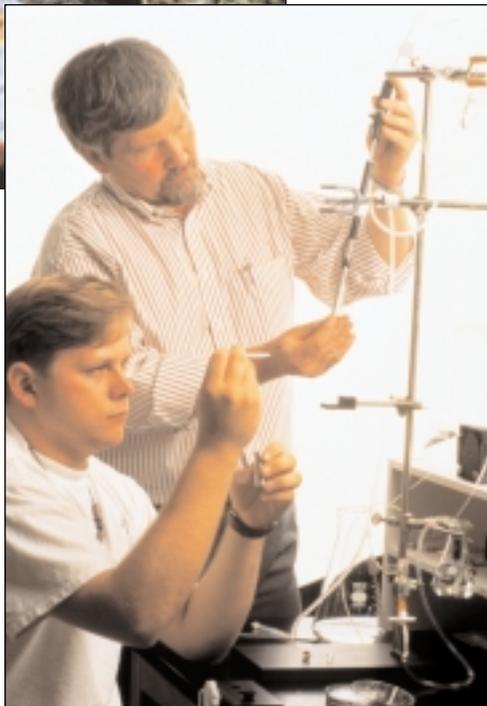


GREENING OUR FUTURE:

A guide to
environmental
research,
academics and activities
at the
University of Colorado
at Boulder



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University of Colorado at Boulder

Office of the Chancellor

301 Regent Administrative Center
Campus Box 17
Boulder, Colorado 80309-0017
(303) 492-8908
Fax: (303) 492-8866

Welcome to *Greening Our Future: a guide to environmental research, studies and activities at the University of Colorado at Boulder.*

Recognized as one of the top research universities in the country, CU-Boulder ranks fifth in the country in federal funding for studies of environmental subjects. CU-Boulder researchers are advancing the frontiers of knowledge in areas from understanding global climate change to developing new ways of tracking urban water use. Professors in every college are recognizing the connections between human, environmental, and economic health.

Interest in the environment also runs deep among CU's students. Today 10 percent of students at both undergraduate and graduate levels are majoring in an environmental area, such as environmental studies, environmental biology, environmental engineering, or environmental law. Colorado's stunning environment serves as a laboratory. Students work on real world environmental problems, learning the problem solving skills our world needs.

Education also takes place outside of the classroom, and CU teaches its students by its commitment to exemplary environmental performance. In 1997 CU Boulder signed the Talloires Declaration, committing us to set an example of environmental responsibility in our teaching, research and operations. CU has received national recognition for our outstanding recycling program, our student bus pass program, and other acts we have taken to minimize the strains that our institution places upon the planet.

Please join me in taking a tour through CU's environmental programs.

Sincerely,

Richard L. Byyny, M.D.
Chancellor

Talloires Declaration

- Use every opportunity to raise public, government, industry, foundation, and university awareness by publically addressing the urgent need to move toward a more sustainable future.
- Encourage all universities to engage in education, research, policy formation, and information exchange on population, environment and development to move toward a sustainable future.
- Establish programs to produce expertise in environmental management, sustainable economic development, population and related fields to ensure that all university graduates are environmentally literate and responsible citizens.
- Create programs to develop the capability of university faculty to teach environmental literacy to all undergraduate, graduate and professional students.
- Set an example of environmental responsibility by establishing programs of resource conservation, recycling, and waste reduction at the universities.
- Encourage the involvement of government (at all levels), foundations, and industry in supporting education, policy formation, and information exchange in environmentally sustainable development. Expand work with non-governmental organizations to assist in finding solutions to environmental problems.
- Convene school deans and environmental practitioners to develop research, policy, information exchange programs and curricula for an environmentally sustainable future.
- Establish partnerships with primary and secondary schools to help develop the capability of their faculty to teach about the population, environment and sustainable development issues.
- Work with the UN Conference on the Environment and Development, the UN Environment Program and other national and international organizations to promote worldwide university effort toward a sustainable future.
- Establish a steering committee and a secretariat to continue this momentum and inform and support each other's efforts in carrying out this declaration.



CU offers a broad range of environmental programs to both undergraduate and graduate students. Whether you are interested in designing a better sewage treatment plant, understanding the global carbon cycle, or improving environmental policy, CU has a program for you! The following section gives brief descriptions of the range of academic departments and degrees relevant to the environment.

COLLEGE OF ARCHITECTURE AND PLANNING

Department of Architecture

University of Colorado
Campus Box 314
Boulder, CO 80309
Phone: 303-492-2803
Fax: 303-492-6163
<http://carbon.cudenver.edu/public/AandP/>

B. Envd. (Bachelors of Environmental Design)

Considered a preliminary degree for those students who want to go on and receive their Master's of Architecture, the bachelors in Environmental Design focuses on the design of buildings as well as the interactions between buildings and their urban and natural settings. The social, aesthetic, technological and ecological facets of design are included in the curriculum. Although most students continue on to a professional Master's of Architecture program, graduates of the programs have also gone on to other fields like computer imaging, environmental law, solar design and technology, community development and environmental psychology.

Course examples: ENVD 2003 (Ecology and Design), ENVD (Land, Law and Sustainability).

COLLEGE OF ARTS AND SCIENCES

Department of Astrophysical and Planetary Sciences (APS)

University of Colorado
Campus Box 391
Boulder, CO 80309
Phone: 303-492-8915
Fax: 303-492-3822
<http://apas.colorado.edu>

MS, PhD Astrophysical and Planetary Sciences

The Department of Astrophysical and Planetary Sciences teaches and researches the areas of Astrophysics and Astronomy, Fluid Dynamics, Planetary Science, Plasma Physics, Solar Physics and Space Physics.

Course examples: ASTR 4800 (Space Science: Practice and Policy), ASTR 5400 (Introduction to Fluid Dynamics)

Department of Chemistry and Biochemistry

University of Colorado
Boulder, CO 80309-0215
Phone: 303-492-6531
Fax: 303-492-5894
E-mail: CHEM@colorado.edu
<http://www.colorado.edu/chemistry>

BA Chemistry & Biochemistry, MS & PhD Chemistry

Students in the Department of Chemistry and Biochemistry can get Master's and PhD degrees with analytical and environmental chemistry emphases. All entering graduate students are encouraged to work directly toward the department's PhD degree.

Departmental research areas include aerosols, environmental biochemistry, environmental benign processing, air and water pollution and atmospheric chemistry.

Course examples: CHEM 1011-3 (Environmental Chemistry 1) and CHEM 5151/ATOC 5151 (Atmospheric Chemistry).

Department of Economics

University of Colorado
Campus Box 256
Phone: 303-492-6394
Fax: 303-492-8960
<http://www.colorado.edu/Economics>

BA, MA, PhD Economics

The economics department offers undergraduate and graduate courses on the subject of natural resources and environmental economics.

Course examples: ECON 3535-3 (Natural Resource Economics), ECON 8545 (Environmental Economics), ECON 6535-3 (Resources and Environment) and ECON 6555-3 (Water Resources Development and Management: Technology, Economics, Institutions)

Environmental Studies (ENVS) Program

University of Colorado
Campus Box 332
Boulder, CO 80309-0332
phone: 303-492-4559
fax: 303-492-5207
<http://www.colorado.edu/envirostudies>

BA Environmental Studies

The bachelor's degree with a major in Environmental Studies is a program, rather than a department, and utilizes courses from many departments, as well as offering ENVS courses. The pro-

gram is designed to provide a broad but rigorous interdisciplinary education in environmental issues and problem solving, as opposed to a traditional, disciplinary-based training.

This program offers students the chance to apply and further develop their skills and knowledge and to gain practical experience by working in a professional-level capacity for government agencies, research labs, planning groups, advocacy organizations, or other such groups that solve problems and develop policies. The training gained and the contacts made become an invaluable asset in obtaining later employment.

Past Environmental Studies graduates have been employed in areas such as: water resources, waste management, environmental journalism, environmental law, cartography, public planning, computer mapping, market analysis, and disposal systems for hazardous materials.

The Environmental Studies program has proposed initiating PhD and Master's degrees into its program. If approved, the first students will be admitted to the graduate program in the fall of 2000.

Environmental, Population and Organismic Biology (EPOB)

University of Colorado
Campus Box 334
University of Colorado
Boulder, CO 80309-0334
Phone: 303-492-8982
Fax: 303-492-8699
<http://www.colorado.edu/epob>

BA Environmental, Population and Organismic Biology
MA, PhD Environmental, Population and Organismic Biology
(The department also offers a combined BA/MA 5-year program.)

The established disciplinary strengths of the Department of Environmental, Population and Organismic Biology include behavior, ecology, endocrinology, genetics, morphology, physiology, and systematics. Approximately half of the department focuses on the adaptation and functioning of organisms in the context of environment, while the other half studies higher levels of organization, including populations, communities, and ecosystems. Research programs have relevance for global change, conservation biology, and revealing fundamental mechanisms underlying the structural and functional adaptations of organisms.

Current faculty research topics include evaluation of the recovery needs of endangered fish in the Colorado River, detection of polar climate change and geographic variation of genetic characters in tree species.

Course examples: EPOB 4590 (Plants and Human Affairs), EPOB 3020 (Principles of Ecology)

Environmental Residential Academic Program (E-RAP)

Campus Box 176
Boulder, CO 80309-0176
Phone: 303-492-3188
<http://www.colorado.edu/WRAP/>

The Environmental Residential Academic Program (E-RAP) at Baker Hall provides a community for freshmen and sophomores interested in the environment and natural sciences. The program is designed for students interested in environmental studies, environmental sciences, or in environmental subdisciplines in areas such as business, law, journalism, planning, and education. It is the official residential program for the Environmental Studies major, as well as being the recommended residential academic program for Environmental, Population, and Organismic Biology major. Students who intend to pursue these majors are urged to take advantage of the benefits offered by the program. E-RAP is also recommended for students with an interest in careers that involve environmental sciences such as geology and physical geography.

Students in the program have many of the benefits of a small liberal arts college within a major research university. E-RAP offers small classes, student internships, guest speakers, field trips, and close faculty contact. E-RAP freshmen and transfer students live in Baker Hall. Although upper-class students who participated in E-RAP as freshmen are encouraged to live in Baker Hall, they may live in any CU-Boulder residence hall.

E-RAP provides introductory courses in geography, economics, mathematics, and expository writing that satisfy College of Arts and Sciences core curriculum requirements. Most courses also fulfill requirements of one of the following majors: Environmental Studies, Environmental, Population, and Organismic Biology, Geological Sciences, Geography, Chemistry and Biochemistry, Economics, Kinesiology, and Psychology. Upper-division courses are presented in ecology, environmental economics, environmental policy, environmental ethics, independent study, and independent research. Students usually take one or two E-RAP courses per semester and also enroll in other courses to meet the typical university load of approximately five courses per semester. E-RAP also reserves seats for its students in certain high-demand courses taught outside the program, including introductory biology laboratories, introductory chemistry lectures and laboratories, and tropical field biology.

One of the other benefits of being in the Environmental Residential Academic Program at Baker Hall is the great field trips. Field trips are designed by the students with an environmental theme and a goal of developing insight into issues involving the world's resources - water, land, air, plants, and animals, and microorganisms - and the human impact on these resources. Trips are usually scheduled on weekends so that everyone has the opportunity to participate. Some past trips include: a hike along Boulder Creek to learn from those directly involved about the major restoration project that returned this area to its current health and beauty, a tour of the Cross Mine, an operating gold

mine in Boulder County, to learn about modern mining techniques and environmental compliance, a tour of the National Oceanic and Atmospheric Administration's Aeronomy Lab to hear a discussion by scientists on the ozone hole and the effects of greenhouse gases in the atmosphere, a snowshoe hike in Rocky Mountain National Park to learn about the adaptations of plants and animals to winter conditions, and a weekend trip to Sand Dunes National Monument of the National Park Service in southern Colorado to learn about plants, animals and cultural heritage of the region.

Department of Ethnic Studies

University of Colorado
Campus Box 339
Boulder, CO 80309-0339
Phone: 303-492-8852
Fax: 303-492-7799
<http://stripe.Colorado.EDU/~ethnicst/>

Since 1996 the Department of Ethnic Studies has been offering CU students coursework dealing with issues of environmental ethics, environmental justice and environmental conflict. The department grew of the Center for Studies of Ethnicity and Race in America (CSERA), founded in 1987, and has sponsored such conferences as 1998's "Justice for All: Racial Equity and Environmental Well-Being." Departmental research includes case studies of environmental racism and research on hazardous work environments.

Course examples: ENV5/ETHN 3003 (Environmental Ethics: Race, Class and Pollution Politics)

Department of Geography

University of Colorado
Campus Box 260
Boulder, CO 80309
Phone: 303-492-2631
Fax: 303-492-7501
<http://www.colorado.edu/geography>

BA, MA, PhD Geography

Possible areas of concentration for undergraduate geography majors include physical geography, human geography, environment-society relations, and geographic information processing. Ongoing research topics include polar and mountain climate change (see profile in research center and institutions chapter).

Course examples: GEOG 2002 (Geographies of Global Change), GEOG 5762 (Sustainable Development)

Department of Geological Sciences

University of Colorado
Campus Box 399
Boulder, CO 80309-0399
Phone: 303-492-8141
Fax: 303-492-2606
<http://www.colorado.edu/GeolSci>

Consider a spherical cow?

Consider a spherical cow? What a strange question! Bring together the environment and mathematics. What a strange combination! But for Martin Walter, chair of the CU mathematics department, the correlation seemed natural.

“Mathematics is everywhere, and the environment is everywhere,” observed Walter, whose background is as a wilderness preservationist and mathematician.

And so Math 2380: Mathematics and the Environment was born with Consider a Spherical Cow as its textbook.

Math and the Environment is part of CU’s arts and sciences core curriculum. The course fulfills the quantitative reasoning and mathematical skills requirement for undergraduate students

“My first goal is that any student who graduates from CU should have an understanding of simple math,” he said.

The course uses elementary mathemat-



Martin Walter with student.

Photo courtesy of CU-Boulder Public Relations

ics to analyze acid rain, radiation at Rocky Flats and radon standards, among other topics.

“Modern industrial society is at odds with nature, on a collision course with the

way nature designs,” Walter said. Math and the Environment teaches students to understand the environmental standards, the politics behind the standards, and the critical thinking that’s involved, he added.

BA Geological Sciences (with options in Environmental Geoscience and in Geophysics) & MS, PhD Geological Sciences (Hydrology option available)

The major in geology offers undergraduates three options, each leading to a Bachelor of Arts (BA) degree: the Geology Option, the Environmental Geoscience Option, and the Geophysics Option. Geological Sciences undergraduate degree recipients have gone on to various entry-level positions in the energy and minerals industry, environmental evaluation and regulation, industrial relations, reclamation, resource evaluation, research, surveying, and numerous other areas. The degree is also excellent preparation for later professional work in such fields as journalism, law, and economics.

Graduate degree recipients can specialize in fields such as geochemistry, paleobiology, tectonics, remote sensing, paleoclimatology, geohydrology, global change, paleoceanography, and environmental geology.

Current departmental research areas include the study of fossil fuels supply and demand forecasts and renewable energy sources.

Course examples: GEOL 3040 (Global Change: The Recent Geological Record) & GEOL 4093

(Remote Sensing of Environment)

Department of Political Science

University of Colorado
Campus Box 333
Boulder, CO 80309-0333
Phone: 303-492-7871
Fax: 303-492-0978
<http://socsci.colorado.edu/POLSCI/>

Interdisciplinary Graduate Certificate in Environmental Policy
(<http://www.colorado.edu/EnvironmentalPolicyCertificate/>)

The Graduate Certificate Program in Environmental Policy provides an interdisciplinary specialization for students in MA, PhD, and JD programs at the University of Colorado at Boulder, drawing on courses in Anthropology, Economics, EPO Biology, Geography, Philosophy, Political Science, Psychology, Sociology, the College of Architecture and Planning, the College of Engineering and Applied Science, the School of Journalism and Mass Communication and the School of Law.

To qualify for the Certificate, students must complete at least 18 hours of course work from the

Leading the Environmental Charge

Since 1990, the University of Colorado at Boulder Environmental Program has been a major force behind the multidisciplinary effort to foster, coordinate and enhance the environmental education and research occurring at the University of Colorado at Boulder.

“Our goal is to position CU as one of the leading universities in the study of the environment,” said Robert Sievers, the Environmental Program’s director since 1993.

The program works to encourage independent research, increase funding available to support the environmental studies of graduate and undergraduate students, build infrastructure and coordinate all the environmental programs in the various disciplinary areas for CU, Sievers said.

Academic programs as diverse as environmental engineering, biogeochemical cycling, water science and policy, environmental policy, environmental law, environmental journalism and environmental ethics are involved in the UCB environmental program, as well as many institutes and centers on campus.

“Few universities have strengths across the spectrum from engineering to the humanities,” Sievers said.

The program is constantly trying to strengthen curriculum, hire new faculty, and create new courses, Sievers said.

“It’s remarkable how important environmental studies is to CU students,” Sievers said.

The environmental program is kept strong by “insisting that students have a good background in the fundamentals of science (statistics and chemistry and biology) as well as policy in order to have a tool chest of skills and knowledge that will help fix what’s wrong with the



The UCB Environmental Program, directed by Bob Sievers (left), provides many opportunities for mentoring of undergraduates such as Jack Schaefer (right), who coauthored a journal article on aerosol generation.

Photo courtesy of the UCB Environmental Program

environment instead of just complaining,” Sievers said.

Through the environmental program “we want to create people who can do something about making the environment better...not just environmental activism or environmental advocacy,” he added.

So far, the greatest accomplishment for the Environmental Program is the fostering of interdisciplinary approaches to environmental education and the strengthening of the research and learning environments that has occurred, Sievers said.

In the future the Environmental Program wants CU to begin offering PhD and master’s degrees in environmental studies. Such degree programs would “complement and strengthen the undergraduate program, which is very popular and successful,” Sievers said. A formal proposal has been made through a concept paper which is being reviewed by

the Colorado Commission of Higher Education. If a full proposal is approved, graduate students can begin applying within a year after the approval. Five tracks are envisioned: Atmospheric Sciences and Climate, Water Science; Environmental Policy; Waste Management Recycling and Environmental Remediation; and Biogeochemical Cycling.

CU has chosen the Environmental Program as an area of excellence for the year 2000 and beyond with two goals in mind. First, it wants to provide students with the knowledge and skills necessary for making wise decisions about stewardship of the Earth. Second, CU wants to convey knowledge to the general public so it can make intelligent decisions, understand the costs and trade-offs of these environmental choices, and appreciate how these issues affect people’s every-day lives.

more than 50 courses in environmental policy and policy sciences offered at CU Boulder, including the two capstone seminars.

Course examples: Capstone seminars—ARSC 5010 (Natural Resource and Environmental Policy), ARSC 5020 (Policy Responses to Global Change)

Program in Atmospheric and Oceanic Sciences

Campus Box 311
Boulder, CO 80309
Phone: 303-492-7167
Fax: 303-492-3524
<http://paos.colorado.edu>

MS, PhD in Astrophysical, Planetary and Atmospheric Sciences, with emphasis in atmos-

pheric and oceanic sciences; PAOS certificate in Atmospheric and Oceanic Sciences, for graduate students concentrating in another discipline, demonstrates completion of a number of courses in atmospheric and oceanic sciences; PAOS Certificate in Remote Sensing for graduate students emphasizing in another discipline but who complete a series of courses in remote sensing; PAOS undergraduate minor in atmospheric and oceanic sciences.

The Program in Atmospheric and Oceanic Studies is an interdisciplinary program in which students examine the dynamical, physical and chemical structures of the atmosphere and ocean. PAOS students, faculty and staff work to together on a wide range of research topics: large-scale dynamics of the ocean and atmosphere; air-sea interaction, monsoon dynamics and predictability; radiative transfer; remote sensing of the ocean and the atmosphere; geophysical fluid dynamics; sea ice and its role in climate; land-atmosphere and cloud-climate interactions; the predictability and consequences of El Niño; upper atmosphere physics and chemistry; weather and climate prediction; hydrological processes; and boundary layer measurement and modeling.

Course examples: PAOS core faculty teach a wide range of undergraduate and graduate ATOC (Atmospheric/Oceans) courses, many of which are cross-listed with other departments participating in the campus-wide PAOS program. These include: ATOC 1060 (Atmosphere, Oceans, Climate), ATOC 3300 (Analysis of Climate and Weather Observations), ATOC 4710 (Atmospheric Physics), ATOC 5060 (Atmospheric Dynamics), and ATOC/ASEN 5225 (Remote Sensing)

COLLEGE OF ENGINEERING AND APPLIED SCIENCE

Department of Aerospace Engineering Science

University of Colorado
Campus Box 429
Boulder, CO 80309-0429
Phone: 303-492-6417
Fax: 303-492-7881
<http://snowwhite.colorado.edu/>

BS, MS, PhD Aerospace Engineering Sciences

This department hosts the Colorado Center for Astrodynamics Research and, in addition to this center, has a number of faculty members who are involved in atmospheric research. Thus, the department now has a strong atmospheric science component. Most of the research in this area is addressed to the air-sea exchange of energy in the polar regions. Another component is the study of the upper atmosphere and the thermosphere. Monitoring our global habitat via remote sensing from space and helping to develop environmentally clean energy and transportation systems are examples of aerospace engineers working to improve our daily lives. Astrodynamics research efforts include the use of Global Positioning Systems data to improve the accuracy of satellite orbits such as those of TOPEX/POSEIDON, the Explorer Platform, and the Geosat Follow-On space-

craft.

Course examples: ASEN 3116 (Bioengineering), ASEN 5235 & (Remote Sensing of the Atmosphere and Oceans)

Department of Civil, Environmental and Architectural Engineering (CEAE)

University of Colorado
Campus Box 428
Boulder, CO 80309
Phone: 303-492-4193
Fax: 303-492-7317
<http://civil.colorado.edu>

BS, MS, PhD Civil, Environmental and Architectural Engineering

The Civil, Environmental and Architectural Engineering department offers masters and doctoral students in the areas of Geotechnical Engineering, Environmental and Water Resources Engineering, Building Systems Engineering and Management and Geoenvironmental Engineering. Undergraduate students can study toward degrees in the areas of Civil Engineering, Environmental Engineering or Architectural Engineering.

Current faculty research topics include developing energy calculations for earth-bermed buildings, studying the fate of deicing fluids in the environment and looking at bio-remediation of acid mine drainages. Student areas of study include contaminant transport, remedial action, risk assessment and geohydrology.

Course examples: CVEN 5444 (Environmental Engineering Chemistry) and CVEN 5748 (Design of Earth Structures)

Department of Chemical Engineering (CHEN)

University of Colorado
Campus Box 424
Boulder, CO 80309-0424
Phone: 303-402-7471
Fax: 303-492-4341
<http://spot.colorado.edu/~chemeng/Home.html>

BS, MS, PhD Chemical Engineering

The Chemical Engineering Department has research and educational strengths in biotechnology/bioengineering, advanced materials, environmental process engineering, membrane separations, reaction engineering, and transport phenomena. Undergraduate students interested in environmental chemical engineering may select the environmental option in Chemical Engineering or the chemical processing track in the new Environmental Engineering major.

Course examples: CHEN 4670/5670 (Environmental Separations) and CHEN 4680/5680 (Environmental Process Engineering)

Environmental Engineering Program

University of Colorado
Campus Box 427
Boulder, CO 80309
Phone: 303-735-0253
Fax: 303-492-2863
<http://www.colorado.edu/engineering/EnvEng>

BS Environmental Engineering

Environmental engineering encompasses the scientific assessment and development of engineering solutions to environmental problems impacting the biosphere, land, water and air quality. To cover the broad base of knowledge required of environmental engineers, the degree program at CU draws on the expertise of more than 25 faculty from four departments: Aerospace Engineering Sciences; Civil, Environmental and Architectural Engineering; Chemical Engineering and Mechanical Engineering. The program offers tracks focused on water and wastewater engineering, air quality engineering and chemical processing, in addition to a general environmental engineering track. Coursework that is specific to environmental engineering includes water and wastewater treatment, hazardous waste storage and treatment, air pollution control and environmental design engineering.

Course examples: EVEN 4830 (Environmental Sampling and Analysis)

UNIVERSITY OF COLORADO SCHOOL OF LAW

University of Colorado School of Law

University of Colorado
Campus Box 401
Boulder, Colorado 80309
Phone: 303-492-7203
Fax: 303-492-1200
<http://www.colorado.edu/law/>

JD (Environmental Law program)

As of 1996, US News and World report ranked the CU Law School's environmental law program third in the nation, up from fourth place the year before. Among the numerous publications that the School of Law houses is the biyearly, student-published Colorado Journal of International Environmental Law and Policy. The School's graduates are academically qualified to take the bar examination in any of the 50 states. In addition, the school houses the Natural Resources Law Center (see profile page 13) which deals with a variety of environmental legal and policy issues.

Course examples: LAWS 7202 (Environmental Law), LAWS 6112 (Foundations of Natural Resources Law and Policy), LAWS 7307 (Taxation of Natural Resources), LAWS 6302 (Water Resources)

SCHOOL OF JOURNALISM AND MASS COMMUNICATION

School of Journalism and Mass Communication

University of Colorado
Campus Box 287
Boulder, CO 80309
Phone: 303-492-5007
Fax: 303-492-0969
<http://www.Colorado.EDU/Journalism/>

MA Mass Communication with an emphasis in environmental journalism (research and print tracks)

In collaboration with the University's Interdisciplinary Graduate Certificate in Environmental Policy, the School of Journalism and Mass Communication offers master's students the opportunity to earn the master's degree in journalism with an emphasis in environmental journalism. In addition, through the School's Center for Environmental Journalism (see profile in Research Centers and Institutions chapter) environmental journalists are brought to the University to participate in the the 10-month-long Ted Scripps Fellowships program.

Course examples: JOU 5812 (Science Writing) and JOU 5872 (Reporting on the Environment)

CU-Boulder is home to a number of premier research facilities. CU also conducts collaborative research with such federal agencies as the National Center for Atmospheric Research, the National Oceanic and Atmospheric Administration, the U.S. Geological Survey and the Department of Energy's nearby National Renewable Energy Lab. On the following pages you will find listings of the research centers and institutes that find their home here at the university.



Center for Advanced Decision Support for Water and Environmental Systems (CADSWES)

College of Engineering and Applied Science
Department of Civil, Environmental, and Architectural Engineering
Campus Box 421
Boulder, CO 80309-0421
Phone: 303-492-3972
Fax: 303-492-1347
<http://casdswes.colorado.edu/>
e-mail: inquiries@casdswes.colorado.edu

The Center for Advanced Decision Support for Water and Environmental Systems is an interdisciplinary setting for the research, development and implementation of Environmental Decision Support Systems, housed within the Department of Civil, Environmental, and Architectural Engineering, of the College of Engineering and Applied Science at the University of Colorado at Boulder.

The CADSWES team, comprised of environmental and water resources engineers, software engineers, operations research analysts, geographers, and management information systems scientists, works together to offer state-of-the-art river basin modeling tools, allowing users to explore and visualize a universe of planning and operations scenarios.

The CADSWES program developed the RiverWare river basin modeling tool which integrates diverse management objectives, such as flood control, navigation, recreation, water supply, and water quality, with power system economics.

Center of the American West

Campus Box 234
Boulder, CO 80309
Phone: 303-492-4879
Fax: 303-492-1868
<http://www.centerwest.org/>

Founded in 1989, the Center of the American West uses the resources of the University of Colorado to explore, debate, and celebrate the distinctive qualities of the West. The Center of the American West makes the walls of the university permeable by facilitating the exchange of information and ideas in a critical dialogue about the West. By uniting the insights of the humanities, the physical sciences, and the

social sciences, the Center informs Westerners about public policy and thus enables our citizens to shape desirable futures for our communities.

Center for Environmental Journalism

University of Colorado
Campus Box 287
Boulder, CO 80309-0287
Phone: 303-492-4114.
Fax: 303-492-0585
e-mail: cej@stripe.colorado.edu
<http://campuspress.colorado.edu/cej.html>

(see profile page 9)

Center for Combustion and Environmental Research

University of Colorado at Boulder
Department of Mechanical Engineering
Boulder, Colorado 80309-0427
Phone: 303-492-7110
Fax: 303-492-2863
<http://me-www.colorado.edu/>

The Joint Center for Combustion & Environmental Research is an interdisciplinary group established to study fundamental problems relating to the field of combustion and environmental protection. Faculty from the Mechanical Engineering, Applied Mathematics, and Computer Science Departments at the University of Colorado, and faculty from the Chemical Engineering and Petroleum Refining Department and the Division of Engineering at the Colorado School of Mines are involved with the Center's research. Examples of current research topics include the modification of combustion processes to minimize the formation of air pollutants and the photothermal destruction of hazardous waste.

Colorado Center for Astrodynamics Research (CCAR)

University of Colorado at Boulder
Campus Box 431
Boulder, Co., 80309
phone: 303-492-8591
fax: 303-492-2825

This center is involved with many different aspect of satellite remote sensing of the Earth. An important focus has been the use of radar altimetry to map the ocean's surface as an indicator for ocean currents and other related parameters. The group has been a central part of a U.S. Effort to reduce the orbit error in the presently flying TOPEX/Poseidon altimeter making it possible to accurately map ocean surface currents.

Another area of research is the application of visible and infrared satellite imagery to mapping sea surface temperature, ocean currents, land surface vegetation, detecting forest fires, mapping snow cover, etc. The group operates antennas for the reception of most forms of weather satellite data enabling a number of research areas and greatly increasing the use of these data in remote sensing classes.

A GPS group rounds out the center leading in research on GPS reception and application. A total of 6 full time faculty and 2 research professors comprise the center

Cooperative Institute for Research in Environmental Sciences (CIRES)

University of Colorado at Boulder
Campus Box 216
Boulder, CO 80309-0216
Phone: 303-492-1143
Fax: 303-492-1149
e-mail: cires@cires.colorado.edu
<http://cires.colorado.edu/>

The Cooperative Institute for Research in Environmental Sciences (CIRES) was established in 1967 to provide a setting for collaborative research and teaching in the wide-ranging disciplines of the environmental sciences. Its mission is to act as a national resource for multidisciplinary research and education in the environmental sciences by providing scientific leadership in research relevant to environmental and earth sciences issues, by contributing scientific expertise and resources to environmental science educational programs, and by providing support to facilitate collaborations among scientists at the University of Colorado, the National Oceanic and Atmospheric Administration (NOAA) and other institutions.

CIRES is sponsored jointly by the University of Colorado at Boulder and the Environmental Research Laboratories of NOAA. Institute scientists collaborate in research programs that are aimed at understanding a variety of basic and applied problems associated with the physics, chemistry, and biology of the subcomponents of the earth system and the integration of these subcomponents. This research includes field studies, laboratory experimental programs, computer simulations, and theoretical investigations.

Institute of Arctic and Alpine Research (INSTAAR)

University of Colorado
Boulder, CO 80309-0450
Phone: 303-492-7909
Fax: 303-492-6388
e-mail: instaar@colorado.edu
<http://instaar.colorado.edu/>

INSTAAR's main research goals are to facilitate and accomplish interdisciplinary studies in high-altitude and high-latitude regions of the world. The primary aims of such research are to improve understanding of these regions and to consider how they affect, and are affected by, natural and human-induced physical, chemical and biological processes on the local, regional, and global scales at the present time, in the past and in the future. The research initiatives undertaken by INSTAAR are interlinked with their educational and societal outreach missions. By encouraging the use of their facilities, and the expertise of INSTAAR personnel, INSTAAR provides educational opportunities to both graduate and undergraduate students. INSTAAR's societal outreach mission to the wider community includes

Reporting on the Environment

The Center for Environmental Journalism began at CU in 1992 with the goal of building bridges between scientists and journalists, said Len Ackland, CU journalism professor and director of the Center.

"Our main mission is to improve coverage of environmental issues and to help create better journalists," Ackland said.

The Center works to improve interaction between students in the School of Journalism and Mass Communication, professional journalists and scientists at the University and in the area.

According to Ackland, the Center's role at CU is two-fold.

First, the Center encourages journalism masters students to gain an emphasis in environmental journalism by taking



Bruce Henderson, one of the CEJ's 1997-98 Scripps Fellows, gets checked for radiation exposure after touring the Rocky Flats Environmental Technology Site.

advantage of the University's Graduate Certificate in Environmental Policy. This program allows students to take course work, concentrating on environmental policy and science, from various depart-

ments on campus, Ackland said.

Past CU Graduates who took courses in environmental journalism are now working in positions as diverse as general assignment reporters at newspapers to public information officers at the Sierra Club.

Secondly, the Center works on "inreach," developing a relationship between university scientists and journalists. "It's useful in environmental science to facilitate discussions with scientists and journalists," Ackland said.

To that end, the Center began the Ted Scripps Fellowship program in 1997. The fellowships bring professional journalists from around the country to CU to take environmental course work for an academic year.

aspects of both research and education.

INSTAAR publishes Arctic, Antarctic and Alpine Quarterly and a series of Occasional Papers.

INSTAAR's Mountain Research Station

The Mountain Research Station (MRS), located near Nederland, CO—25 minutes from Boulder—is an interdisciplinary research facility that is one of the best known sites for alpine research in the world. Its reputation stems from decades of research in biology, geology, geography and atmospheric sciences in the mountain environment on Niwot Ridge and the adjacent City of Boulder Watershed. Approximately 40 researchers a year use the MRS as a base of operations, including CU faculty and students and many from other universities in the US and around the world. Over 800 scientific publications have been produced by researchers working through the MRS, and hundreds of graduate research projects have been completed there. The teaching mission of the MRS includes formal undergraduate and graduate field courses, which have become an integral part of the academic experience for many students.

Niwot Ridge Long-Term Ecological Research based at the Mountain Research Station

Research at Niwot Ridge has been underway for 60 years, probably making the area the most thoroughly studied alpine area in North America.

The alpine research area of Niwot Ridge, 4 km

from the MRS, was designated in 1975 as an Experimental Ecological Reserve by the Institute of Ecology and in 1979 as a Biosphere Reserve by UNESCO, the U.S. State Department, and U.S. Forest Service. In 1980 Niwot Ridge was selected by the National Science Foundation as the alpine tundra component of the Long-Term Ecological Research (LTER) program. The Niwot LTER consists of long- and short-term manipulative experiments and long-term monitoring to study biotic and ecosystem responses and feedbacks to interannual variation in climactic and atmospheric inputs. The site is an essential benchmark for local, regional and national networks that measure ecological phenomena and biological change to human-induced changes in climate and atmospheric chemistry.

Institute of Behavioral Science (IBS)

University of Colorado at Boulder
Boulder, CO 80309-0483
Phone: 303-492-8147
Fax: 303-492-6924
e-mail: IBS@colorado.edu

For almost four decades, the Institute of Behavioral Science (IBS) has provided a setting for interdisciplinary research on problems of societal concern. The Institute also assumes responsibility for the dissemination of information about research findings and for the training of both pre- and postdoctoral students in behavioral science research. The Institute focuses its attention on a small number of interdisciplinary research programs. These include:

the Research Program on Population Processes, the Research Program on Political and Economic Change, the Research Program on Environment and Behavior, and the Research Program on Problem Behavior.

Faculty are drawn from the Departments of Anthropology, Economics, Geography, Political Science, Psychology, and Sociology, and from the Department of Pediatrics, School of Medicine, at the University of Colorado Health Sciences Center. Current faculty research topics include water resources, natural hazards and tradable emission permits.

The Natural Hazards Research and Applications Information Center (NHRAIC) is an integral part of the Research Program on Environment .

Joint Center for Energy Management
University of Colorado
Engineering Center ECCE 246, Box 428
Boulder, Colorado 80309-0428
Phone: 303-492-3915
Fax: 303-492-7317
e-mail: jceminfo@colorado.edu
<http://www.colorado.edu/jcem>

The Joint Center for Energy Management (JCEM) is a research center in the Department of Civil, Environmental, and Architectural Engineering and the College of Engineering and Applied Science at the University of Colorado at Boulder. It is dedicated to excellence in energy-related research, development, education, and technical assistance. The Center is a collaborative effort of the engineering programs at CU and Colorado State University. Management and administrative support staff are located in the Engineering Center on the CU campus. Center programs focus on energy efficiency in the buildings and industrial sectors as well as on practical applications of renewable energies.

Laboratory of Atmospheric and Space Physics
LASP Space Technology Building
1234 Innovation Dr.
Campus Box 590
Boulder, CO 80309
Phone: 303-492-7677
Fax: 303-492-6946
<http://lasp.colorado.edu/>
The Laboratory for Atmospheric and Space Physics scientists conduct experimental and theoretical studies of Earth and planetary atmospheres and solar-terrestrial relations, develop instrumenta-

Exploring Greenland's Ice

CU-Boulder graduate and undergraduate geography students are some of the key players in a climate change research project going on half a world away. The students are working with Konrad Steffen, a CU geography professor and CIRES fellow, to develop a network of weather stations in Greenland.

"This is the first climate monitoring network on the Greenland Ice Sheet," Steffen said.

Fifteen Automated Weather Stations are running continuously, monitored by satellite data-link. Every year, Steffen and his students travel to Greenland to do maintenance on the stations. So far, eleven years of climate measurements have been collected.

One of the most unique aspects of the project is the extent to which students are involved in the field work and data collection.

Jason Box, a CU PhD geography student, has been working on the project



Cut-line will go here

since he was a senior undergrad. Now four years and four trips to Greenland later, Box's role in the Automated Weather Stations study is to examine accumulated

snow totals while Steffen looks at energy exchange at the surface of the snow pack. Their research will eventually be extrapolated to the whole of the ice cap to determine how sensitive Greenland's climate is to "changing and possibly warming global change," Box said.

In addition, Jeff Webber, a geology master's student, is analyzing barometric pressure measurements for the Automated Weather Station sites.

"I believe that a combination of work and theoretical studies is the best education for students," Steffen said. "To know the climate processes in theory is not sufficient. There is much better understanding with [hands-on] measurement."

The project, called PARCA: Program in Arctic Regional Climate Assessment, is the product of a collaboration of 8 universities and 3 National Aeronautics and Space Administration labs. NASA is sponsoring the project.

Defending the Environment

In response to the growing public concern over the use of the region's valuable and frequently scarce natural resources, the Natural Resources Law Center was established in 1982. The NRLC investigates the laws and policies relating to the allocation and use of natural resources in the western United States and disseminates these findings to a broad audience.

Today, the Center is guided by a single objective: promoting a sustainable society through improved public understanding of environmental and natural resources issues, including water, timber, minerals, oil and gas, rangeland, and fish and wildlife and their habitats.

As the Center has grown, many have benefited from its work. The research and publications help shape public discussion, improving the governance, administration, and field-level management and use of important natural resources questions. The public education programs serve an important public outreach function, linking the Law School to the broader community. The Center's activities enrich and supplement the outstanding teaching program at the Law School, involving students as research assistants, volunteers, and participants.

The NRLC engages in an extensive research and publications program, intended to be of value to all natural resources professionals whose work depends upon understanding natural resources law and policy. The projects often are interdisciplinary and frequently include participants from outside the Law School, including individuals in the Fellows and Visitors Programs. Recent publications include: "The State Role in Western Watershed Initiatives," "Values of the Federal Public Lands" and "The Watershed Source Book."

tion for aircraft, rockets, satellites and planetary probes, operate space missions and instruments and create computer information systems for spacecraft operations. Current research areas include stratospheric chemistry and dynamics (polar and global ozone depletion), tropospheric chemistry and dynamics (measurements of trace gases from aircraft) and climate (clouds and aerosols).



Ann Morgan, Director of the Colorado Bureau of Land Management, reviews management programs at the NRLC's 1998 Outdoor Recreation Conference.

Photo courtesy of the Natural Resources Law Center

Public education programs are an important part of the NRLC agenda. The Center sponsors an annual conference, hot topic seminars, and brown bag lunches that address pertinent issues in natural resources policy. Recent conferences include: "Outdoor Recreation: Promise and Peril in the New West" (1998), "Dams: Water and Power in the New West" (1997), and "The National Forest Management Act in a Changing Society" (1996).

Although natural resources conferences may be biased toward either the industrial or environmental perspective, "We try to be a bit more balanced," says Kathryn Mutz, the interim director for the NRLC.

Deb Schallert, an industry representative and recent conference attendee from Portland General Electric, illustrates the point, "[The] June Conference presented a wide range of perspectives. Recreation managers struggle to reconcile views that

are highly diverse as well as emotionally charged. This forum was a good reflection of that diversity."

The Center's "Hot Topics in Natural Resources" series, luncheon presentations held in Denver, examines issues of current interest to resource managers and policymakers and provides a forum for public discussion and debate on current issues.

Through its research and education programs, the NRLC also offers many opportunities for law students to get directly involved in natural resources issues.

"We hire [law students] as research assistants, full-time in the summer and part-time during the school year, co-sponsor events with student groups, and are always available to help individual students with their research projects," says Mutz. Additionally, students are encouraged to attend all Center events and volunteer with Center projects.

Natural Resources Law Center

University of Colorado
Campus Box 401
Boulder, CO 80309-0401
Phone: 303-492-1293
Fax: 303-492-1297
<http://www.colorado.edu/law/NRLC/>

[see profile this page]



There are a wide variety of extra-curricular activities at CU related to the environment. Many independent student groups are active at the University, offering students the opportunity to work on environmental issues that they care about. There are also internship programs which offer students the opportunity to gain real world experience, working for environmental consulting firms, advocacy groups, government agencies and the private sector.

CU ENVIRONMENTAL CENTER

Campus Box 207
Boulder, CO 80309
Phone: 303-492-8308
Fax: 303-492-1897
<http://www.Colorado.EDU/cuenvironmentalcenter/>
Email: ecology@stripe.colorado.edu

[see profile page 16]

EARTH EDUCATION

Campus Box 207
Boulder, CO 80309
Phone: 303-492-8308

Earth Education members help elementary students improve their understanding of environmental problem and solutions. Members can participate in recess programs, in-depth classroom projects, or planning and discussion sessions.

THE ENVIRONMENTAL LAW SOCIETY (ELS)

Campus Box 401
Boulder, CO 80309
Phone: 303-492-8073
<http://www.colorado.edu/law/studentlife.html>

The Environmental Law Society, a club for Law Students, makes education and action two of its primary goals. The ELS Supports a speaker series, holds an environmental jobs day, works to support the environmental curriculum at the School of Law and involves its members in environmental legal issues by assisting Colorado environmental and community groups with legal research. The ELS also provides financial support for law students who work as summer interns, coordinates recycling within the law school and has work days to help clean up parks or maintain trails.

THE ENVIRONMENTAL STUDIES CLUB

UMC 316
Boulder, CO 80309
phone: 303-492-2186
<http://www.colorado.edu/envirostudies/esclub.html>

Enjoying the Outdoors

Want to go rock climbing up Boulder Canyon? How about kayaking the Colorado River? Who said college had to be all books and studying?

Each year at the University of Colorado approximately 1500 students get out and explore the region, the state and the nation while learning new skills through the University's Outdoor Program. The program offers single and multi-day courses that take students away from the University's classes and sets them down in the out-of-doors.

"Most courses are geared toward skill acquisition, not just taking students out into the woods, but teaching them how-to," said Tim Jorgenson, the Outdoor Program Director. So in addition to rock climbing and kayaking, students can get their SCUBA or Wilderness EMT certification, take first aid classes or attend leadership clinics through the program.

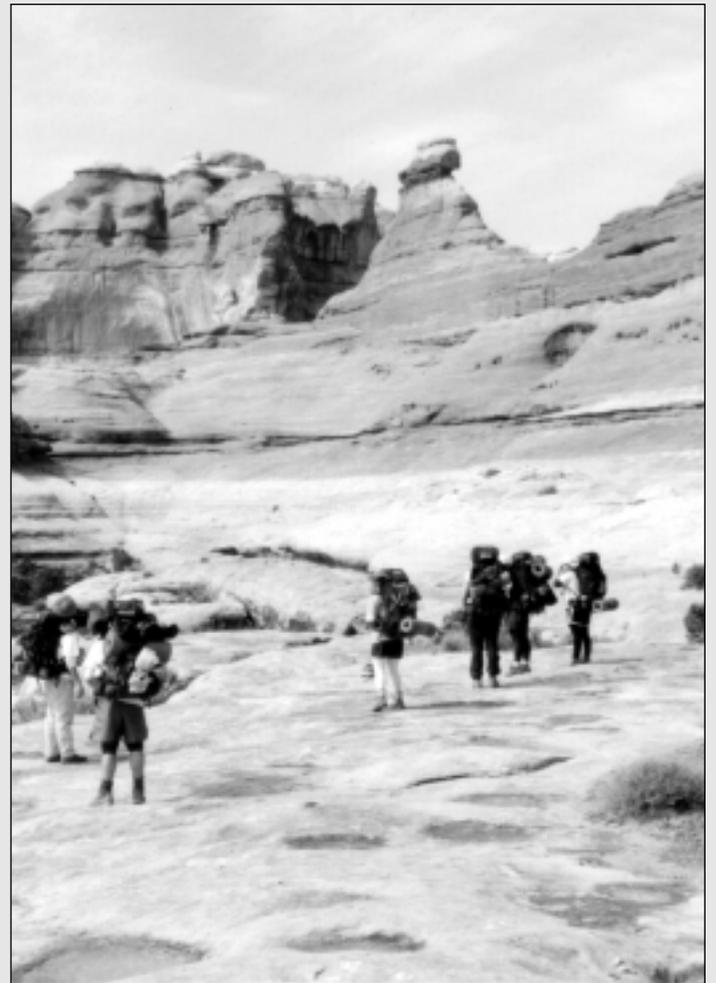
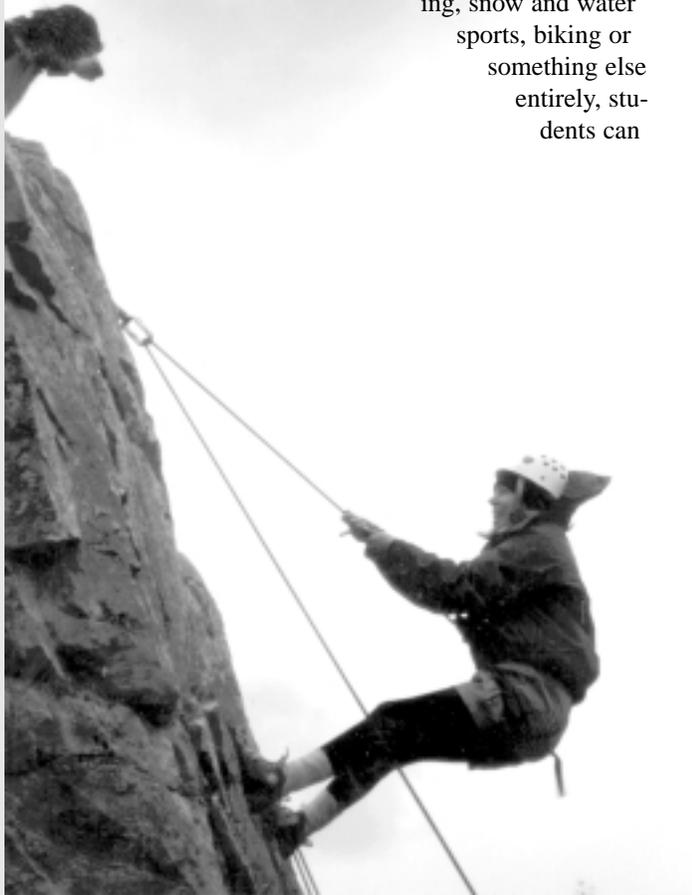
"Most instructors are older students or grad students who work in the summertime for large outdoor companies," he added.

But whether the activity is ice climbing, hiking, fly fishing, snow and water sports, biking or something else entirely, students can

expect "small groups to insure safety and a good group experience," Jorgenson said.

And the Outdoor Program provides all the equipment students need so even first-timers can be fully prepared.

In past years, the Outdoor Program has lead extended trips to backpack Canyonlands National Park, canoe Ruby/Horsethief Canyon and backpack Southeast Utah.



CU students rock climb in Boulder Canyon (left) and backpack in Utah (above) as part of their Outdoor Program activities.
-Photos courtesy of the CU Outdoor Program

Getting students involved

The CU Environmental Center is the nation's largest student-run environmental resource center with four permanent staff and over 100 volunteers. The Center, a branch of the UCSU student government, is the focal point for efforts to make the university more environmentally responsible.

"One of the most interesting things about the Center is that it is a unique example of an environmental program that is funded and controlled by students," said Will Toor, the Environmental Center's director. "While there are full-time staff, the student board has the ultimate decision-making authority."

For many CU students, working with the Center is a life changing experience.

"They start out with an internship at the center and end up deciding to dedicate their lives to environmental work," Toor said. Past Environmental Center interns and employees are now working for such groups as the Glass Packaging Institute and the US Fish and Wildlife Service.

"And none of them had graduate degrees when they got their jobs," Toor said. "It just shows how with a bachelor's degree you can get really meaningful jobs, working for the environment - if you get real world experience."

"The Center provides students a great opportunity to actually leave school and get a job in their field," Toor said.

Volunteering with one of the many student groups housed in the Environmental Center gives students the opportunity to grapple with real world environmental change.

"Instead of studying environmental pol-



Joan Schunck, president of the CU Environmental Center Board, introduces Adam Werbach, the youngest president in the history of the Sierra Club, at his fall 1998 on-campus talk. The Environmental Center sponsors many events throughout the school year.

- Photo courtesy of the CU Environmental Center

icy, they are actually getting out there and trying to change things," Toor said.

Past Center projects include creating the CU Recycling program 23 years ago—which has grown into a student/administrative partnership that is recognized as one of the best in the country—and working to encourage use of alternative forms of transportation.

In the fall of 1997, the University of Colorado Environmental Center received a Way to Go! Award from the U.S. Environmental Protection Agency for its part in the development of the student bus pass program. The award is given to only a handful of innovative programs around the country that reduce air pollution and emissions of greenhouse gases. The program provides bus passes to all CU students, and works to improve local and

regional transit service.

The Center also serves as environmental clearing house, holding more than 1,300 books, 40 periodicals, an audio and videotape collection and subject files.

Student's environmental work through the Center has helped change the culture on campus, Toor said. "Departments such as Facilities Management and Parking Services have really developed a strong environmental ethic. They have also seen that there are many opportunities to simultaneously save money and reduce the environmental impacts of campus operations."

"Working at the Center has great educational value," Toor said. "It forces you to think interdisciplinarily. True integration across different disciplines is how decisions actually get made," Toor added.

The CU Environmental Studies Club was established during the 1995 fall semester to advocate for more resources for the Environmental Studies program and to communicate between students and faculty. The club also allows Environmental Studies students to help structure their own education.

ONE LESS CAR CLUB

Campus Box 207

Boulder, CO 80309
Phone: 303-492-8308

The One Less Car Club works to focus attention on ways to save energy and reduce CU-Boulder's contribution to air pollution caused by cars. The group promotes the use of bicycles, mass transit and other alternatives to single passenger cars.

RAINFOREST ACTION GROUP

Campus Box 207
Boulder, CO 80309
Phone: 303-492-5738

Through presentations and literature distribution, the RAG provides the community with factual information on the value of the world's tropical resources and their alarming rate of destruction.

SINAPU

Campus Box 207
Boulder, CO 80309
Phone: 303-492-5024
<http://ucsu.colorado.edu/~cusinapu/>

Sinapu (pronounced Sin-ah-pyoo) is named after the Ute Indian word for wolves. CU Sinapu is dedicated to recovery of the gray wolf in Colorado, and to restoration of the habitat that all species need to survive and flourish. The group educates the public about the role of wolves and other large predators in an ecosystem.

STUDENT ENVIRONMENTAL ACTION COALITION

Campus Box 207
Boulder, CO 80309
Phone: 303-492-5449

As the local chapter of a national student environmental network, the Student Environmental Action Coalition works to create local and global social change.

STUDENTS FOR COOPERATIVE HOUSING

Campus Box 207
Boulder, CO 80309
Phone: 303-492-8308

This committee passed a student referendum in the spring of 1998 to create student funding for cooperative housing at the University of Colorado at Boulder. The group has been working to develop a student co-op with an environmental theme at CU. The group envisions a CU co-op as a laboratory for appropriate technology, combining the technology of solar collectors, recycling, composting, organic gardening and energy conservation.

WILDERNESS STUDY GROUP

Campus Box 207
Boulder, CO 80309
Phone: 303-492-6870
e-mail: WSG@ucsu.colorado.edu
<http://ucsu.colorado.edu/~wsg/>

W.S.G. is the oldest student environmental group on campus. Formed in 1970, W.S.G. members work closely with the Colorado conservation community to preserve public lands and defend wilderness. Current projects include timber sales moni-

toring, wilderness suitability studies, prevention of wild lands roads, efforts to define lynx habitat in Colorado and the fight to stop logging on an area of virgin forest in Southern Colorado that is home for many species of animals and the watershed for six traditional Chicano agricultural communities.

OUTDOOR PROGRAM

Recreation Services
University of Colorado at Boulder
Phone: 303-492-6080
<http://www.colorado.edu/sacs/rec-center/programs/outdoor/index.html>

[see profile page 15]

UNIVERSITY MEMORIAL CENTER EXPANSION

In 1998 the CU-Boulder Student Government decided to expand and renovate the student union building on campus. The UMC Millennium project will add 50,000 square feet to the University Memorial Center and dramatically remodel the entire building.

The expansion is led by four guiding principles, one of which is "the project must be environmentally sensitive and efficient." Students are participating in design character, examining issues such as the use of "green" finishing materials, recycled building materials and energy efficient building design.



In addition to research and education, the University is also involved in the transformation of resources--food, water, energy, forest products, chemical inputs--into sewage, various oxidation products, solid waste, and hazardous waste. These flows are the most direct connections between the campus and the biosphere.

During the last two decades, the University of Colorado has introduced new programs to reduce environmental impacts in a variety of areas including solid waste, transportation, energy use, water use, pest control, and waste reduction. The CU-Boulder Recycling and Bus Pass programs have become national models. In 1998 Facilities Management took a major step with the creation of an environmental coordinator who will work on further greening of campus operations.

At the same time, CU faces major environmental challenges. Campus use of electricity and energy for heating and cooling is growing at 5 percent annually, leading to major increases in emissions of greenhouse gases. Water use has surged recently. These issues are not simple, and there are many tradeoffs involved.

These problems provide a unique educational opportunity. By studying the environmental impacts of their University, many students gain their first real exposure to interdisciplinary research, requiring them to integrate skills from the natural sciences, policy and economics. Students connect their academic studies to their everyday experience.

Read on for a tour of campus operations.....

BUS PASS PROGRAM

University of Colorado

Campus Box 207

Boulder CO 80309

Phone: 303-492-8308

Fax: 303-492-1897

<http://ucbparking.colorado.edu/AlternativeTransportation/StudentBusPass.htm>

During the last decade, the University of Colorado has been grappling with how to provide access to the campus without destroying the quality of the campus as an educational community. It has been a difficult and fascinating process, which has led to some fundamental changes in the way we approach transportation. We no longer automatically assume that the only solution to demand is building new parking structures. Multiple factors - lack of land for new parking lots, the high costs of building parking structures, pressure from surrounding communities, concerns about environmental impacts - are leading us towards a new vision based upon expanded transit access, better bicycle and pedestrian facilities, and higher fees for

parking.

One key step in this process was the creation of the University of Colorado Student Bus Pass program, designed to give the 25,000 students at the Boulder campus easy alternatives to using automobiles for transportation. The program is unique in that it was initiated by students, in partnership with local government, and has been managed by the student government for the last 6 years.

The bus pass program was initiated by a student vote in the spring of 1991, when students voted 4 to 1 to assess themselves a \$10/semester fee to provide free access to local buses to any student with a valid ID. Since that time the program has grown substantially. Students are now able to ride local and regional buses, have initiated weekend bus service to a number of ski areas, and are partially funding a new community shuttle program. The student body reaffirmed their support by voting 15 to 1 to raise their fees again in April of 1997.

The success of the program has been remarkable. Before the passes were issued, a survey by the Regional Transportation District indicated that 300,000 student bus trips took place in the 1991-92 school year. Within three years, this number grew to 900,000. For academic year 1996-97, preliminary numbers indicate that we will surpass 1,500,000 student rides. Surveys conducted by Quantum Research Associates in 1995 indicated that 42 percent of these trips would have taken place in automobiles.

This implies that avoided driving mileage is in the range of 3.4-6.5 million miles/year. At an average CO2 emissions of .51 kg/mile, this implies avoided greenhouse gas emissions of 1700- 3300 metric tons/year.

There are also economic side benefits. The University of Colorado is landlocked, and has no space to build additional surface lots. Any new parking requires building structures on top of existing parking lots, at a cost per new space of over \$10,000. The bus pass program has reduced parking demand by approximately 1,000 spaces, as well as reducing pressure to expand the parking supply, helping avoid major capital expenditures.

In January of 1998, the new faculty/staff bus pass started. Permanent employees are now able to ride local and regional buses by showing their valid campus id card. They also have access to a guaranteed ride home, if they need to get home after the buses stop running. In the first year of the program, employee transit use rose 80 percent. The City of Boulder and the Regional Transportation District both offered financial support to help the University start the faculty/staff bus pass.

UNIVERSITY OF COLORADO RECYCLING SERVICES

Campus Box 207
Boulder, CO, USA 80309
Phone: 303-492-8307
Fax: 303-492-1897
<http://www.colorado.edu/cure/>

[see profile page 20]

FACILITIES MANAGEMENT

Customer Service Center
Campus Box 53
Phone: 303-492-5522

Fax: 303-492-8656
<http://fm.colorado.edu>

Facilities Management is responsible for the care and upkeep of much of campus, from the flower beds to running the co-generation [power] plant. Some of the most interesting and innovative environmental activities on campus are run by Facilities Management. These include:

◆ Integrated Pest Management

Since 1986, the Grounds Department has been incorporating Integrated Pest Management practices into their care of the campus landscape.

Integrated Pest Management (IPM) is a system whereby the grounds staff works to deal with pests more effectively by using biological controls and cultural practices in lieu of traditional pesticide application. While the grounds manager and the three area supervisors hold pesticide applicator licenses from the state department of Agriculture, ultimately, the goal is to avoid pest infestation in the first place. IPM has been applied most notably in the management of about 50 American and Augustine elm trees on campus —other areas of IPM approaches include broadleaf and noxious weed management.

In addition, Grounds Maintenance has eliminated the use of restricted use chemicals on the exterior portions of campus. In 1998, the grounds division cooperated in the Colorado Clean sweep program to properly dispose of agricultural chemicals that were purchased prior to 1986.

◆ Campus Composting

Grounds crews are actively working to collect organic wastes on campus and get them ready to be shipped off-campus for composting. CU-Boulder's composting program has diverted approximately 2,500 cubic yards of organic material from the landfill since 1993.

◆ Raw Water Irrigation

The general fund areas of campus are irrigated using non-potable water from the New Anderson ditch system. This water is used in a "raw" state and eventually works its way back into the Boulder Creek watershed. There is a significant cost avoidance associated with the use of raw water as opposed to use of treated city water, and computerized soil moisture meters help avoid unnecessary watering.

◆ Resource Conservation

Resource-conservation elements are incorporated, whenever possible, into renovations and new construction on campus. Some of these elements include: high-efficiency lighting with optimized layout, close monitoring of insulation drawing details and installation, high-efficiency motors, building pre-cooling with outside air, water-conserving faucets and toilet fixtures and drinking fountains without mechanical cooling.

In addition, the CU-Boulder campus is probably the best example in the state, if not the southwest, of installation and use of indirect/direct evaporative cooling. The dry climate and the need for high ventilation rates in classroom and other high-occupancy buildings makes this a very good application. The simple

Recycling is tops at CU-Boulder

The University of Colorado at Boulder has created one of the most successful university recycling programs in the nation. The comprehensive recycling program serves all of its 168 campus buildings, 25,000 students, and 8,500 faculty and staff, collecting and finding markets for 1,200 tons of recyclable materials annually.

The University generates an estimated \$79,000 in recycling revenue and waste disposal avoidance last year (\$55,000 revenue generated and \$24,000 avoided costs of landfill disposal). In fact, Colorado University recently retired the debt on its \$500,000 recycling facility with careful budgeting and accrued savings in disposal costs.

Additional proceeds from recycling have been dedicated to the community in the form of mentoring programs for disadvantaged youth, teacher training, and research and internship placement to off-campus recycling agencies and businesses.

The success is not limited to waste diversion, community development, and money savings, however. It is also effective in creating markets for recycled products and training students in managing recycling programs nation wide.

"Buying recycled" is an important element of the CU-Boulder recycling program. It is acutely aware of the constraints imposed by limited markets for recycled materials, and makes a concerted effort to expand markets by purchasing recycled products whenever possible. Over 60 percent of all paper purchased by the University (\$525,000) contains EPA minimum standards for post consumer fiber. Xerographic paper and finished compost are two examples of the closed-loop purchasing efforts made at CU-Boulder.

The recycling program, one of the first



CU Recycling collects cans and bottles at every Buffs football game./ Photo courtesy of CU Recycling

four campuses to offer recycling in the United States, was launched by the student government in 1976. In 1990 a Student-Administration Partnership for recycling was formed. As part of this program, students staff the on-campus recycling processing center, prepare materials for market, manage recycling contracts, and coordinate campus outreach and research related to the recycling program. Facilities Management employees coordinate a convenient desk-side program, collect recyclables, and operate an efficient trash disposal operation. In addition, the program uses its considerable expertise to teach about recycling by sponsoring internships, independent studies and more than 15 class projects each year.

CU-Boulder shares its recycling strategies with campuses all across America. It

was a founding member of the College and University Recycling Council. CURC is affiliated with the National Recycling Coalition and represents over 180 university recycling coordinators nationwide.

In addition to its economic, community and professional development benefits, the recycling program at Colorado University also offers one more direct advantage...a cleaner environment. To date, the program has diverted more than 11,500 tons of recyclable paper, cardboard, metals, glass and plastic from its local landfills.

Given all of the above achievements, it is no surprise that Colorado University has been the recipient of several distinguished recycling awards over the past ten years. In 1988 Colorado University was recognized as the "Colorado Recycler of the Year". In 1992, EPA awarded Colorado University with its Pollution Prevention Award. Finally, in 1995 Colorado University was the first recipient of the National Recycling Coalition's "Outstanding School Recycler of the Year" Award. CU Recycling plans significant improvements in the months and years to come. Some of the projects underway include revising building codes to include recycling provisions and recycled products in all new construction and remodeling projects.

According to Jack DeBell, CU recycling director, "The combination of a strong partnership with Facilities Management plus a supportive student government, will maintain momentum for campus recycling. However, off campus support from the manufacturing sector and recycling industry will be needed for campus recycling to reach its full potential"

payback for this type of cooling versus using mechanically-chilled air is approximately seven years.

A research campus such as CU-Boulder has a very high need for cooling of equipment with water. Over the years, there has been much use of potable water for one-pass cooling and then dumping down the drain. This has caused wasting of water at a rate of many millions of gallons a year. The best way to overcome this waste is to provide

chilled water in closed loop. Aside from not wasting water, it has the benefit of providing mineral-free water at a consistent temperature. In a recent retrofit, roughly 8 million gallons of water per year are being saved, with a simple payback of approximately 10 years, as well as the environmental benefits.

— GREENING OUR FUTURE —

Editor.....Sarah Elizabeth Drury

Editorial Advisors.....Robert Sievers & Will Toor

Editorial Intern.....Tomas A. Murray

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Please contact the CU Environmental Center at 303-492-8308 to order additional copies of this document.

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