

The Impacts of Campus Activities on the Environment 2005 Update

July 26, 2006

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. Since this initial report, the Committee has conducted annual updates. This report presents data for 2005. There are three new areas of exploration in this Impacts report, including a section on Campus Dining and a table of environmental-related research being conducted at MU, as well as a new section on Student and Organizational Environmental Efforts.

Methods

Questionnaires were distributed to various campus departments in the early months of 2006. These surveys ask for both qualitative and quantitative information to follow up on information from previous reports (released in 2003, 2004, and 2005). In addition to the surveys, follow up questions were also asked to better define resource usage and impacts. This report contains a summary of the collected information about the year 2005 and makes comparisons with previous reports, when possible and appropriate.

The Research Committee compiled information from the interviews and reports supplied by units into narratives covering each category. These were returned to the heads of units for fact checking. Unit heads were informed that the narratives would be part of a published assessment of MU's environmental stewardship. Once the narratives were returned, we edited them into a single report on MU's environmental stewardship. The individual summaries are presented next.

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. Though such information was not collected for the initial report, some general statistics were collected for the past two years. These statistics for FY2005 are as follows:

Demographic	FY03	FY04	FY05
# Full Time Students (full-time equivalents)	22,550	23,055	23,707
# Faculty and Staff (full-time equivalents)	10,489	10,522	11,380*
Campus Expenditures (excluding hospital):	\$697,816,000	\$745,175,000	\$816,972,148
Gross Square Feet of Campus (excluding hospital)	12,976,507	12,607,378	14,247,117
Gross Square Feet of Hospital	--	--	2,579,319
Hospital Expenditures	--	==	\$458,706,424
* Number of Faculty/Staff in 2005 includes 756 from extension, which were not included in 2004			

It should be noted that the Committee has had difficulty getting meaningful and accurate numbers for some of these parameters in years past—particularly number of employees and gross square feet of buildings. As a result, we suggest the reader focus on the gross impacts described below rather than trying to adjust impacts based on the specific number of students, staff, budget or gross square feet.

Residential Life

Estimates of Resource usage by students.

Statistic	2004	2005
Capacity of Residence Halls	6,026	6,033
Gallons of water per day	33	27
Kilowatt hours of electricity per day	5.6	432
Pounds of solid waste per day	1	1

Residential Life has continued a number of environmental initiatives. Assigned staff empty recycling containers on a weekly basis. Each floor has one recycling container for paper/cardboard and another for plastic/glass/aluminum/metal. Asbestos removal is constant, especially for pipe insulation and floor tile as areas are upgraded and improved. Florescent bulb recycling is continuing to work well.

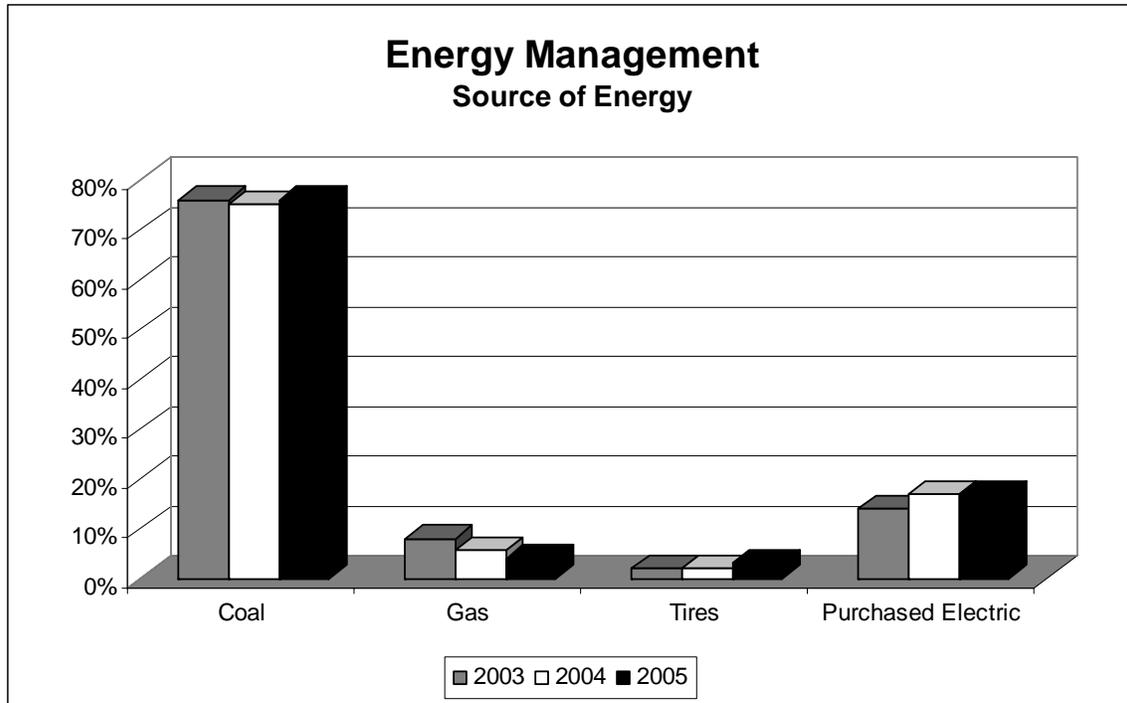
All residence halls are smoke free due to no smoking policies in place for residents.

In Spring 2005, Residential Life began on a 3 to 4 year program to add recycling containers on the exterior of all residence halls and in parking lots that Residential Life operates. Placement will be adjacent to existing exterior trash containers

Energy

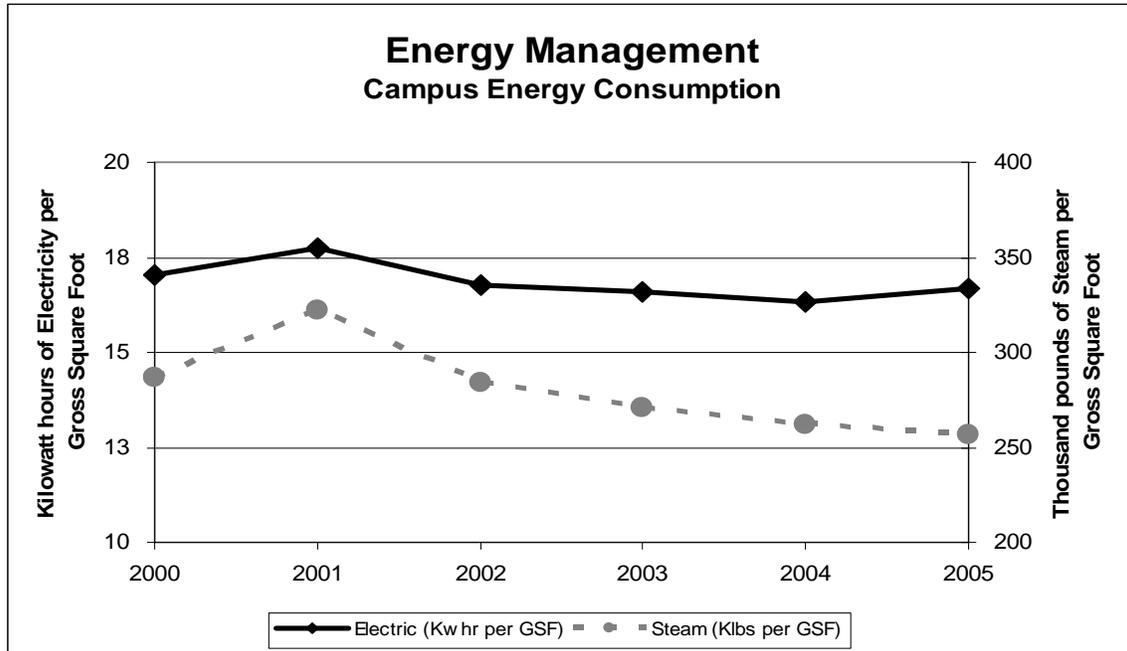
Energy Management, a unit within Campus Facilities, is responsible for providing energy to campus. The area that Energy Management provides services for includes the Columbia campus and University Hospital and Clinics. Steam, but no electricity, is provided to the VA Hospital. Ellis Fischel Cancer Center and Columbia Regional Hospital obtain energy from the City of Columbia.

In FY2005 the campus consumed 217 million kilowatt-hours of electricity, a 6.4% increase over FY2004. The campus also consumed 2.5 billion pounds of steam, a figure that has remained the same since FY2003. Compared to FY2000, these numbers represent a nearly 11% increase in kilowatt-hours of electricity consumed and a 1.6% decrease in steam consumption overall. In FY2005 energy was provided from the following sources: coal—76%, gas—4%, tire-derived fuel—3%, purchased electricity--17%. These percentages are essentially the same as FY2004. The campus also consumed 27 million ton-hours of chilled water in FY2005, an increase of 1.3 million ton hours from FY2004.



Energy Management continues to maintain an aggressive and proactive program of energy conservation projects. In FY2005 projects were completed in the Nursing School, Reynolds Alumni Center, and Schweitzer Hall, including replacement of cooling units, improving the efficiency of ventilation systems, and installing occupancy sensors/automatic lighting controls. These three projects had an average investment of \$92,000 and average expected energy savings of \$29,000 annually per project. These figures work out to an average payback time of 3.2 years, with additional savings to continue for the life of the building.

The energy conservation efforts of FY2005 trimmed an additional 2.8% from the campus energy bill, with similar savings expected in the future. Overall, Energy Management has reduced the campus energy bill by \$3.3 million annually through energy conservation initiatives since initiating its energy conservation program in the early 1990's.



Hazardous materials

Environmental Health and Safety (EHS) is responsible for coordinating the campus' program for safe and environmentally sound management of hazardous (chemical) materials. If handled improperly, hazardous materials may present hazards to students, faculty, and staff as well as expose MU to potential regulatory enforcement actions. EHS has direct responsibility for managing the campus' hazardous wastes. Improper disposal of hazardous wastes may cause pollution of air, water and soil. Environmental Health and Safety coordinates the campus hazardous waste management program. The service area for these programs includes the main MU campus, University Hospital and Clinics, Ellis Fischel Cancer Center, and Columbia Regional Hospital. EHS also oversees environmental compliance at a number of outlying facilities.

EHS has disposed of the following materials since 2002:

Material	2003	2004	2005
EPA regulated Hazardous Waste	161,000	129,000	116,700
Medical/pathological waste	415,000	443,000	480,000
Low level radioactive waste	40,400	37,000	20,700
Regulated wastes (special projects)	480,000	227,000	400,000
Mixed wastes (radioactive/haz waste)	800	840	335
Used oil	9,900	13,800	11,500
Universal waste	15,900	33,500	33,100
other (specify)	0	0	0

Note: All measurements are in pounds

EHS has written procedures, the Hazardous Materials Management Manual, to guide its operations. EHS overhauled its website in January 2005. EHS procedures undergo constant review.

In FY05, a retraining program was launched to address common problems being observed by staff. All registered users of hazardous materials were notified that retraining of all staff using chemicals was required, since procedures had changed significantly since the last training update. Additionally, the entire training program was overhauled to add emphasis on safety when working with chemicals. An FAQ about the retraining was posted on the EHS website (<http://ehs.missouri.edu/train/chemical-faq.html>). According to EHS, through the end of the fiscal year, 48 classes had been held and 1,754 persons on campus had been retrained.

EHS staff has annual training requirements under the Resource Conservation and Recovery Act. Additionally, staff that provide emergency response services comply with retraining requirements of OSHA's Hazardous Waste Operations and Emergency Response Standard (HAZWOPER) program.

While there were no new projects started or completed in FY05, the ongoing chemical recycling program continues to provide a win-win situation for the campus: the university avoids disposal costs for materials that enter the program, and campus users avoid purchase costs from materials taken back out of the program. In FY05, 2,451 container were distributed out of the program with an avoided purchase cost (adjusted for MU discounts) of \$117,600. (Avoided disposal costs are not available at this time.)

In the long term, EHS has plans to tighten the communication between the Registered User (RU), his/her chemical workers and EHS. EHS states, "We believe that providing better tracking of individuals and training those persons will result in a stronger awareness of chemical hazards and the need to reduce those hazards to whatever practical extent is possible."

Printing Services

Printing services reported a variety of resource usage statistics for FY2005.

For ink usage, the breakdown is as follows: Soy/vegetable—5%, Metallic Inks—15%, Low VOC petroleum-based—80%. These figures show 10% higher use of metallic inks and 10% lower use of low VOC vegetable based inks compared to both FY2003 and FY2004. Although this shift in usage is not ideal from an environmental standpoint, the Printing Services staff pointed out that much of their ink and paper use is dictated by the needs of the customer, and thus the department itself has little control over these figures.

The cost of purchasing paper was reported at \$1.5 million in FY2005, a 3% increase over the cost for FY2004. The FY2005 figure remains \$540,000 below the paper cost for FY1997. Digital processing accounted for 20% of business, compared to 12% in FY2003 and 18% in FY2004.

Printing Services reported using twelve 55-gallon drums of Varn 230 offset press roller cleaner and fifteen 55-gallon drums of Barsol A 4267 blanket wash, both of which are considered toxic chemicals.

In Calendar Year 2005, the following amounts of materials were recycled by Printing Services:

Material	Amount (in pounds)
Coated Book Bales/Skids	650,000
Cardboard	26,500
Glue Bales	5,200
Misc. Skids	55,000
Misc. Bales	8,900
Aluminum Plates	14,000
Film	2,100*
* Due to a change in technology, Printing Services no longer produces waste film, but there is still some stored film that is being recycled as time permits	

Planning, Design, and Construction (PD&C)

Planning, Design and Construction, a unit with Campus Facilities, is responsible for master planning, new building design and construction, additions, renovations, and for overseeing construction projects. In FY2005, campus construction totaled approximately \$100 million dollars, 6.5% less than the previous year.

The following “environmentally friendly” specifications are included in bids:

- Developed specifications for safe removal of hazardous materials
- Low VOC paints
- Formaldehyde free wood materials
- Minimize use of off-gassing from solvents and adhesives
- High efficiency windows to reduce energy consumption
- Sensor devices for HVAC and lighting controls
- Using sustainable/recyclable products for interior finishes and furniture.
- Storm water retention areas to reduce site runoff.

- Developed specifications for grinding/pulverizing demolition materials for use as on site fill to reduce debris removal.

The PD&C professional staffs receive continual training as part of their professional licensing/certification requirements. This training is provided by vendors/manufacturers/suppliers to keep the design and construction industry updated on all new product and technological improvements. Training is carried out through a variety of professional organizations, including Envirodesign, the Association of University Architects, and the American Institute of Architects. Staff have also received LEED training, participated in the Greening of the Heartland conference and attended Construction Specification Institute seminars.

As sustainable building practices have moved from the fringes of the construction and design world into the main stream, vendors in the design industry have increased efforts to “go green”. This puts greater responsibility on the designer to ensure that manufacturer claims are reasonable and valid with respect to environmental qualities.

Environmental successes in the past year include the forming of, “The Green Group,” a grassroots network of campus environmentally focused individuals working to increase awareness and interest in sustainability on campus. This group is headed by the Manager of Interior design.

Landscape Services

Landscape Services, a unit with Campus Facilities, has responsibility for implementing the campus landscape master plan, maintaining grounds and landscape for most of campus, litter collection, snow removal, and the campus trash removal contract. Landscape Services maintains 296 acres of green space on campus. This does not include University Hospital, the golf course, or naturalized areas owned by the campus.

In FY2005 over half of the permanent staff hold 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 FY2005, Landscape Services only used high-grade synthetic and organic fertilizer. These types of fertilizers have a slow-release system, which means the applied fertilizer releases nutrients evenly throughout the year and largely mitigates chemical runoffs. The tonnage of synthetic versus organic fertilizer is irrelevant and environmental effects are instead impacted by the quality of fertilizer and its application on the soil.

In FY2005, Landscape Services used the following for ice control: 40 tons of sand, 12 tons of potassium-chloride ice-melt compounds, and 75 tons of salt. Sand usage is down 44% from the previous year while ice-melt compounds usage is up by 50%. No cinders were used for ice control by campus during the year.

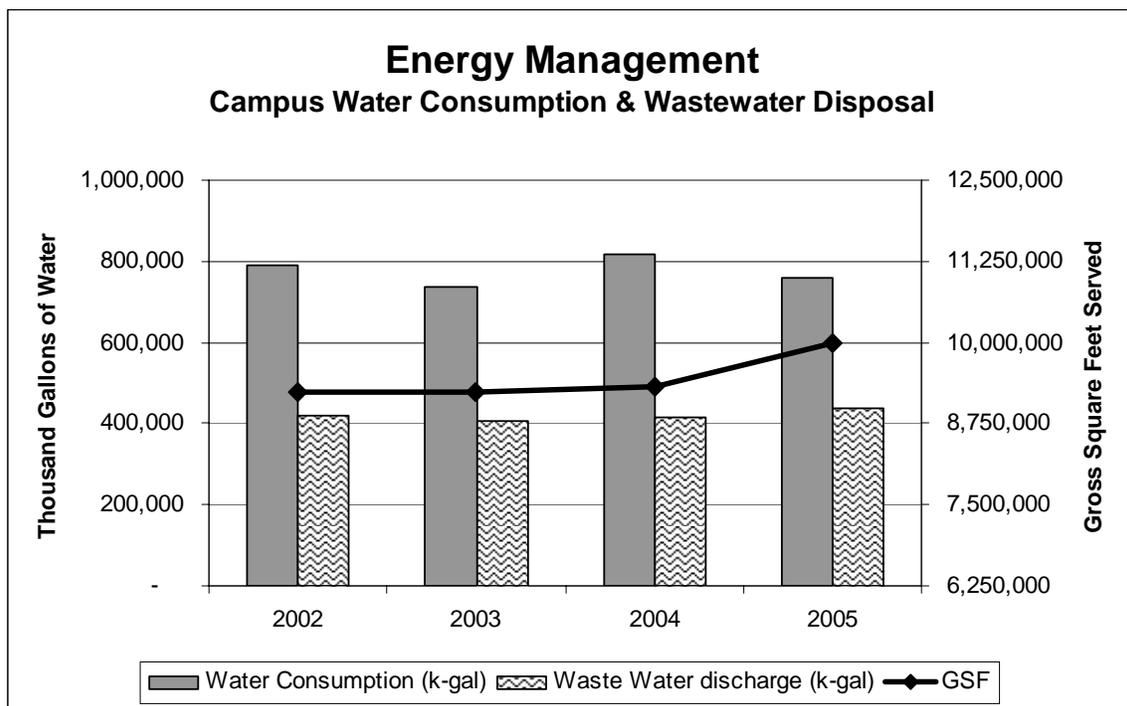
Landscape Services estimates there are 7,500 landscape trees on campus. Roughly 75.6 tons of landscape waste was mulched or recycled.

Environmental successes in the past year include Tiger Tailgate Recycling, a program to place recycling bins at home football games for tailgaters to throw recyclables into and then collect the bins through the use of volunteers from the environmental club on campus, Sustain Mizzou. This resulted in the diversion of 12 tons of recyclables in 6 games and recognition by Anheuser-Busch for environmental achievement. Additionally, 110 bins for collection of glass, plastic, and aluminum and cardboard containers and green totes were added to residence halls and buildings throughout campus to increase locations where recyclables can be deposited. The university also received a district H grant for event recycling bins.

Water

Energy Management, a unit within Campus Facilities, is responsible for providing drinking water to campus and tracking wastewater discharged to the Columbia sanitary sewer system. The service area includes the Columbia campus and University Hospital. In FY2005, the campus consumed 761 million gallons of water and discharged 436 million gallons to the sanitary sewer system. These numbers represent a 7% decrease in water consumed and a 5% increase in wastewater discharged over FY2004 levels.

Energy saving technologies and water/wastewater efficiencies are incorporated into the designs for new buildings to reduce water usage and operating costs for the life of the building.



Solid Waste and Recycling

Solid Waste and Recycling duties are managed by Landscape Services and Procurement and Materials Management (PMM). The Solid Waste and Recycling service area includes the main MU campus, Records Management, Printing Services and University Hospital and Clinics.

Total solid waste sent to the Columbia landfill in FY2005 was 6,156.56 tons, a 1.5% increase from FY2004 and a 6% increase from FY2003.

Recycling Statistics for Calendar Year 2005 are as follows:

Item	Pounds recycled
Mixed Office Paper	979,452
Newsprint	320,533
Cardboard	624,975
Cardboard—Compactors/ Fiber	295,588
Cardboard—Bingham Drop-off Roll-off	46,940
City Phone Books	10,000
University Phone Books	5,000
Records Center—Recycled Paper	360,080
Printing Services—Cardboard	25,231
Printing Services---Printer Mix (Paper)	674,069
Glass	4,200
Aluminum (Printing Services)	13,950
Other Roll Off Containers (Glass, Tin, Aluminum, Plastic, etc.)	63,680
Others	
Fluorescent Light Bulbs	20,277
Batteries	3,048
Yard Waste	151,200
Scrap Metal (Energy Mgmt.)	188,200
Tire Derived Fuel TDF (Energy Mgmt.)	6,074,000
Power Plant Ash (Energy Mgmt.)	40,403,600

In December of 2004, MU hired a Solid Waste and Recycling Coordinator. During 2005, the Solid Waste and Recycling Coordinator managed to save the University thousands of dollars annually on the hauling of its solid waste. The coordinator reported that in December of 2004 the university was paying \$31,210.59 a month to the City for services. Currently, the university is only paying the city \$24,852.81 a month. This was accomplished by auditing containers and removing unnecessary dumpsters, which had a direct impact of \$48,786.24 in total savings annually. These savings more than justify the need for this position, as the position more than pays for itself. Additionally, these savings have been used to help Landscape Services fund this position and expand some campus recycling efforts. In December of 2005, the position was extended to June of 2006. At that point, the position will be evaluated and may or may not be made permanent.

A Tiger Tailgate Recycling project was initiated this year as a cooperative project between the Solid Waste and Recycling Coordinator, Landscape Services, the City of Columbia, and the student group Sustain Mizzou, and was sponsored by Anheuser-Busch Recycling. The Solid Waste and Recycling Coordinator was the principal organizer of this project. This project diverted an additional 12 tons of recyclable beverage containers from the landfill over the course of 6 home football games (this figure is not included in the roll off container figure above for glass, tin and aluminum).

The Solid Waste and Recycling Coordinator applied for a grant from the Mid Missouri Solid Waste Management District for several items to improve recycling efforts at MU. The grant was partially approved in the amount of \$10,319.03 for special event recycling containers. The Solid Waste and Recycling Coordinator reported that he anticipates additional funding in the next grant cycle.

Environmental 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.

The table shows numbers of current and graduating students in majors whose principal focus is environmental:

Department	Sub-divisions	Current Undergrad Majors	2005 Graduates	Current Masters	2005 Masters Graduates	Current PhD	2005 PhD Graduates
Environmental Studies	Major	6	1	---	---	---	---
	Certificate	5	6	---	---	---	---
Forestry & Wildlife		147	35	21	9	19	2
Forestry		84	14	18	4	15	3
Parks, Recreation and Tourism		111	22	11	4	---	---
Soil, Environmental and Atmospheric Sciences		102	12	18	7	11	2

Over 90 faculty in 21 departments in 5 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 -- The conservation of living species, ecological communities and/or ecosystems

Human Dimensions -- The economic, sociological, historical and political aspects of human interactions with the environment

Resources -- The conservation and preservation of renewable and non renewable resources and the discovery of new resources

Pollution -- The identification, separation, minimization, and removal of pollutants from the environment

There can be considerable overlap in these categories; heavy metals get into wildlife, human waste gets into water, and business decisions influence traffic corridors. However, grouping research, scholarship and service by these main categories does a more effective job of showing how and where MU faculty are contributing to solving environmental problems than using departmental affiliations. A detailed listing of faculty and their area of research appears in the Appendix.

Farm Operations

The College of Agriculture, Foods, and Natural Resources manages 22 farms and centers on 14,500 acres throughout the state for various research purposes. This is a correction from FY2002, when data was first collected for this survey. There is no farm operations data for FY2003 or FY2004.

Each location handling hazardous materials is required to comply with the same Registered User program that Environmental Health and Safety provides and directs. EH&S does on-site inspections of the facilities and works with stations and personnel in the transport of hazardous materials. At many of the outlying centers and farms only one or a few persons will be Registered Users and the rest of the staff (size of staffs range from 0 to 14) will work under their supervision.

Less than 1% of the crops are non-approved genetically modified organisms (GMOs) crops. Approved crops have met FDA and EPA standards for use as feed or food and therefore do not pose a risk of contamination of other strains of similar crops when handled under the conditions set forth for their handling. Inspections by the Federal Animal and Plant Health inspection Service (APHIS) and the Missouri Department of Agriculture (MDA) are typical during the growing season. Scientists work with the Biological Safety Committee to assure compliance. Non-approved GMO crops are destroyed according to protocol, in most cases long before viable grain develops. Protocol for dealing with spills of hazardous materials and transgenic crop disposal and use is addressed at an annual meeting.

Sixteen of the locations reported that they used a total of 424 tons of fertilizer as part of their operations. Data were not available from the other six locations, though two of those are not likely to use fertilizer. Used oil is recycled for space heating. In 2005, 2,000 gallons of used oil from four of the centers were used for this purpose. In addition, 110 gallons of used oil were collected by a recycler from two additional locations.

There are many research initiatives at the farms and centers with an environmental focus. These include:

- Rigorous soil testing that over a period of 3 to 5 years updates current fertility levels
- Utilization of lagoons to manage animal wastes, as well as for recovery of nutrients for fertilization purposes.
- Extensive training of industry personnel in Integrated Pest Management techniques to reduce pesticide use
- Establishment of wildlife studies (quail, song & migratory birds) at Bradford Research & Extension Center
- Private and Commercial Pesticide Applicator Training and Certification is coordinated by Dr. Wayne Bailey in conjunction with the Missouri Department of Agriculture
- Pasture Based Dairy operation at the Southwest Center is designed to better manage some of the environmental challenges of confined dairy operations, and the prototype at the Mt. Vernon Center has been copied multiple times by the public.
- Three paired watersheds at one Center that document water quality and run-off amounts of water and soil
- Demonstration and research of a controlled drainage and sub-irrigation project that promises low impact environmental aspects while adding significantly to yield of crops.

Some of the trends seen at the farms and centers include the following:

- Farm programs are focusing more on conservation and less on production. Centers and farms are structuring their programs to provide more training for landowners.
- Increased cooperation and collaboration between Missouri Department of Conservation and MU Centers and Farms on projects with public appeal/education
- Precision Agriculture that applies a prescribed amount of fertilizer, lime, herbicide, etc. on land is a focus of several farms
- Ammonium nitrate and anhydrous ammonia are becoming harder to acquire due to reactive forces and methamphetamine use respectively. Security and inventory control is being upgraded.

Campus Dining

Campus Dining Services is the organization at MU for most food and food retail services. CDS operates 10 residential locations and 11 retail locations. Examples of residential locations include Plaza 900 and Baja Bingham. Retail locations include Union Square cafeteria in Memorial Union and Bookmark Café in Ellis Library. CDS uses a number of different units to track information; those figures are used.

CDS registered a total of 3.6 million transactions (July 1, 2004, through June 30, 2005). The number of transactions is split between residential locations, with 2 million transactions, and retail locations, with 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, etc.

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 \$5.61 million for the 2004-2005 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.

USDA Organic is one indicator of food impact. For example, the use of USDA Organic foods can signify that foods are being produced without pesticides and chemical fertilizers. Many of these foods are currently inaccessible to CDS, and no current USDA Organic or otherwise certified food is used.

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. One measure of food impacts is a food mile, or “the distance food travels from where it is grown or raised to where it is ultimately purchased by the consumer or other end-user” (Pirog et al. 2001). These measurements of environmental impacts are still in development, but may be of value in selection of food in the future.

In a pilot project, Plaza 900 served local apples, from Mid-Missouri orchards. One of the theories behind the project is that local food travels less distance and thus has reduced food miles, generating less pollution during the transport phase. CDS plans to investigate a local supply for tomatoes for the fall of 2006. These projects contribute to a “Farm to College” CDS program at Mizzou, which emphasizes local food options. Some of local foods may or may not be organic, depending on availability and price.

Vegetarian options are also available at all meals. Dobbs Pavilion, one of the residential all-you-care-to-eat locations, offers a vegan option at lunch and dinner. CDS is investigating the possibility of offering vegan options at all meals.

CDS looks for energy-efficient upgrades and Energy Star products as they replace equipment.

Student and Organizational Environmental Efforts

The research committee has realized that there are several organizations on campus that are working to promote environmentally sustainable practices, but are not affiliated with any of the departments described above. The Student and Organizational Environmental Efforts section of the report will henceforth highlight and describe work going on within the campus community to promote environmental practices. This year the committee communicated with three groups on campus about their efforts; The Planeteeers, Sustain Mizzou, and the Technotrash program. Details about each organization or program are as follows:

The Planeteeers

The Planeteers are a new student-lead organization on campus devoted to environmental stewardship. Members of this group meet at a designated location on campus once a week to pick up litter, which they then separate into two bags; one for trash and one for recyclables. The Planeteers formed in February of 2006, and report collecting approximately 1.5 trash bags of litter at each weekly meeting. The group has also been involved in placing “Dump No Waste—Leads to Stream” stickers on storm drains on and near campus. At this point in time there are 8-10 consistent and dedicated members.

Sustain Mizzou

Begun in the fall of 2003, Sustain Mizzou has become the primary organization for student environmental action on campus. According to the organization’s constitution, “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”. One of Sustain Mizzou’s key beliefs is that environmental health is not a political issue, but an issue of human rights, and thus the organization has a commitment to remain non-partisan and work with any group or individual with a concern for the environment and issues of sustainability.

Sustain Mizzou sends an email newsletter to its listserv of nearly 300 people every Monday, and attendance at any of the group’s biweekly meetings averages 28 people. The organization has seen large growth in participation over the past year, and that growth is expected to continue in the near future.

Sustain Mizzou coordinates multiple projects throughout the academic year, most notably Tiger Tailgate Recycling and the Local Food Drive. Tiger Tailgate Recycling, as previously mentioned, was a cooperative project between the Solid Waste and Recycling Coordinator, Landscape Services, the City of Columbia, and Sustain Mizzou, and was sponsored by Anheuser-Busch Recycling. In this program over 12 tons of material was recycled in 6 home football games. The Local Food Drive campaign raised \$3,000 last year for the purchase of locally produced food to supply to the Central Missouri Food Bank. In addition, Sustain Mizzou has multiple other programs, including producing and selling recycled notebooks, the Recycling Ambassadors outreach/education program, Recycle Mountain, Footprint sustainability magazine, and numerous service activities throughout the year. The group hosts a table every week on Wednesdays in Brady Commons for the collection of ink cartridges, Add Sheets, and batteries. Additionally, Sustain Mizzou continued to play a large role in campaigning for the Solid Waste and Recycling Coordinator position and other waste/recycling improvements on campus. Further details on these projects are available on Sustain Mizzou’s website (www.sustainmizzou.org).

Sustain Mizzou received the Best Service or Honorary Organization Award in the 2004-2005 academic year and the Best Large Organization Award for the 2005-2006 academic year (both awards from the Department of Student Life) for all of its efforts.

Technotrash

The Technotrash program is an electronic waste mitigation project, part of a research unit of the USDA's Agricultural Research Service located on the MU campus. There are approximately 20 Technotrash cans in Ellis library collecting technology-related waste for recycling. As of October 7, 2005, the program had recycled 14 laser toner cartridges, 85 inkjet cartridges, 1 laser fuser unit, 68 broken jewel cases, 5 rechargeable batteries, 355 floppy disks, and 199 compact disks, for a total weight of 140 pounds of material recycled. Technotrash cans are available for use by anyone on campus. Additionally, the project addresses other electronic waste issues, such as promotion of energy conservation and encouraging double-sided printing.

Research Reactor

No new information was received for 2005.

Procurement

No new information was received for 2005.

Summary and Conclusions

The Committee found that many good practices have been implemented. On the other hand, the Committee also found many areas of opportunity. Fiscal concerns and human behavior often place significant constraints on what can be accomplished. It is the aim of the Committee to be understanding in these matters while still holding a vision in mind for the sort of environmentally sound campus we would like to become.

The committee views this report as a method of informing the campus community about environmental efforts, challenges, and successes on campus, as well as a method of tracking and reporting data on an annual basis. We welcome feedback about the data collected, the way the material is presented and about any conclusions that are drawn. We intend to make future reports more comprehensive by continuing to increase the amount of quantitative data included and by adding other units.

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Campus Dining:	Sandy Perley, Campus Dining Services
Energy:	Ken Davis, Energy Management
Environmental Education:	Jan Weaver, Environmental Studies
Farm Operations:	John Poehlmann, CAFNR
General Campus Statistics:	Mary Reichel, EHS
Hazardous Materials:	Peter Ashbrook, EHS
Landscape Services:	Charles Paxton, Landscape Services
Planning Design and Construction:	Bob Unrath, PD&C
Printing Services:	Rick Wise, Printing Services
Residential Life:	Kirsten Kennedy, Residential Life
Solid Waste and Recycling:	Phil Shocklee, Campus Facilities
Water and waste water:	Ken Davis, Energy Management

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The 2005-2006 members of the Environmental Affairs Committee are:

Chair: N. Patrick Peritore
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Daniel Hooley, Classical Studies
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Dennis Miller, Psychological Sciences
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Bob Unrath, Design/Construction
Caitlin Alexander, Missouri Students Association
Heather Clenin, Sustain Mizzou
Jared Cole, Missouri Students Association
Kelli White, Missouri Students Association
Travis Elliott, Graduate Professional Council
Amber Langston, Graduate Professional Council
Chadwick Rittenhouse, Graduate Professional Council
Phil Shocklee, Campus Facilities
Jan Weaver, Environmental Studies
Peter Ashbrook, Environmental Health & Safety

Appendix: Table of MU Environmental Research.

The table sorts information first by the four areas, then by department, and then by faculty members' last names. Where available, it includes information on the research area and/or a recent publication by that faculty member.

Area	Name	Department	Research Area	Recent Publication
Biodiversity	James Carrel	Biology	Conservation biology of spiders	Carrel, J.E. 2003. Burrowing wolf spiders, <i>Geolycosa</i> ssp. (Araneae: Lycosidae): gap specialists in fire-maintained Florida scrub. <i>Journal of the Kansas Entomological Society</i> 76: 557-566
Biodiversity	Jim Coleman	Biology	Responses of desert ecosystems to environmental change	Nowak, R.S., S.F. Zitzer, D. Babcock, V. Smith-Longozo, T.N. Charlet, J.S. Coleman, J.R. Seemann and S.D. Smith. 2003. Elevated atmospheric CO ₂ does not conserve soil moisture in the Mojave Desert. <i>Ecology</i> : accepted.
Biodiversity	Lori Eggers	Biology	Ecological and conservation genetics of elephants	Eggert, L. S., Maldonado, J. E., and Fleischer, R. C. 2005. Nucleic acid isolation from ecological samples: animal scat and other associated materials. In: <i>Molecular Evolution: Producing the Biochemical Data, Part B. Methods in Enzymology</i> 6:73-87
Biodiversity	John Faaborg	Biology	Avian ecology, behavior and conservation	Faaborg, J. 2004. How do birds respond to clear-cuts? A forest management experiment in the Ozarks. <i>Environmental Review</i> 11 (3): 1-8.
Biodiversity	Candace Galen	Biology	Effect of climate on plant pollinator systems	Galen, C., and M. L. Stanton. 2003. Sunny-side up: flower heliotropism as a source of parental environmental effects on pollen quality and performance in the snow buttercup, <i>Ranunculus adoneus</i> (Ranunculaceae). <i>Am. J. Bot.</i> 90: 724-729.
Biodiversity	Raymond Semlitsche	Biology	Conservation of declining amphibian species	Semlitsch, R.D., and Bodie, J.R. 2003. Biological criteria for buffer zones around wetlands and riparian habitats for amphibians and reptiles. <i>Conservation Biology</i> 17: 000-000
Biodiversity	David Galat	F&W	Large river flood plain ecology	Galat, D. L. and R. Lipkin. 2000. Restoring the ecological integrity of great rivers: historical hydrographs aid in defining reference conditions for the Missouri River. <i>Hydrobiologia.</i> 422/423: 29-48.
Biodiversity	Matthew Gompper	F&W	Biology and conservation of mammalian carnivores	Gittleman, J.L. and Gompper, M.E. (2005) Plight of predators: The importance of carnivores for understanding patterns of biodiversity and extinction risk. Pp. 370-388 in: (P. Barbosa and I. Castellanos, eds) <i>Ecology of Predator-Prey Interactions</i> . Oxford U

Biodiversity	Josh Millspaugh	F&W	Wildlife stress physiology, management of large mammals	Schulz, J. H., J. J. Millspaugh, A. J. Bermudez, X. Gao, T. W. Bonnot, L. G. Britt, and M. Paine. 2006. Experimental acute lead toxicosis in mourning doves. <i>J. of Wildlife Mgmt</i> : In press
Biodiversity	Douglas Noltie	F&W	Reproductive ecology and behavior of fishes	Schubert, A. L. S., C. D. Nielsen, and D. B. Noltie. 1993. Habitat use and gas bubble disease in southern cavefish (<i>Typhlichthys subterraneus</i>). <i>International Journal of Speleology</i> 22(1-4):131-143.
Biodiversity	Charles Rabeni	F&W	Conservation, restoration of aquatic systems	Zweig, L.D. and C. F. Rabeni. 2001. Biomonitoring for deposited sediment using benthic invertebrates: a test on 4 Missouri streams. <i>Journal of the North American Benthological Society</i> . 20:643-657.
Biodiversity	Mark Ryan	F&W	Endangered species, avian ecology and conservation	Ryan, M. R., R. A. Pierce, III, K. M. Suedkamp-Wells, and C. K. Kerns. 2002. Assessing bird population responses to grazing. Pages 16-34 in W. Hohman, editor. <i>Migratory bird responses to grazing</i> . U.S.D.A., Natural Resources Conservation Service, Wash
Biodiversity	Hong He	Forestry	Landscape ecology and ecological modeling	He, H. S., Hao, Z., Mladenoff, D. J., Shao, G., Hu, Y., Chang, Y. 2005. Simulating Forest Ecosystem Response to Climate Warming Incorporating Spatial Effects in Northeastern China. <i>Journal of Biogeography</i> . 32: 2043-2056.
Biodiversity	David Larsen	Forestry	Forest information systems and ecological modeling	Hooten, M. B., D. R. Larsen and C. K. Wikle. 2003. Predicting the spatial distribution of ground flora on large domains using a hierarchical Bayesian model. <i>Landscape Ecology</i> 18:487-502.
Biodiversity	Rose-Marie Muzika	Forestry	Impacts of disturbance and pollution on forests	Muzika, R.M., R.P. Guyette, T. Zielonka, and A. M. Liebhold. 2004. The influence of O ₃ , NO ₂ and SO ₂ on growth of <i>Picea abies</i> and <i>Fagus sylvatica</i> in the Carpathian Mountains. <i>Environmental Pollution</i> 130: 65-71
Biodiversity	C. J. Wang	Geography	Biophysical remote sensing, GIS, ecosystem monitoring	Wang, C., J. Qi and M. Cochrane, 2005. Assessment of Tropical Forest Degradation with Canopy Fractional Cover from Landsat ETM+ and IKONOS Imagery. <i>Earth Inter.</i> , 9(22), 1-18.
Biodiversity	Robert Sites	Plant Sci	Community structure of aquatic insects in relation to land use	Hall, D. L., B. S. Bergthold, and R. W. Sites. 2003. Macroinvertebrate communities of prairie streams in Missouri: The influence of adjacent land uses. <i>J. Freshwater Ecology</i> 18(1): 55-68
Human Dimensions	Leonie Marks	Ag Econ	Public perception of biotechnology and food safety issues	Marks, L.A., N. Kalaitzandonakes, L. Wilkins, and L. Zakharova. Forthcoming. <i>Mass Media Framing of Biotechnology News</i> . <i>Public Understanding of Science</i>
Human Dimensions	Raymond Massey	Ag Econ	Economic analysis of environmentally driven ag. tech and policy	Massey, Raymond, John Lory and Joe Zulovich. "The Farm Level Impact of Phosphorous Reducing Technologies in Swine Manure." Abstract in <i>Journal of Agricultural and Appl. Econ.</i> Vol. 33. (December 2001). 630.

Human Dimensions	Laura McCAnn	Ag Econ	Transaction costs of agri-environmental policies	McCann, L., B. Colby, K.W. Easter, A. Kasterine and K.V. Kuperan. "Transaction Cost Measurement for Evaluating Environmental Policies" <i>Ecological Economics</i> , Vol 52 (4), March 2005. pp. 527-542.
Human Dimensions	Craig Palmer	Anthropology	Impacts of fisheries and conservation practices on fisherman	Palmer, C. T., and P. R. Sinclair. 2002 "Whose Knowledge is Local Knowledge? Dragger Skippers' Perceptions of the Fishery in Northwest Newfoundland" In <i>Identities, Power, and Place on the Atlantic Borders of Two Continents: Proc Int Res Linkages</i>
Human Dimensions	Deborah Pearsall	Anthropology	Historic and prehistoric human impacts on plant communities	Pearsall, Deborah M. <i>Plants and People in Ancient Ecuador: The Ethnobotany of the Jama River Valley</i> . 2004. Wadsworth/Thomson Learning.
Human Dimensions	Lisa Sattenspiel	Anthropology	Influence of cultural factors on spread of disease	Herring, D. Ann and Lisa Sattenspiel (2003) <i>Death in winter: the Spanish flu in the Canadian Subarctic</i> . In <i>The Spanish Influenza Pandemic of 1918-19</i> , Howard Phillips & David Killingray (eds). London: Routledge, pp. 156-172.
Human Dimensions	Reed Wadley	Anthropology	Local management of natural resources and forest-based ag	
Human Dimensions	Michael Goldschmidt	Env Design	Environmentally sustainable design	
Human Dimensions	Bill Kurtz	Forestry	Forest economics and public resource policy	Noweg, T.A. and W.B. Kurtz. 1987. Eastern black walnut plantations: an economically viable option for Conservation Reserve lands within the Corn Belt. <i>Northern Journal of Applied Forestry</i> 4(3):158-160.
Human Dimensions	Mark Cowell	Geography	Anthropogenic landscape change, GIS and landscape ecology	Cowell, C.M. and Dyer, J. M. (2002) <i>Vegetation development in a modified riparian environment: Human imprints on an Allegheny River wilderness</i> . <i>Annals of the Association of American Geographers</i> 92: 189-202.
Human Dimensions	Joseph Hobbs	Geography	Anthropogenic landscape change, env ethics in env management	Hobbs, J. 2004. "Problems in the Harvest of Edible Birds' Nests in Sarawak and Sabah, Malaysian Borneo." <i>Biodiversity and Conservation</i> 13: 2209-2226
Human Dimensions	Soren Larsen	Geography	Political ecology, indigenous & resource dependent communities	Larsen, Soren C. 2004. <i>Place identity in a resource-dependent area of British Columbia</i> . <i>Annals of the Association of American Geographers</i> 94: 944-960.
Human Dimensions	Gail Ludwig	Geography	Env edu, land use planning	
Human Dimensions	Michael Urban	Geography	Anthropogenic landscape change, env ethics in env	Urban, M. A. (2005). "An uninhabited waste: The transformation of environmental imagery and the Grand Prairie through agricultural drainage in nineteenth century Champaign

			management	County, Illinois." <i>Journal of Historical Geography</i> 31: 647-665
Human Dimensions	Susan Flader	History	American environmental history	Thinking Like a Mountain: Aldo Leopold and the Evolution of an Ecological Attitude Towards Deer, Wolves, and Forests (1974; 1994)
Human Dimensions	Mark Morgan	PRT	Human dimensions of natural resource management	
Human Dimensions	Patrick Peritore	Political Sci	Environmental politics	The Environmental Attitudes of Indian Elites: Challenging Western Postmodernist Models, <i>Asian Survey</i> , Vol. 33, no. 8 (August, 1993), pp. 804-818.
Human Dimensions	Robert M. Baum	Religion	Religion and the environment	in Bron Taylor, editor, <i>THE ENCYCLOPEDIA OF RELIGION AND NATURE</i> , Continuum International, 2005: "West African Religions" and "Diola Religions"
Human Dimensions	Jose Garcia	Rural Soc	Sustainable agriculture	
Human Dimensions	Jere Gilles	Rural Soc		Valdivia, C. J. L. Gilles, C. Jetté, R. Quiroz, R. Espejo. 2003. "Coping and Adapting to Climate Variability: The Role of Assets, Networks, Knowledge and Institutions." In <i>Insights and Tools for Adaptation: Learning from Climate Variability</i> . 189-199.
Human Dimensions	Mary Grigsby	Rural Soc	Voluntary simplicity movement	Grigsby, M. 2004. <i>Buying Time and Getting By: The Voluntary Simplicity Movement</i> . SUNY Press
Human Dimensions	Sandy Rikoon	Rural Soc	Political ecology of env conflict	Rikoon, J.S. <i>Wild Horses and the Political Ecology of Nature Restoration in the Missouri Ozarks</i> . <i>Geoforum</i> , 2006 (37:2): 184-199.
Human Dimensions	Corrine Valdiva	Rural Soc	Adaptation in rural and developing economies to climate var.	Valdivia C. and J. L. Gilles. 2003. "Coping and Adapting to Climate Variability in the Andes: Strategies and Local Knowledge." Presented at the 2003 Open Meeting Human Dimensions of Global Environmental Change. 16-18 October.
Human Dimensions	Charles Nilon	F&W	Urban wildlife ecology and conservation, human dimensions	Van Velsor, S.M. and C.H. Nilon. A qualitative investigation of the urban African-American and Latino adolescent experience with wildlife. <i>Human Dimensions of Wildlife</i> . In press.
Pollution	Willard Bowns	Ag Syst Mgmnt	Air quality	
Pollution	Trig Veum	Animal Sciences	Reducing excretion of nutrients in hogs by managing diets	Liu, J., D. W. Bollinger, D. R. Ledoux and T. L. Veum. 2000. Effects of dietary calcium: phosphorus ratios on apparent absorption of calcium and phosphorus in the small intestine, cecum, and colon of pigs. <i>J. Anim. Sci.</i> 78:106-109
Pollution	Dennis Lubhan	Biochemistry	Environmental estrogens	Watanabe H, Suzuki A, Goto M, Lubahn DB, Handa H, Iguchi T. Tissue-specific estrogenic and non-estrogenic effects of a xenoestrogen, nonylphenol. <i>J Mol Endocrin.</i> 2004 33:243-252.

Pollution	Judy Wall	Biochemistry	Bioremediation of toxic metals	Pattarkine, M.V., J.J. Tanner, C.A. Bottoms, Y.-H. Lee, and J.D. Wall. (2006) Desulfurovibrio desulfuricans G20 tetraheme cytochrome structure at 1.5 Å and cytochrome interaction with metal complexes. J. Mol. Biol. (In press).
Pollution	Frederich vom Saal	Biology	Reproductive system development and estrogenic compounds	Richter, C.A., Timms, B.G. and vom Saal, F.S. 2005. Prostate Development: Mechanisms for opposite effects of low and high doses of estrogenic chemicals. In: R.K. Naz, ed. Endocrine Disruptors (2nd Edition): Effects on Male and Female Reproductive Systems.
Pollution	Baolin Deng	CEE	Fate and transport of contaminants in drinking water	
Pollution	Hirotsugu Yasuda	Chemical Eng	Corrosion protection of metals	H. K. Yasuda, Q. S. Yu, C. M. Reddy, C. E. Moffitt, D. M. Wieliczka, "Adhesion of spray primers to plasma polymer coatings", J. Appl. Polymer Sciences, 85, 1387-1398 (2002)
Pollution	Qinsong Yu	Chemical Eng	Corrosion protection using green processes	Q.S. Yu, J. Deffeyes, H. K. Yasuda, "Corrosion protection of ion vapor deposition (VD) Al-coated Al alloys by low-temperature plasma interface engineering: Part II: DC cathodic polymerization under conditions of IVD", Progress in Organic Coatings, 43, 24
Pollution	Sylvia Jurisson	Chemistry	Detection, separation of radiometals for waste minimization	Extraction of Per technetate and Perrhenate from Water with Deep Cavity [CpFe(arene)] ⁺ Derivatized Cyclotrimeratrylenes, J.A. Gawenis, K.T. Holman, J.L. Atwood, S.S. Jurisson, Inorg. Chem. 2002, 41, 6028-6031.
Pollution	Susan Lever	Chemistry	Chelating agents to remove heavy metals from living organisms	S. Z. Lever and T. L. Parsons. The Presence of Lead Decreases the Availability of meso-2,3-Dimercaptosuccinic Acid in the Monobromobimane Assay. Chem Res Tox, 1999, 12, 1057-1065.
Pollution	David Robertson	Chemistry	Source and potential health risks of fine airborne particulates	F. E. Huggins, G. P. Huffman and J. D. Robertson. Speciation of Elements in NIST Particulate Matter SRMs 1648 and 1650. J. Hazard. Mater. 2000, 74, 1-23
Pollution	Sheryl Tucker	Chemistry	Separation of PHAs from streams, lakes and rivers	C. Mao, K.E. McGill and S.A. Tucker*. Optimization of Micellar Liquid Chromatographic Separation of Polycyclic Aromatic Hydrocarbons with the Addition of Second Organic Additive J. Sep. Sci. 2004, 27, 991.
Pollution	Cheryl Kelley	Geology	Carbon cycling and greenhouse gas emissions	Kelley, C. A. 2003. Methane oxidation potential in the water column of two diverse coastal marine sites. Biogeochemistry, 65, 105-120
Pollution	Carol Wicks	Geology	Ground water contamination in Karst, sediment in streams	Peterson, E. W., Wicks, C. M. (in press), Fate of 17 beta -estradiol in waters and sediment from karst streams: Environmental and Engineering Geology

Pollution	Clark Gantzer	SEAS	Factors affecting soil erosion	Blanco-Canqui, H., C. J. Gantzer, S. H. Anderson, E. E. Alberts, and A. L. Thompson. 2005. Grass barrier and vegetative filter strip effectiveness in reducing runoff, sediment, nitrogen, and phosphorus loss. Soil Sci. Soc. Am. J. 68:1670-1678.
Pollution	Keith Goyne	SEAS	Environmental soil chemistry	Goyne, K.W. , J. Chorover, J.D. Kubicki, A.R. Zimmerman, and S.L. Brantley. 2005. Sorption of the antibiotic ofloxacin to mesoporous and nonporous alumina and silica. J. Colloid Interface Sci. 283: 160-170.
Pollution	Randall Miles	SEAS	On-site waste water treatment and disposal	Miles R.J., D.M. Sievers, J. Gaughan and P. Johnson. 2004. A Certification Program for the Inspection and Evaluation of Existing Onsite Wastewater Systems for Loan Transactions. Pp. 59-67. Onsite Wastewater Treatment
Resources	Steve Borgelt	Ag Syst Mgmt	Prescription farming	
Resources	Leon Schumacher	Ag Syst Mgmt	Alternative fuels	
Resources	Allen Thompson	Ag Syst Mgmt	Hydrology of submerged flow constructed wetlands	
Resources	Shankha Banerji	CEE	Biopesticides from wastewater sludge	
Resources	John Bowers	CEE	Logging effects on water quality	
Resources	Charles Nemmers	CEE	Intelligent transportation systems	
Resources	Brian Reed	CEE	Reuse of corn solids waste as activated absorbent material	
Resources	Carlos Sun	CEE	Intelligent transportation systems	
Resources	Kathleen Trauth	CEE	User requirements to support transportation corridor investments	
Resources	William Jacoby	Chemical Eng	Conversion of biomass into fuels and chemicals	Coll, R., Udas, S. D. and Jacoby, W. A. "Conversion of the Rosin Acid Fraction of Crude Tall Oil into Fuels and Chemicals." Energy and Fuels, 2001, 15, 1166-1172
Resources	Sunggyu Lee	Chemical Eng	Alternative fuels, "green" engineering,	Methanol Synthesis Technology, CRC Press, Boca Raton, FL, ISBN-0-8493-4610-X, 1990."

			destruction of toxics	
Resources	Galen Suppes	Chemical Eng	Alternative fuels, fuel cells, PHEV technology	Energy Disclosed: Abundant Resources and Unused Technology. A book on energy technology and options available to make our country stronger and the world a better place. Galen J. Suppes, Ph.D., P.E. , Truman S. Storvick, Ph.D., P.E.)
Resources	Rob Hayward	F&W	Fish bioenergetics, population dynamics and aquaculture	Weiland, M.A., and R.S. Hayward. 1997. Cause for the decline of large rainbow trout in a tailwater fishery: too much putting or too much taking? Transactions of the American Fisheries Society 126:758-773
Resources	John Jones	F&W	Abundance and distribution of algal biomass in freshwater	LaPerriere, J. D., J. R. Jones, and D. Swanson. 2003. Limnology of lakes in Gates of the Arctic National Park and Preserve, Alaska. Lake and Reserv. Manage. 19:108-121
Resources	Bruce Cutter	Forestry	Tree growth-wood interactions	Kolaks,J.J., B. E. Cutter, E.F. Loewenstein, K.W. Grabner, G. Hartman and J.M. Kabrick. 2004. The effect of thinning and prescribed fire on fuel loading in the Central Hardwood Region of Missouri. Pages 168-178 in Proc. 14th Central Hardwood Conference,
Resources	John Dwyer	Forestry	Forest management guidelines for health and sustainability	Ficklin, R.L., E.G. Dunn and J.P. Dwyer. 1996. Ecosystem management on public lands: An application of optimal externality to timber production. Journal of Environmental Management. 46:395-402.
Resources	Gene Garrett	Forestry	Agroforestry	Garrett, H.E., J.E. Jones, W.B. Kurtz and J.P. Slusher. 1991. Black walnut (<i>Juglans nigra</i> L.) Agroforestry -- Its design and potential as a land-use alternative. Forestry Chronicle 67:213:218.
Resources	Michael Gold	Forestry	Agroforestry	Grossman, B.C., M.A. Gold and D.C. Dey. 2003. Floodplain restoration of hard mast species for wildlife in Missouri: precocious flowering in <i>Quercus</i> . Agroforestry Systems 59:3-10.
Resources	Richard Guyette	Forestry	Using tree rings to monitor growth and environment	Guyette, R.P. and C. Rabeni. 1995. Climate response among the rings of fish and trees. Oecologia 104:272- 279
Resources	Stephen Pallardy	Forestry	Impacts of water stress and CO2 enrichment on forests	Pallardy, S. G., J. S. Pereira, and W. C. Parker. 1991. The State of Water in Forest Trees. Pp. 28-75. In: Lassoie, J. P. and T. M. Hinckley. (eds.) Techniques in Forest Eco-physiology, Vol. II. CRC Press. Boca Raton, Florida.
Resources	Kevin Bradley	Plant Sci	Cost effective and environmentally sound weed management	
Resources	Johann Bruhn	Plant Sci	Ecology, management of oak root fungi,	Bruhn, J.N., and Mihail, J.D. 2003. Opportunistically pathogenic root rot fungi - <i>Armillaria</i> species. Pages 337-346 In: Hanson,

			cultivation of fungi	P.J., and Wullschleger, S.D. (eds.), North American Temperate Deciduous Forest Responses to Changing Precipitation Regimes.
Resources	Georgia Davis	Plant Sci	Identifying genes, mech resp for insect, fungal resist in maize	
Resources	James English	Plant Sci	Env. benign methods of disease control using resistance in plants	
Resources	Harlan Palm	Plant Sci	Precision agriculture	
Resources	Peter Scharf	Plant Sci	Optimizing nutrient uptake, minimizing nutrient movement	
Resources	Reid Smeda	Plant Sci	Alternative weed management systems	
Resources	Chris Starbuck	Plant Sci	Composts from sawdust, manure, other organic residues	
Resources	David Trinklein	Plant Sci	Biological control of greenhouse pests	
Resources	Bill Wiebold	Plant Sci	Cropping systems with reduced impacts, grower education	
Resources	James Wrathier	Plant Sci	Integrated disease management	
Resources	Stephen Anderson	SEAS	Effects of soil management on soil processes and properties	Rachman, A., S.H. Anderson, C.J. Gantzer, and A.L. Thompson. 2004. Influence of stiff-stemmed grass hedge systems on infiltration. Soil Sci. Soc. Am. J. 68:2000-2006.
Resources	Neil Fox	SEAS		Fox, N.I., 2004: The representation of rainfall drop-size distribution and kinetic energy. Hydrology & Earth Systems Sciences, 8, 1001-1007
Resources	Peter Motavalli	SEAS	Effects of organic materials/wastes as soil amendments	Motavalli, P.P., R.J. Kremer, M. Fang and N.E. Means. 2004. Impact of genetically-modified crops and their management on soil microbially-mediated plant nutrient transformations. J. Environ. Qual. 33:816-824.
Resources	Ranjith Udawatta	SEAS	Quantifying environmental benefits of agroforestry	Udawatta, R.P. , P.O. Nygren, and H.E. Garrett. 2005 Growth of three oak species during establishment in an agroforestry practice for watershed protection. Canadian Journal of Forest Research. 35: 602-609

