9
Paper Recycling (academic, administrative, support)	518.0
Cardboard (academic, administrative, support)	414.0
Newsprint (academic, administrative, support)	158.0
Total	**1181.2**

Hazardous Materials

Environmental Health and Safety coordinates the campus hazardous waste management program. The service area for these programs includes the Columbia campus, University Hospital and Clinics, Ellis Fischel Cancer Center, Columbia Regional Hospital, University Physicians clinics, off-site research facilities (including farms), and the Missouri Rehabilitation Center in Mt. Vernon.

The table below shows amounts of various types of hazardous materials disposed by campus both for 2006 and previous years back to 2000. Although EPA regulated hazardous waste was up about 4% over 2005, there has been a significant decrease since 2000. Low level radioactive waste and mixed wastes generated were each substantially reduced in 2006 compared with both 2005 and 2000. On the other hand, medical/pathological waste was up slightly in 2006 and more so compared with 2000; however, the 2000 figure does not include Columbia Regional Hospital, which is a significant generator of such wastes.

Used oil was up about 20% in 2006, though this number can fluctuate significantly from year to year. Universal wastes (fluorescent lamps and batteries) decreased almost 20% in 2006.

Material	2000	2003	2004	2005	2006
EPA regulated Hazardous Waste	210,000	161,000	129,000	116,700	126,000
Medical/pathological waste	325,000	415,000	443,000	480,000	486,000
Low level radioactive waste	38,000	40,400	37,000	20,700	6,700
Regulated wastes (special projects)	128,000	480,000	227,000	400,000	240,000
Mixed wastes (radioactive/haz waste)	1,100	800	840	335	208
Used oil	NR	9,900	13,800	11,500	13,700
Universal waste	NR	15,900	33,500	33,100	26,700
Notes: All measurements are in pounds. NR= Not Reported					

Environmental Health and Safety (EHS) continued to emphasize training programs for chemical management. In FY06, 888 campus persons were trained in the standard programs and an additional 433 persons attended miscellaneous or specialized training programs involving chemical or miscellaneous environmental issues. These numbers do not include training for radiation or biological safety.

EHS has operated a chemical recycling program that takes unwanted excess chemicals from laboratories and returns them free of charge to other interested campus researchers. In FY06, EHS recycled 2400 chemical containers, which had an avoided purchase price, adjusted for MU discounts, of $119,000. This past year, EHS also started a program for recycling of laboratory equipment and recycled 614 pieces of

equipment with an avoided purchase cost of $17,500. EHS continued the mercury reduction program and removed eight pounds of elemental mercury from use.

FINDINGS—INFRASTRUCTURE

Purchasing

Purchasing is centralized under the University System offices; MU is serviced by a campus Procurement Service Center.

Procurement oversees the Surplus Property operation. Surplus Property serves MU as well as some local government bodies. Approximately 200 tons of computer monitors, autos, and scrap metals pass through Surplus Property annually. The total weight of other items is not available. Surplus Property uses eBay to move items, and this has proven to be quite successful.

There are currently no policies on recycled content for copier paper; however, for rough paper (paper towels, toilet paper, etc) we buy only products that have recycled content.

Future trends identified by Procurement are a move toward green computers, safer cleaning products, and increased use of soy-based products.

Printing Services

Printing Services reported a variety of resource usage statistics for FY2006. For inks, the breakdown was as follows: vegetable/soy – 20%, metallic – 10%, low VOC petroleum based – 70%. Paper cost was reported at $1.78 million; however, the amount of paper purchased is not available.

In FY2006, the following amounts of materials were recycled: 589,000 pounds of printer's mix (good) paper; 58,100 pounds miscellaneous (low grade) paper; 29,200 pounds of cardboard; 12,540 pounds of aluminum; and 842 pounds of waste film.

Printing Services reported that they are receiving inquiries about Forest Stewardship Council approved paper and expect to see increased requests in the future.

Residential Life

Estimates of Resource usage by students:

Statistic	2004	2005	2006
Capacity of Residence Halls	6,026	6,033	5,800
Gallons of water per person per day	33	27	40
Kilowatt hours of electricity per person per day	5.6	5.91	8.05
Pounds of solid waste per person per day	1	1	1

Residential Life has continued a number of environmental initiatives. Assigned staff, both student and full time, empty recycling containers on a weekly basis. Each floor has one recycling container for paper/cardboard and another for plastic/glass/aluminum/metal. Two large roll-off recycling containers were relocated by Residential Life to the Plaza 900/Rollins parking lot to facilitate and support campus recycling efforts. Residential Life reports that contamination of recyclables coming from residential

locations on campus has been reduced by 75% since 2004 due to increased student-focused educational efforts. Additionally, fluorescent bulb recycling is continuing to work well.

Asbestos removal is constant, especially for pipe insulation and floor tile as areas are upgraded and improved. All residence halls are smoke free due to no smoking policies in place for residents.

Residential Life plans to play a large role in the first ever Tiger Treasures Rummage Sale. Student donations will be collected during move out at the end of the academic year. These materials will be transported to Faurot Stadium, priced, sorted and sold at a large rummage sale type event. Proceeds from this sale will benefit charity.

Landscape Services

Campus Facilities, through its Landscape Services department, has responsibility for implementing the campus landscape master plan, maintaining grounds and landscape for most of campus, litter collection, and snow removal. Campus Facilities maintains 840 acres of space on campus. These 840 acres do not include University Hospital, the golf course, or athletic facilities.

In FY2006 over half of the permanent Landscape Services staff holds a Missouri Pesticide Applicator's license, which requires testing, periodic training, and periodic recertification. All employees receive safety training on a broad range of safety issues including yearly hazardous material training.

In FY2006, Campus Facilities used only high-grade synthetic and organic fertilizer. These types of fertilizers have a slow-release system that releases nutrients evenly throughout the year and largely mitigates chemical runoff. According to the Campus Facilities Landscape Services staff, the variety of types of fertilizers used makes the ratio of synthetic versus organic fertilizer irrelevant, and environmental effects are instead impacted by the quality of fertilizer and its application on the soil. Campus Facilities makes every effort to use fertilizer and pesticide application techniques that minimize any adverse environmental impact.

In FY2006, Campus Facilities used the following for snow/ice control: 410 tons of sand, 67 tons of bagged potassium-chloride ice-melt compounds, and 506 tons of road salt (NaCl). Additionally, 90 tons of cinders and 1,000 gallons of calcium chloride were used during FY2006 for ice control operations. Each of these figures represents a dramatic increase from FY2005 due to above average winter precipitation.

Campus Facilities estimates there are over 6,000 landscape trees on campus. No figures were given for the amount of landscape waste that was mulched or recycled in FY2006.

Campus Facilities received first place in the overall university division of the America In Bloom contest for outstanding campus landscaping, with special recognition for urban forestry efforts.

Building Planning, Design and Construction

Campus Facilities, through its Planning Design and Construction department, is responsible for master planning, new building design and construction, additions, renovations, and for overseeing construction projects. In FY2006, campus construction totaled $100 million. Major projects included the Reynolds Journalism Institute, International Institute for Nano and Molecular Medicine, and the Regional Biocontainment Laboratory.

In FY2006, the size of the Columbia campus was 1350 acres, of which 500 acres (37%) is classified as green space.

Several environmental concerns are incorporated into building design specifications:

- Use of materials with recycled content (furniture, flooring, composite materials).
- Use of insulation materials and fresh air to reduce HVAC loads.
- Use of tinted/energy efficient glass in window replacements.
- Specify use of low/no VOC paint manufacturers only.
- Temporary erosion control on any project that affects a site.

Specific initiatives include the installation of environmentally "happy" height adjustable tables for ADA/Bariatric workstations in our various classroom projects and for instructor stations in General Classroom Building, and all furnishings for the School of Medicine floors of the Clinical Support and Education Building will meet green/sustainable standards. Campus Facilities began compiling data to determine benchmarks and goals for future purchasing strategies for green and recycled materials.

Campus Facilities arranged for several special professional development opportunities for staff including hosting the Society of College and University Planners (SCUP) "Campus Sustainability Day" webinar, a lunch and learn session on indoor air quality, a webinar entitled "Making the Business Case for Environmental Design", and a presentation on moisture management in commercial building envelops.

Campus Facilities has observed that the design world has become "green" to such an extent that it will be increasingly difficult NOT to design sustainable spaces. Recycled and recyclable products proliferate. There is still a lot of "greenwashing"out there though, and one has to thoroughly research a product to filter out those products that really aren't green.

FINDINGS—EDUCATION

Environmental courses are taught throughout the University of Missouri, including courses in Agricultural Economics, Anthropology, History, Parks Recreation and Tourism, Political Science, and Rural Sociology. However the departments and programs with the greatest concentration of environmentally related courses are: Biology, Environmental Studies, Fisheries and Wildlife, Forestry, Geography, Geology and Soil, Environmental and Atmospheric Sciences (SEAS).

Environmentally related Majors at MU focused on the scientific dimensions of environmental problems include those in the School of Natural Resources - Fisheries and Wildlife, Forestry, and SEAS. SEAS recently began an emphasis area within the program in Environmental Science to better prepare students for the interdisciplinary nature of environmental problems and their solutions. The Geology Department in the College of Arts and Science offers an emphasis area in Environmental Geology. The Civil and Environmental Engineering Department in the College of Engineering also prepares students for addressing environmental problems, but with more focus on engineering solutions to problems.

The Environmental Studies program offers an Environmental Studies emphasis area within the Special Degree Programs in Arts and Science. This major is equal parts human and natural dimensions and prepares students to identify the underlying social causes of environmental problems, how the social aspects interact with the natural aspects, and how to find workable solutions to environmental problems.

People in business, agriculture, government, education and engineering have jobs that are related to environmental protection. The Environmental Studies Program offers a Certificate in Environmental Studies that gives students majoring in areas that lead to these jobs the background, principles and vocabulary to address issues from an environmental perspective.

Over 140 faculty in 30 departments in 6 colleges and schools at the University of Missouri engage in research, scholarship or service in the environmental area. Their contributions can be roughly categorized

into four areas, Biodiversity, Human Dimensions, Pollution and Resources. A listing of faculty and their research appears in Appendix A.

FINDINGS—RESEARCH

Research Farms

No new information was received.

Research Reactor

The Research Reactor activities described in the initial report continued in FY2006. Radioactive releases in FY2006 to the sewer system (117 Curies of tritium, 11 Curies of all other isotopes). These were 2% and 1%, respectively, of the allowable limits. Air releases in FY2006 for Ar-41 (half-life of 1.83 hours) totaled 1180 Curies; however, this was only 73% of the Technical Specification limit and is within normal variation. All other air releases were less than 0.1% of the Technical Specification limits.

Low level radioactive waste shipped from the Research Reactor in FY2006 totaled 12,450 pounds.

MURR continues to ensure that all persons with unescorted access to the research reactor have hazardous material and radiation safety training. This training is designed to meet all regulatory requirements and to provide the staff and students with the knowledge necessary to perform their responsibilities in a safe manner.

The Research Reactor continues to maintain compliance with all applicable environmental regulations.

STUDENT AND ORGANIZATIONAL ENVIRONMENTAL EFFORTS

This year the committee communicated with four student groups on campus about their efforts. Details about each organization or program are as follows:

Sustain Mizzou

Sustain Mizzou is a student organization that is committed to creating a sustainable way of life at the University of Missouri-Columbia through public education and local action regarding the environment. Sustain Mizzou is non-partisan and entirely student volunteer driven, with an emphasis on education, cooperation, local action and leadership development. Sustain Mizzou strives to address all aspects of sustainability on the MU campus. Further organizational information is available at www.sustainmizzou.org.

Sustain Mizzou completed several campus sustainability projects in 2006. Results include:

- 19 tons of material recycled through Tiger Tailgate Recycling during the 2006 football season (up from 12 tons during the 2005 season)
- $3,000 dollars collected for the Local Food Drive to buy food from local farmers to donate the Central Missouri Food Bank
- 262 trees planted near Hinkson Creek at Hinkson Recreation Area
- 1 Stream Team Water Quality Monitoring event conducted by the newly revitalized Sustain Mizzou Stream Team
- 6,000 pounds of local, organic food grown through the Farm Project (all donated to the Central Missouri Food Bank)
- Production of an estimated 150 Recycled Notebooks in the Recycled Notebook project
- Continued publication of Footprint Sustainability Magazine
- Working to support the Tiger Treasures Rummage sale, planned to take place in June 2006

Sustain Mizzou also served in several advocacy and advisory roles regarding campus sustainability in 2006, including:

- Assisting the Environmental Affairs Committee in advocating for the formation of a comprehensive campus sustainability plan
- Active membership in the MU Recycling Committee
- Active Membership in the MU Environmental Affairs Committee
- Service as the MSA Senate Sustainability Advisor, a new position created in Spring 2006 to actively convey sustainability news and information to student government
- Membership on the Energy Conservation Task Force
- Staffing of a table in Brady Commons every Wednesday to raise sustainability awareness and speak with concerned students, faculty and staff about campus sustainability issues and efforts

Sustain Mizzou received the Missouri Recycling Association's "Best Higher Education Recycling Effort" Award in 2006 for the 2005 Tiger Tailgate Recycling season.

In Spring of 2006, Sustain Mizzou underwent a reorganization of executive structure, expanding from a traditional four-person executive board model to a model with six executive positions. This reorganization was necessary in order to manage the high organizational workload--a result of high demand for environmental sustainability on the MU campus. Sustain Mizzou anticipates continued growth in organization size, as well as growth in the variety and scope of projects and efforts undertaken.

Weatherization 4 Winds

Weatherization 4 Winds is a group of MU students dedicated to tackling the increasing energy inefficiency of homes and poverty of senior citizens in Columbia. Students from across campus, including the Four Winds Residential Community, train in the installation of simple weatherization materials that improve insulation and reduce the waste of energy, and then travel in teams to the homes of Columbia elderly to make these changes and improve their comfort during extreme weather.

Last year, students helped 45 homes stay warmer and accrue less utility bills for the winter. One hundred kits valued at $100 each were donated for an Energy Fair hosted by AARP, Central Missouri Community Action, Boone Electric, City of Columbia Water & Light, and Home Depot. Additionally, four full sets of tools needed for installations were donated by Home Depot. Approximately 60 students volunteered their time and energy installing these materials, both those involved in Four Winds and Service-Learning students, as well as those attracted through word of mouth.

AmerenUE offered to quantify the savings per property and is in the process of calculating this data, but nationally the U.S. Department of Energy estimates that an average of $1.53 is saved in utilities for every $1 spent on weatherizing. A one-time investment replaces frequent public assistance and wasteful energy provision from utility companies.

Additionally, Weatherization 4 Winds provides students an opportunity to connect with Columbia citizens and get a first-hand look into the rapid rise in poverty experienced by the elderly. The Four Winds Residential Community is comprised of Health Professions majors such as Physical Therapy, Ultrasound and Radiography, and thus these students are typically passionate about improving the quality of life for senior citizens and the work they do prepares them to interact with patients in their future careers. Residents of the Columbia community also benefit from the positive example these volunteers provide of the caring, dedicated and conscientious students on the MU campus.

The time invested by Weatherizers has a very high return; volunteers give hours of their time for installation, but the residents benefit from their services for the duration of their stay in that home. One

resident in particular saw her utility bills instantly cut in half, and her favorite part of the kit was the low-flow showerhead; until the volunteers came to her home, she had been showering from an open-ended pipe in the wall. Weatherization 4 Winds is a group of MU students affecting such change on a broad scale by bringing comfort and efficiency to senior citizens, connecting the MU campus to the Columbia community at large, and decreasing the waste of energy and money for utility companies and city assistance agencies.

Mizzou Environmental Science Club

A relatively new organization on campus, Mizzou Environmental Science Club strives to promote environmental awareness to students, faculty, staff, and the larger community through the organization's website and other environmentally focused activities. Additionally, the group hopes to create a network of established environmental organizations and companies to help guide students in locating environment-related internships and potential employers.

In Fall of 2006, Mizzou Environmental Science Club participated in the Hinkson Clean Sweep, an event in which volunteers work to clean up litter from Hinkson Creek and its tributaries. Additionally, Environmental Science Club organized Carbon Awareness Week, an event centered around global warming issues. Environmental Science Club challenged students to reduce their carbon footprint throughout the course of the week by several means, including informational flyers, a staffed table, and a showing and discussion of Al Gore's, "An Inconvenient Truth."

Mizzou Tigers for Tigers

Mizzou Tigers for Tigers, founded in 1999 as the nation's first mascot conservation program, works to preserve and protect wild tigers. Each year this student organization holds public informational events on tiger conservation and raises funds to donate to the Save the Tiger Fund and the World Wildlife Fund.

Activities in 2006 included Tiger Awareness Month, a series of conservation-focused events held annually in October. During this effort, Mizzou Tigers for Tigers held a showing of, "Tigers of the Emerald Forest," an award winning documentary. Guest speakers included Brian Gatwick of the Save the Tiger Fund and Mathew Lewis of World Wildlife Fund, who gave public lectures on current issues facing wild tigers. Additionally, MU Tigers for Tigers held a month-long conservation/animal themed art exhibit and silent auction at the Cherry Street Artisan which raised $800. Joel Sartore, an acclaimed photographer for National Geographic, also gave a talk on photographing and saving endangered species.

In 2006, MU Tigers for Tigers was chosen by the homecoming steering committee to be one of two benefactors of the funds raised by the MU Homecoming 5K Run/Walk. These funds, along with others raised throughout the year, were presented to World Wildlife Fund in the amount of $3800. These funds will be used for a camera trapping study to acquire more accurate data regarding tiger population in Nepal's Parsa Wildlife Reserve.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This report is intended as a supplement to the report issued in April 2003. It is intended to provide information about the environmental impacts of MU activities and to stimulate discussion about these impacts and the projected trends.

The Environmental Affairs Committee notes that there are many success stories contained within this report. On the other hand, the report points toward opportunities in a number of instances. The Committee welcomes feedback about the data collected, the way the material is presented and any conclusions that are drawn.

In past reports, the Committee has refrained from making recommendations. With this report, we begin offering some recommendations to enhance sustainability at MU. We offer the following recommendations with the knowledge that some of these are already being pursued.

1. MU should adopt a campus sustainability policy.
2. MU should develop a campus sustainability plan.

Once the campus has adopted a sustainability plan and sustainability policy, the Committee recommends that the campus consider further analysis and planning to address the follow issues:

3. Greenhouse gas emissions. Data provided by Campus Facilities show that greenhouse gas emissions related to energy supply for the campus have decreased by 1% between 1990 and 2005, this in spite of significant growth in the campus building space. The Committee believes that the campus should consider the long term economic and environmental benefits of building upon this excellent past performance.
4. Campus energy efficiency: Campus Facilities has done an excellent job in efficiently providing heat, cooling and power to campus. In addition, energy conservation efforts over the past 15 years have yielded significant results. The Committee believes that there are both economic and environmental benefits for ongoing efforts to reduce reliance on fossil fuels by emphasizing both energy conservation measures and exploring renewable fuel sources.
5. Water consumption: Over the past 15 years, water consumption dipped about a third due primarily to eliminating once-through cooling applications and improved maintenance of water lines by Campus Facilities, but usage has been slowly rising again in recent years. The Committee believes that the campus should continue exploring opportunities to reduce water consumption to preserve ground water resources.
6. Locally grown foods: The Committee believes that increased purchases of locally grown foods would have positive economic impacts for Missouri and positive environmental impacts. Information provided by Campus Dining shows that logistical issues make it difficult to purchase significant amounts of locally grown foods. The Committee applauds Campus Dining's openness to exploring options for local food purchases and encourages these efforts to continue and expand.
7. Green buildings: Building construction has a major impact on the environment, not just during construction, but throughout the lifetime that buildings are in service. The Committee believes that all new construction and major renovations should be designed to qualify for LEED certification, which would have the twin benefits of reducing long term operating and maintenance costs, and minimizing adverse impacts on the environment.

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Appendix A: Table of MU Environmental Research

The following sections summarize information on faculty available on departmental and personal websites. Where available, the title, year and source for a recent publication are also included. The tables are organized by department (in alphabetical order) and then by faculty members (in alphabetical order by last name). A website address is provided for each faculty member, though in some cases it will take the user to a departmental website.

Biodiversity - This area of research concerns the distribution and abundance of wildlife, strategies for managing, conserving and reintroducing species, and the conservation and restoration of natural communities. The species include deer, buttercups, wolf spiders, elephants, salamanders, smallmouth bass, cavefish, three toed box turtles, bats and stream invertebrates. The communities include temperate grasslands, large river systems, Alaskan lakes, Ozark forests, Chinese forests and tropical forests. The research approaches include carbon exchange modeling, using scat to identify individuals, the impacts of logging roads, CRP, global warming and predators on communities and species, and aerial, satellite and GIS techniques to monitor landscape scale disturbances.

Department	Name	Interests	Recent Paper	Website
Anim Sci	Trista Strauch	captive wild animal management	Observational versus electronic methods for the detection of estrus in farmed red deer hinds. 2002 Texas Agricultural Experiment Station Field Day Repo	http://animalsciences.missouri.edu/faculty/strauch/
Biology	Candace Galen	effect of climate on plant pollinator systems	Solar furnances or swamp coolers: costs and benefits of water use by solar-tracking flowers of the alpine snow buttercup, Ranunculus adoneus. 2006 Oecologia, DOI: 10.1007 / s00442-006-0362-Y	http://www.biology.missouri.edu/faculty/index.html
Biology	James Carrel	conservation biology of spiders	Burrowing wolf spiders, Geolycosa ssp. (Araneae: Lycosidae): gap specialists in fire-maintained Florida scrub. 2003 J Kan Ent Soc 76: 557-566	http://www.biosci.missouri.edu/carrel/
Biology	Jim Coleman	responses of desert ecosystems to environmental change	Net ecosystem carbon exchange in two experimental grassland ecosystems. 2004 Global Change Biology 10: 498-508.	http://www.biology.missouri.edu/faculty/index.html
Biology	John Faaborg	avian ecology, behavior and conservation	Avian habitat management meets conspecific attraction: if you build it, will they come? 2006 The Auk 123: 301-312.	http://www.biology.missouri.edu/faculty/index.html
Biology	Lori Eggert	ecological and conservation genetics of elephants	Nucleic acid isolation from ecological samples: animal scat and other associated materials. 2005 In: Mol Evol: Biochem Data, Part B. Methods in Enzymology 6:73-87	http://www.biology.missouri.edu/faculty/index.html
Biology	Raymond Semlitsch	conservation of declining amphibian species	Legacy of land use in southern Appalachian forests: effects on terrestrial salamander abundance along edges and within abandon logging road. 2006 Conservation Biology, in press	http://www.biology.missouri.edu/faculty/index.html
Fish & Wildl	Charles Rabeni	conservation, restoration of aquatic systems	Natural-occurring landscape and in-channel factors affecting the distribution and relative abundance of riverine smallmouth bass in Missouri. 2007 N. Am J. of Fisheries Management. 27:326-3	http://www.snr.missouri.edu/fw/faculty/rabeni-c.php
Fish & Wildl	David Galat	large river ecology, native fish, restoration ecology	Flow and form in rehabilitation of large-river ecosystems: an example from the lower Missouri River. 2006 Geomorphology. 77:249-269	http://www.snr.missouri.edu/fw/faculty/galat-d.php

Fish & Wildl	Douglas Noltie	reproductive ecology and behavior of fishes	Habitat use and gas bubble disease in southern cavefish (Typhlichthys subterraneus). 1993 Int J. of Speleology 22(1-4):131-143.	http://www.snr.missouri.edu/fw/faculty/noltie-d.php
Fish & Wildl	Frank Thomp-son	neotropical migratory birds, landscape ecology		http://www.snr.missouri.edu/fw/faculty/thompson-f.php
Fish & Wildl	Jack Jones	freshwater lakes	Limnology of lakes in Gates of the Arctic National Park and Preserve. 2003. Alaska. Lake and Reserv. Manage. 19:108-121	http://www.snr.missouri.edu/fw/faculty/jones-j.php
Fish & Wildl	Josh Mill-spaugh	wildlife stress physiology, management of large mammals	Movement patterns and space use of translocated and resident three-toed box turtles. 2007. J of Herpetology: In press.	http://www.snr.missouri.edu/fw/faculty/millspaugh-j.php
Fish & Wildl	Mark Ryan	endangered species, avian ecology and conservation	Impact of the CRP on wildlife conservation in the Midwest. in J. Haufler and T. Franklin, editors. Fish and Wildlife Benefits from Farm Bill Programs: Update 2000-2005. The Wildlife Soc.	http://www.snr.missouri.edu/about/director.php
Fish & Wildl	Matthew Gompper	biology and conservation of mammalian carnivores	Plight of predators: The importance of carnivores for understanding patterns of biodiversity and extinction risk. 2005 Pp. 370-388 in: Ecol of Predator-Prey Inter.	http://www.snr.missouri.edu/fw/faculty/gompper-m.php
Fish & Wildl	Robert Pierce	wildlife ecology & habitats adaptive management	Projecting the bird community response resulting from the adoption of shelterbelt agroforestry practices in Eastern Nebraska. 2001 Agrofor Sys 53: 333-350. Kluwer Acad Pub.	http://www.snr.missouri.edu/fw/faculty/pierce-r.php
Forestry	David Larsen	forest stand dynamics, high res digital photography	Long-term economic simulation: Even-aged and uneven-aged examples from MOFEP. 2005 Northern J of Appl For. 22(1):42-47.	http://www.snr.missouri.edu/forestry/faculty/larsen-d.php
Forestry	Hong He	landscape ecology and ecological modeling	Simulating Forest Ecosystem Response to Climate Warming Incorporating Spatial Effects in Northeastern China. 2005 J of Biogeog. 32: 2043-2056.	http://www.snr.missouri.edu/forestry/faculty/he-h.php
Forestry	Rose-Marie Muzika	disturbance ecology of oak dominated forests	Effect of forest structure and fragmentation on site occupancy of bat species in Missouri Ozark forests. 2006 J of Wildl Mgmt 70:1238-1248.	http://www.snr.missouri.edu/forestry/faculty/muzika-r.php
Geography	Cuizhen (Susan) Wang	GIS, ecosystem monitoring	Assessment of Tropical Forest Degradation with Canopy Fractional Cover from Landsat ETM+ and IKONOS Imagery. 2005 Earth Int, 9(22), 1-18.	http://www.geog.missouri.edu/people/wang.shtml
Plant Sci	Bruce Barret	insect ecology in agro-forestry systems		http://plantsci.missouri.edu/faculty/barrett.htm
Plant Sci	Robert Sites	communities of aquatic insects in relation to land use	Macroinvertebrate communities of prairie streams in Missouri: The influence of adjacent land uses. 2003 J. Freshwater Ecol 18(1): 55-68	http://plantsci.missouri.edu/faculty/sites.htm

Human Dimensions - This area of research concerns the economic, aesthetic, political, sociological and historical roots, causes of and solutions to environmental problems. The subject areas include climate change, sustainable agriculture, alternative fuels, energy efficiency and conservation, water resource use - ancient and current, building design, big box stores, oil price shocks, soil erosion, corporate social performance, caves, religion, materialism, parks, wild horses and food systems. The tools of investigation include economic modeling, transaction costs comparisons, public perception analyses, behavior-based evaluation, marketing strategies, GIS, risk communication, policy analysis, group decision making, and historical and pre historical investigations.

Department	Name	Interests	Recent Paper	Website
Ag Econ	Corrine Valdiva	adaptation in rural and developing economies to climate var.	Coping and Adapting to Climate Variability in the Andes: Strategies and Local Knowledge. 2003 Open Meeting - Human Dimensions of Global Environmental Change. 16-18 October.	http://web.missouri.edu/~valdiviac/
Ag Econ	Harvey James	the economics of trust, ethics, and happiness	Sustainable Agriculture and Free Market Economics: Finding Common Ground in Adam Smith. 2006 Ag and Human Values, 23(4): 427-438	http://web.missouri.edu/~jamesha/
Ag Econ	Laura McCAnn	transaction costs of agri-environmental policies	Transaction Cost Measurement for Evaluating Environmental Policies. 2005 Ecol Econ, 52 (4), March pp. 527-542.	http://web.missouri.edu/~mccannl/Home.htm
Ag Econ	Michael Kaylen	natural resource economics	Estimating the Economic Feasibility of Producing Ethanol and Fine Chemicals from Municipal Solid Waste in Missouri.. In prep for Bioresource Tech	http://web.missouri.edu/~kaylenm/
Ag Econ	Nicholas Kalaitzan-donakes	public perception of biotechnology	Cartagena Protocol: A New Trade Barrier. 2006 Regulation, 29(2), 18-25	http://www.agbionetwork.net/%7Ekalaitzandonakesn/
Ag Econ	Steven Matthews	teaching environmental law		http://web.missouri.edu/~matthewss/
Ag Econ	Tony Prato	resource and environmental economics	Selection and evaluation of projects to conserve ecosystem services. 2007 Ecological Modelling 203:290-296.	http://www.cares.missouri.edu/about/vitae/prato.html
Ag Ed	Leon Schu-macher	energy conservation, alternative fuels	Tractor ballasting for fuel efficiency. 1993 Journal of Agricultural Mechanization. 7,(7), 69-72.	http://web.missouri.edu/~schumacherl/leon.html
Ag Jour	Bill Allen	science, environment and medical reporting		http://journalism.missouri.edu/faculty/bill-allen.html
Anthro	Craig Palmer	fisheries and conservation practices	Water, land, and politics on the north coast of Peru. 2006 Latin American Antiquity 17(3):243-264.	http://web.missouri.edu/~palmerct/
Anthro	Deborah Pearsall	human impacts on plant communities	Plants and People in Ancient Ecuador: The Ethnobotany of the Jama River Valley. 2004. Wadsworth/Thomson Learning.	http://web.missouri.edu/~umcasphyto/index.shtml
Anthro	Frances Hayashid a	historic water management in Peru	Water, land, and politics on the north coast of Peru. 2006 Latin American Antiquity 17(3):243-264.	http://anthropology.missouri.edu/people/hayashida.html
Anthro	Lisa Satten-spiel	cultural factors & spread of disease	Tropical environments, human activities, and the transmission of infectious diseases. 2000 Yearbook of Physical Anthropology 43:3-31	http://rcp.missouri.edu/lisasattenspiel/index.html
Anthro	Reed Wadley	local natural resource mgmnt and forest-based ag	Histories of the Borneo Environment: Economic, Political and Social Dimensions of Change and Continuity. 2005 Verhandelingen van het Koninklijk Instituut voor Taal-, Land- en Volkenkunde 231. Leiden, Netherlands: KITLV Press.	http://rcp.missouri.edu/reedwadley/index.html

Arch St	Arthur Mehrhoff	sustainable urban development	Is Universal Design a Critical Theory? 2004 Designing a More Inclusive World Springer-Verlag	http://web.missouri.edu/~umchesarchweb/people/people.htm
Arch St	Hee-Jin Pak	environmentally friendly interior design	Environmentally friendly remodeling of interior space: Implementation of construction process. 2005 Korean Institute of Interior Design Journal , 14(6), 270-279	http://web.missouri.edu/~umchesarchweb/people/people.htm
Arch St	Michael Gold-schmidt	ecological interior design		http://web.missouri.edu/~umchesarchweb/people/people.htm
Arch St	Ruth Brent	sustainable living environments		http://web.missouri.edu/~umchesarchweb/people/people.htm
Economics	Emek Basker	big box retailers	The Causes and Consequences of Wal-Mart's Growth, Journal of Economic Perspectives (forthcoming)	http://economics.missouri.edu/~baskere/
Economics	Ron Harstad	behavior-based environmental valuation	Experimental Methods and Elicitation of Values 2004 Experimental Economics, 7, 123-140	http://web.missouri.edu/~harstadr/
Economics	Xiaoguang (Shawn) Ni	macroecon problems (oil shocks)	On the Dynamic Effects of Oil Price Shocks - A Study Using Industry Level Data	http://web.missouri.edu/~nix/
Fish & Wildl	Charles Nilon	urban wildlife ecology and conservation, human dimensions	A cross-town walk to assess environmental changes along an urban socioeconomic gradient. 2005 Teaching Iss & Exp in Ecol 3: Experiment 3	http://www.snr.missouri.edu/fw/faculty/nilon-c.php
Forestry	Michael Gold	marketing nontraditional products	Competitive market analysis of Eastern red cedar. 2005 For Prod J 55(12): 58-65.	http://www.snr.missouri.edu/forestry/faculty/gold-m.php
Geography	Gail Ludwig	env edu, land use planning		http://www.geog.missouri.edu/people/ludwig.shtml
Geography	Joseph Hobbs	anthropogenic landscape change, env ethics	The Involvement of Indigenous and Local Peoples in Karst Protection and Management J of Cave and Karst Studies	http://web.missouri.edu/~hobbsj/
Geography	Mark Cowell	GIS and landscape ecol of N American forests	Vegetation development in a modified riparian environment: Human imprints on an Allegheny River wilderness. 2002 Ann Ass of Am Geogr 92: 189-202.	http://www.geog.missouri.edu/cowell/
Geography	Michael Urban	anthropogenic landscape change, env ethics	Exploring the links between Geomorphology and Ecology. 2006 Geomorphology 77 (3-4): 203-206.	http://www.geog.missouri.edu/people/urban.shtml
Geography	Soren Larsen	political ecology, indigenous & resource dep communities	Place, activism, and development politics in the Southwest Georgia United Empowerment Zone. 2004 Journal of Cultural Geography 22: 27 – 49.	http://www.geog.missouri.edu/people/larsen.shtml
Geography	Yingkui (Philip) Li	GIS, soil erosion and land use change	Human impacts on soil erosion identified using land-use changes: A case study from the Loess Plateau, China. 2006 Phys Geog 27, 109-126	http://web.missouri.edu/~liyk/
History	Susan Flader	American environmental history	Thinking Like a Mountain: Aldo Leopold and the Evolution of an Ecological Attitude Towards Deer, Wolves, and Forests (1974; 1994)	http://history.missouri.edu/people/flader.html
Law	Thom Lambert	regulatory theory & business law		http://law.missouri.edu/faculty/lambertt.html

Management	Daniel Greening	corporate social responsibility	Corporate social performance as a competitive advantage in attracting a quality workforce. 2000 Business and Society, 39: 254-280.	http://business.missouri.edu/1409/235.aspx
Management	Richard Johnson	corporate social responsibility		http://business.missouri.edu/1409/3606.aspx
Parks Rec & Tourism	Mark Morgan	nat resource management, education and outreach	Nontraditional activities and interpretation at national parks: Conflict or coexistence? 2005 J of Interp Res, 10(2), 6-17.	http://www.snr.missouri.edu/prt/faculty/morgan-m.php
Parks Rec and Tourism	Randy Vessell	applied management in parks, park policy	2002 State Economic Impacts of Missouri State Park Visitors. 2003 23 p	http://www.snr.missouri.edu/prt/faculty/vessell-r.php
Marketing	Marsha Richins	consumer values, materialism, products in people's lives	The Material Values Scale: A Re-inquiry into Its Measurement Properties and the Development of a Short Form. 2004 J of Consumer Res, 31 (June), 209-219	http://business.missouri.edu/156/312.aspx
Pol Sci	David Webber	public policy, environmental science and tech policy	The Emerging Federalism of Biotechnology Policy, 1995 Politics and the Life Sciences (February,).	http://politicalscience.missouri.edu/people/webber.html
Public Policy	Chris Fulcher	using GIS to evaluate socio-econ and enviro impacts group decisions		http://truman.missouri.edu/facultystaff/faculty.asp?FSID=33
Public Policy	David Konisky	state enviro regulatory competition and wetlands protection	Regulatory Competition and Environmental Enforcement: Is There a Race to the Bottom?, 2007. Forthcoming, Am J of Pol Sci.	http://web.missouri.edu/~koniskyd/
Public Policy	Lee Wilkins	communicating risk - natural and anthropogenic		http://truman.missouri.edu/facultystaff/faculty.asp?FSID=56
Religion	Robert M. Baum	religion and the environment	"West African Religions" and "Diola Religions" 2005 in: The Encyclopedia of Religion and Nature.	http://sociology.missouri.edu/
Rural Soc	Elizabeth Barham	environmental sociology, food systems	A full plate: challenges and opportunities for remaking the food system. 2007 in: Remaking the North American Food System. Lincoln: Univ Nebraska Press	http://web.missouri.edu/~barhame/
Rural Soc	Jere Gilles	natural resource management		http://dass.missouri.edu/ruralsoc/faculty/gilles-j.php
Rural Soc	Jose Garcia	sustainable agriculture		http://dass.missouri.edu/ruralsoc/faculty/garcia-j.php
Rural Soc	Mary Grigsby	voluntary simplicity movement	Buying Time and Getting By: The Voluntary Simplicity Movement. 2004 SUNY Press.	http://web.missouri.edu/~grigsbym/
Rural Soc	Mary Hendrick-son	food circles		http://dass.missouri.edu/ruralsoc/faculty/hendrickson-m.php
Rural Soc	Mary Leuci	comm info syst to foster sustainable development		http://dass.missouri.edu/ruralsoc/faculty/leuci-m.php
Rural Soc	Rex Campbell	social impacts of population change	A Revolution in the Heartland - web version: http://web.missouri.edu/~campbellr/Book/title.html	http://dass.missouri.edu/ruralsoc/faculty/campbell-r.php
Rural Soc	Sandy Rikoon	env soc, pol ecology, food security	Wild Horses and the Political Ecology of Nature Restoration in the Missouri Ozarks. 2006 Geoforum, (37:2): 184-199.	http://dass.missouri.edu/ruralsoc/faculty/rikoon-j.php

Rural Soc	Stephen Jeanetta	comm development, land use planning		http://dass.missouri.edu/ruralsoc/faculty/jeanetta-s.php
Sociology	Clarence Lo	petroleum politics & global warming	Marxist Models of the Capitalist State and Politics, Research in Political Sociology: Theoretical Directions in Political Sociology for the 21st Century, vol 11 2002 Elsevier Science, Ltd., 2002, pp. 197-231	http://sociology.missouri.edu/

Pollution - This area of research concerns the impacts, identification, separation, neutralization, minimization, and removal of pollutants from the environment and or living organisms. The subject areas include nitrogen, soil, heavy metals, atrazine, estrogenic compounds, polycyclic aromatic compounds, arsenic, airborne particulates, methane, antibiotics, and fecal bacteria. The investigative approaches include precision agriculture, microorganisms as alternatives to herbicides, cancer promotion, impacts on fetal development, green chemistry, clean processing, fate and transport in soils and water and effectiveness of barrier plantings.

Department	Name	Interests	Recent Publication	Website
Ag Res Ser	Kenneth Suddoth	precision agriculture, agr and env effects of site-specific management	An environmental assessment of sensor-based variable-rate nitrogen management in corn. 2006 North Central Extension Ind Soil Fertility Conf Proc	http://www.ars.usda.gov/pandp/people/people.htm?personid=5478
Ag Res Ser	Newell Kitchen	alt crop prod syst for ground water quality	Landscape and Conservation Management Effects on Hydraulic Properties on a Claypan-Soil Toposequence. 2007	http://www.ars.usda.gov/pandp/people/people.htm?personid=3042
Ag Res Ser	Robert Kremer	bio weed mgmt pesticide fate and soil quality	Occurrence of weed-suppressive microorganisms in soils of crop production fields [abstract]. 2007 Weed Sci Soc Am Meeting. Feb 4-9, San Antonio, TX	http://www.ars.usda.gov/pandp/people/people.htm?personid=3132
Ag Res Ser	Robert Lerch	transport of herbicides Karst water quality	Utilizing vegetative buffer strips to remove dissolved and sediment-bound atrazine, metolachlor and glyphosate from surface runoff [abstract]. 2006 in: ASA-CSSSA-SSSA	http://www.ars.usda.gov/pandp/people/people.htm?personid=3318
Ag Syst Mgmnt	Bob Broz	watershed management, extension		http://asm.missouri.edu/faculty/broz-r.php
Ag Syst Mgmnt	Willard Downs	air quality in agriculture		http://asm.missouri.edu/faculty/downs-w.php
Biochem	Dennis Lubhan	environmental estrogens	Phytoestrogens in common herbs regulate prostate cancer cell growth in vitro. 2004 Nutr Cancer. 49:200-208	http://biochem.missouri.edu/dlubahn.php
Biochem	Judy Wall	bioremed-iation of toxic metals by bacteria	Desulfovibrio desulfuricans G20 tetraheme cytochrome structure at 1.5 Å and cytochrome interaction with metal complexes. 2006 J. Mol. Biol.	http://biochem.missouri.edu/jwall.php
Biology	Frederich vom Saal	repro syst dev and estrogenic compounds	Estrogenic chemicals in plastic and oral contraceptives disrupt development of the fetal mouse prostate and urethra. 2005 PNAS 102: 7014-7019.	http://www.biology.missouri.edu/faculty/index.html
Chem Eng	Qinsong Yu	corrosion protection using green processes	Corrosion protection of ion vapor deposition (VD) Al-coated Al alloys by low-temperature plasma interface engineering: IVD", Progr in Org Coatings, 43, 24	http://che.missouri.edu/people/yu.html
Chem Eng	Thomas Marrero	oxygenated fuels emissions		http://che.missouri.edu/people/marrero.html

Chemistry	David Robertson	fine airborne particulates	Speciation of Elements in NIST Particulate Matter SRMs 1648 and 1650. 2000 J. Hazard. Mater. 74, 1-23	http://chem.missouri.edu/faclist.html
Chemistry	Sheryl Tucker	separation of PHAs from streams, lakes and rivers	Optimization of Micellar Liquid Chromatographic Separation of Polycyclic Aromatic Hydrocarbons with the Addition of Second Organic Additive. 2004 J. Sep. Sci. 27, 991.	http://chem.missouri.edu/faclist.html
Chemistry	Steven Keller	solid state materials for env remed or remote sensing		http://chem.missouri.edu/faclist.html
Chemistry	Susan Lever	chelating agents to remove heavy metals	The Presence of Lead Decreases the Availability of meso-2,3-Dimercaptosuccinic Acid in the Monobromobimane Assay. 1999 Chem Res Toxicol, 12, 1057-1065.	http://chem.missouri.edu/faclist.html
Chemistry	Sylvia Jurisson	detection, separation of radiometals	Inorganic .Extraction of Pertechnetate and Perrhenate from Water with Deep Cavity [CpFe(arene)]+ Derivatized Cyclotriveratrylenes, 2002 Chem., 41, 6028-6031.	http://chem.missouri.edu/faclist.html
Civ Env Eng	Baolin Deng	fate,trans-port of contam in drnkg water	Preparation and evaluation of GAC-based iron-containing adsorbents for arsenic removal. 2005 Environ. Sci. Technol., 39, 3833-3843.	http://web.missouri.edu/~dengb/
Civ Env Eng	Thomas Clevenger	movement of chemicals in environment		http://www.civil.missouri.edu/html/faculty/clevenger.htm
Forestry	Milon George	bioreme-diation with plants and microbes	Soil microbiological activities in vegetative buffer strips and their association with herbicide degradation. 2005 in: Moving Agroforest	http://www.snr.missouri.edu/forestry/faculty/george-m.php
Geology	Carol Wicks	ground water contam in Karst, sed in streams	Fate of 17 beta -estradiol in waters and sediment from karst streams. (in press) Env and Eng Geology	http://web.missouri.edu/~wicksc/
Geology	Cheryl Kelley	bigeochem-istry	Methane oxidation potential in the water column of two diverse coastal marine sites. 2003 Biogeochemistry, 65, 105-120	http://web.missouri.edu/~kelleyc/
Plant Sci	Arthur Karr	microbes for bio control and soil fertility		http://plantsci.missouri.edu/faculty/karr.htm
Plant Sci	Harlan Palm	precision agriculture		http://plantsci.missouri.edu/faculty/palm.htm
Plant Sci	John Lory	eff use of nutrients from manure		http://plantsci.missouri.edu/faculty/lory.htm
Soil Env Atm Sci	Clark Gantzer	soil, water conserv and management	Performance of grass barriers and filter strips under interrill and concentrated flow. 2006 J of Env Quality 35:1969-1974	http://www.snr.missouri.edu/seas/faculty/gantzer-c.php
Soil Env Atm Sci	Keith Goyne	fate and transport of pharmaceuticals in soils	Sorption of the antibiotic ofloxacin to mesoporous and nonporous alumina and silica. 2005 J. Colloid Interface Sci. 283: 160-170.	http://www.snr.missouri.edu/seas/faculty/goyne-k.php
Soil Env Atm Sci	Randall Miles	on-site waste water treatment and disposal	A Certification Program for the Inspection and Evaluation of Existing Onsite Wastewater Systems for Loan Transactions. 2004 Pp. 59-67. Onsite Wastewater Treatment Proc of the 10th Nat Symp	http://www.snr.missouri.edu/seas/faculty/miles-r.php

Resources - This area of research concerns the conservation and preservation of renewable and non-renewable resources and the discovery of new resources. The subject areas include water quality, wetlands, soy protein, pasture based dairy systems, biomass fuels, fuel cells, intelligent transportation systems, pedestrian traffic flow, storm water, snowfall, fish farming, forest fires, soil nutrients, oak decline, hydrogen storage, compost, edible fungi, and medicinal plants. The investigative strategies include watershed-scale analysis, prescription farming, fractionating plant oils, performance assessments of policy decisions, best management practices for storms and floods, forest fuel load management, video monitoring (deer cam), tree ring analysis, fractals, genes for insect and fungal resistance, and rainfall runoff modeling.

Department	Name	Interests	Recent Paper	Website
Ag Res Ser	John Sadler	watershed-scale hydrology and water quality	Landscape and Conservation Management Effects on Hydraulic Properties on a Claypan-Soil Toposequence 2007 Soil Sci Soc of Am. 71:803-811	http://www.ars.usda.gov/pandp/people/people.htm?personid=4892
Ag Syst Mgmnt	Allen Thompson	hydrology of submerged flow constructed wetlands		http://asm.missouri.edu/faculty/thompson-a.php
Ag Syst Mgmnt	Fu-Hung Hsieh	soy protein, vegetable oil plastics		http://asm.missouri.edu/faculty/hsieh-f.php
Ag Syst Mgmnt	Steve Borgelt	prescription farming		http://asm.missouri.edu/faculty/borgelt-s.php
Anim Sci	Barry Steevens	pasture based dairy systems	Comparison of Bermuda grass and Caucasian bluestem in a dairy grazing system. 2002 J. Dairy Sci., 85 (Suppl. 1).	http://animalsciences.missouri.edu/faculty/steevens/
Chem Eng	Galen Suppes	alternative fuels, fuel cells, PHEV technology	Energy Disclosed: Abundant Resources and Unused Technology.	http://web.missouri.edu/~suppesg/suppes.html
Chem Eng	William Jacoby	conversion of biomass into fuels and chemicals	Conversion of the Rosin Acid Fraction of Crude Tall Oil into Fuels and Chemicals. 2001 Energy and Fuels, 15, 1166-1172	http://che.missouri.edu/people/jacoby.html
Civ Env Eng	Carlos Sun	intelligent transportation systems		http://www.civil.missouri.edu/html/faculty/sun.htm
Civ Env Eng	Kathleen Trauth	public policy & decision making, performance assess, radio waste		http://www.civil.missouri.edu/html/faculty/trauth.htm
Civ Env Eng	Lee Peyton	storm water bmps, flood plain hydrology, ground energy systems		http://www.civil.missouri.edu/html/faculty/peyton.htm
Civ Env Eng	Mark Virkler	pedestrian characteristics of traffic flow		http://www.civil.missouri.edu/html/faculty/virkler.htm
Civ Env Eng	Robert Reed	water & wastewater treatment, env regs		http://www.civil.missouri.edu/html/faculty/reed.htm
Civ Env Eng	Shawn Yunsheng Xu	green building, renewable energy, industrial processing analysis		http://www.civil.missouri.edu/html/faculty/xu.htm

Civ Env Eng	Zhiqiang Hu	biological treatments, emerging energy systems		http://www.civil.missouri.edu/html/faculty/hu.htm
Elec Comp Eng	Curt Davis	remote sensing, ice sheet mapping	Snowfall-driven growth in East Antarctic ice sheet mitigates recent sea-level rise. 2005 Science308, No. 5730, pp. 1898-190	http://www.ee.missouri.edu/?page=davis
Elec Comp Eng	Randy Curry	environmental applications		http://www.ee.missouri.edu/?page=curry
Elec Comp Eng	Zhihai He	video monitoring (incl. wildlife "DeerNet")		http://web.missouri.edu/~hezhi/
Fish & Wildl	Rob Hayward	fish bioenergetics, population dynamics and aquaculture	Inherent growth capacity and social costs of bluegill and hybrids of bluegill and green sunfish: which fish really grows faster? 2002 N Am J of Aquaculture 64:34-46.	http://www.snr.missouri.edu/fw/faculty/hayward-r.php
Forestry	Bruce Cutter	tree growth-wood interactions	The effect of thinning and prescribed fire on fuel loading in the Central Hardwood Region of Missouri. 2004 pp 168-178 in Proc. 14th Central Hardwood Conf	http://www.snr.missouri.edu/about/cutter-b.php
Forestry	Gene Garrett	agroforestry	Ability of forage grasses exposed to Atrazine and Isoxaflutole (Balance TM) to reduce nutrient levels in soils and shallow ground water. (in press) Comm in Soil Science and Plant Analysis	http://www.snr.missouri.edu/forestry/faculty/garrett-h.php
Forestry	Hank Stelzer	best management practices for watersheds		http://www.snr.missouri.edu/forestry/faculty/stelzer-h.php
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Geology	Martin Appold	hydrogeology		http://web.missouri.edu/~appoldm/
Physics	Peter Pfeifer	physical properties of solids and materials - hydrogen storage	Wetting Transition and Screening Transition on Fractal Surfaces: Critical Phenomena Which Do Not Exist on Flat Surfaces (submitted) Phys. Rev. E.	http://web.missouri.edu/~umcasphysweww/people/PeterPfeifer.html
Plant Sci	Bill Wiebold	cropping systems with reduced impacts, grower education		http://plantsci.missouri.edu/faculty/wiebold.htm
Plant Sci	Chris Starbuck	composts from sawdust, manure, other organic residues		http://plantsci.missouri.edu/faculty/starbuck.htm
Plant Sci	David Trinklein	biological control of greenhouse pests		http://plantsci.missouri.edu/faculty/trinklein.htm
Plant Sci	Georgia Davis	identifying genes, mech resp for insect, fungal resist in maize		http://plantsci.missouri.edu/faculty/davis.htm

Plant Sci	James English	env benign methods of disease control using resistance in plants		http://plantsci.missouri.edu/faculty/english.htm
Plant Sci	James Wrather	integrated disease management		http://plantsci.missouri.edu/faculty/wiebold.htm
Plant Sci	Jeanne Mihail	Armillaria pop growth, cultivating specialty fungi in riparian corridors	Opportunistically pathogenic root rot fungi - Armillaria species. 2003 pp 337-346 in: North American Temperate Deciduous Forest Responses to Changing Precipitation Regimes.	http://plantsci.missouri.edu/faculty/mihail.htm
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Plant Sci	Leszek Vincent	botanical and medicinal aspects of medicinal plant of the U.S. and South Africa		http://plantsci.missouri.edu/faculty/vincent.htm
Plant Sci	Reid Smeda	alternative weed management systems		http://plantsci.missouri.edu/faculty/smeda.htm
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