

and fluorescence, gas and ion chromatography, and ion-selective electrodes.

EnSci 559. Environmental Soil Chemistry. (Dual-listed with 459, same as Agron 559.) (3-0) Cr. 3. S. *Prereq:* Agron 354, Chem 178L or 210 Thompson. An introduction to the chemical properties of soils, chemical reactions and transformations occurring in the soils and their impact on the environment. Topics include composition of soils, acid-base equilibria, buffer systems, mineral dissolution and precipitation, speciation, ion exchange, redox reactions, absorption phenomena, soil pollution and chemical-equilibria computer programs.

EnSci 564. Wetland Ecology. (Same as EEOB 564.) (3-0) Cr. 3. S. *Prereq:* 15 credits in biological sciences. Ecology, classification, creation and restoration, and management of wetlands. Emphasis on North American temperate wetlands.

EnSci 564L. Wetland Ecology. (Same as la LL 564L.) See Iowa Lakeside Laboratory.

EnSci 571. Surface Water Hydrology. (Same as C E 571.) (3-0) Cr. 3. *Prereq:* 372. Analysis of hydrologic data including precipitation, infiltration, evapotranspiration, direct runoff and streamflow; theory and use of frequency analysis; theory of streamflow and reservoir routing; use of deterministic and statistical hydrologic models. Fundamentals of surface water quality modeling, point and non-point sources of contamination. Design project.

EnSci 572. Analysis and Modeling of Aquatic Environments. (Same as C E 572.) (3-0) Cr. 3. *Prereq:* 571. Principles of surface water flows and mixing. Introduction to hydrologic transport and water quality simulation in natural water systems. Advection, diffusion, and dispersion, chemical and biological kinetics, and water quality dynamics. Applications to temperature, dissolved oxygen, primary productivity, and other water quality problems in rivers, lakes, and reservoirs. Deterministic vs. stochastic models.

EnSci 573. Groundwater Hydrology. (Same as C E 573.) (3-0) Cr. 3. *Prereq:* C E 372. Principles of groundwater flow, hydraulics of wells, super-position, slug and pumping tests, streamlines and flownets, and regional groundwater flow. Contaminant transport. Computer modeling. Individual and group projects.

EnSci 574. Environmental Impact Assessment. (Same as C E 574.) (3-0) Cr. 3. *Prereq:* Four courses in natural, biological, or engineering sciences and senior or above classification. Review of federal and state requirements for environmental impact assessment, requirements of the National Environmental Policy Act and Council on Environmental Quality, methods of evaluating the environmental impacts on the physical, biological, socioeconomic, cultural/historical, human health and psychological environments, public participation in EIS, review and evaluate project environmental impact statements. An environmental impact assessment of a proposed project will be completed in small teams.

EnSci 577. Soil Physics. (Same as Agron 577.) (3-0) Cr. 3. S. *Prereq:* 354. *Recommended:* Math 166. Horton. The physical soil system: the soil components and their physical interactions; transport processes involving water, air, and heat.

EnSci 578. Laboratory Methods in Soil Physics. (Same as Agron 578.) (3-0) Cr. 3. S. *Prereq:* 577 concurrent. Horton. Methods of measuring soil physical properties such as texture, density, and water content, and transport of heat, water, and gases.

EnSci 579. Surficial Processes. (Dual-listed with 479, same as Geol 579.) (2-2) Cr. 3. F. *Prereq:* Geol 100 or 201 or equivalent experience. Study of surficial processes in modern and ancient geological environments. Topics include weathering, sediment transport, and landform genesis with emphasis on fluvial, glacial hillslope, eolian, and coastal processes. Applications to engineering and environmental problems. Laboratory emphasizes aerial photo and topographic map interpretation.

EnSci 580. Engineering Quantification of Biological Processes. (Same as A E 580.) (2-2) Cr. 3. S. *Prereq:* Math 266; Biol 101 or 211; M E 330. Prediction of biological systems behavior by computer simulation of mathematical system models. Focus on mathematical representation of biological processes including population dynamics, growth, development, diffusion, bioenergetics, enzyme kinetics. Flow diagrams for representing systems and constructing mathematical models. Finite difference techniques for continuous system simulation including examples of plant growth and soil water balances. Students enrolled in A E 580 will be required to answer an additional final exam question, to report on two journal articles, and to complete a more comprehensive class project than students enrolled in A E 480.

EnSci 581. Environmental Systems. (Dual-listed with 381, same as EEOB 581.) (2-4) Cr. 4. F. *Prereq:* Biol 212 or Micro 201, Chem 164, 167, or 178, Math 165 or 181. Crumpton. Introduction to the dynamics of metabolic and biogeochemical processes in environmental systems, emphasizing microbial processes. Environmental factors controlling major autotrophic and heterotrophic processes of microbes and higher organisms. Laboratory emphasizes mass balance analysis and environmental simulation modeling.

EnSci 583. Environmental Biogeochemistry. (Dual-listed with 483, same as EEOB 583, Geol 583.) (3-2) Cr. 4. S. *Prereq:* EnSci 381 and 402 or 402L. Fang, Raich. Biological, chemical, and physical phenomena controlling material, energy, and elemental fluxes in the environment. Human interactions with and effects on environmental systems.

EnSci 584. Ecosystem Ecology. (Same as EEOB 584.) (3-0) Cr. 3. Alt. S., offered 2006. *Prereq:* Combined 12 credits in biology and chemistry. Survey of the structure and functioning of major terrestrial ecosystems. Nutrient cycles, energy flows, and biotic and abiotic controls over ecosystem structure and composition.

EnSci 585. Soil Microbial Ecology. (Dual-listed with 485, same as Agron 585, Micro 585.) (2-3) Cr. 3. F. *Prereq:* 402 or Agron 154, Micro 201 (*Micro 203 recommended*). Loynachan. The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues.

EnSci 586. Aquatic Ecology. (Dual-listed with 486, same as EEOB 586.) (3-0) Cr. 3. F. *Prereq:* 301, 312, or 381. Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine and wetland ecology.

EnSci 586L. Aquatic Ecology Laboratory. (Dual-listed with 486L, same as EEOB 586L.) (0-3) Cr. 1. F. *Prereq:* Concurrent enrollment in 586. Field trips and laboratory exercises to accompany 586. Hands-on experience with aquatic research and monitoring techniques and concepts.

EnSci 587. Aquatic and Wetland Microbial Ecology. (Dual-listed with 487, same as EEOB 587, Micro 587.) (3-0) Cr. 3. S. *Prereq:* 6 credits in biology and 6 credits in chemistry. Crumpton. Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in aquatic and wetland ecosystems. Emphasis on energy flow and nutrient dynamics.

EnSci 590. Special Topics. Cr. var. *Prereq:* Permission of major professor in Environmental Science faculty. Literature reviews and conference in accordance with needs and interest of the student.

EnSci 599. Creative Component. Cr. var. *Prereq:* Permission of major professor in Environmental Science faculty. Creative component for nonthesis master of science degree.

Courses for graduate students

EnSci 690. Seminar in Environmental Science. (1-0) Cr. R. F.S. Reports and discussion of recent research and literature.

EnSci 699. Research.

Environmental Studies

www.envs.iastate.edu

(Interdepartmental Undergraduate Program)

William G. Crumpton: Coordinator

The Environmental Studies Program deals with the relationship between humans and nature, or between humans and natural systems. The curriculum is designed to give students an understanding of regional and global environmental issues and an appreciation of different perspectives regarding these issues. Courses are provided for students pursuing careers related to the environment and for others who simply want to know more about environmental issues. In addition, students in any college may elect to take a secondary major or minor in Environmental Studies.

Secondary Major

The Environmental Studies secondary major is taken in addition to one's first major and provides the breadth of preparation and integrated perspective necessary to understand environmental issues. Students seeking a major in Environmental Studies complete 24 credits of Env S coursework including (1) at least one general survey course chosen from Env S 101, 120, 173, and 201, (2) at least one integrative/issues course chosen from Env S 304, 324, 342, 404, 424, and 450, and (3) at least two human/societal perspectives courses chosen from Env S 303, 320, 334, 345, 380, 382, 384, 442, 472, 482, 484, and 491. Beyond these three requirements, any Environmental Studies course and up to six credits of approved departmental coursework may be applied toward the 24 credit total for the major. Regardless of their home college, Environmental Studies majors must complete 12 credits of approved coursework in natural science including coursework from life sciences and physical sciences. Since Environmental Studies is a secondary major, courses used in the major may also be used to satisfy general education and other requirements of departments and colleges. A combined average grade of C or higher is required in courses applied to the major.

Regardless of their primary major, Environmental Studies graduates have a broad foundation in science and humanities, an understanding of major regional and global environmental issues, and an appreciation of the varied and sometimes opposing perspectives regarding these issues.

Minor

Students seeking a minor in Environmental Studies complete 15 credits in Environmental Studies courses including (1) at least one general survey course chosen from Env S 101, 120, 173, and 201, (2) at least one integrative/ issues course chosen from Env S 304, 324, 342, 404, 424, and 450, and (3) at least two human/societal perspectives course chosen from Env S 303, 334, 345, 380, 382, 384, 442, 472, 482, 484, and 491. Beyond these three requirements, any Environmental Studies course may be applied toward the 15 credit total for the minor. A combined average grade of C or higher is required in courses applied to the minor, and the minor must include at least 9 credits that are not used to meet any other department, college, or university requirement.

Courses open for nonmajor graduate credit: 303, 334, 342, 381, 384, 404, 460, 4611, 472, 4801, 482.

Courses primarily for undergraduate students

Env S 101. Environmental Geology: Earth in Crisis. (Same as Geol 101.) (3-0) Cr. 3. F.S. An introduction to geologic processes and the consequences of human

activity from local to global scales. Discussion of human population growth, resource depletion, pollution and waste disposal, global warming and ozone depletion, desertification, and geologic hazards such as earthquakes, landslides, flooding, and volcanism.

Env S 108. Introduction to Oceanography. (Same as Geol 108.) (3-0) Cr. 3. F. Introduction to study of the oceans. Ocean exploration. Waves and currents. Shape, structure, and origin of the ocean basins. Sedimentary record of oceanic life. Composition of seawater and its significance for life. Ocean circulation and its influence on climate. Life of the oceans, including coral reefs. Use and misuse of ocean resources. Anthropogenic impacts on the oceanic environment.

Env S 120. Introduction to Renewable Resources. (Same as Agron 120, AST 120, NREM 120.) (3-0) Cr. 3. FS. Overview of soil, water, plants, and animals as renewable natural resources in an ecosystem context. History and organization of resource management. Concepts of integrated resource management.

Env S 130. Natural Resources and Agriculture. (Same as AST 130, NREM 130.) (3-0) Cr. 3. Survey of the ecology and management of fish, forest, and wildlife resources in areas of intensive agriculture, with emphasis on Iowa. Conservation and management practices for private agricultural lands.

Env S 173. Environmental Biology. (Same as Biol 173.) (3-0) Cr. 3. FS. An introduction to the structure and function of natural systems at scales from the individual to the biosphere and the complex interactions between humans and their environment. Discussions of human population growth, biodiversity, sustainability, resource use, and pollution.

Env S 201. Introduction to Environmental Issues. (4-0) Cr. 2. FS. First 8 weeks. *Prereq: Sophomore classification.* Ecological and human/societal dimensions of environmental issues; how humans and their institutions interact with and affect the environment; how societies are affected by environmental change. Selected issues such as human population growth, loss of biodiversity, and effects of agriculture on the environment.

Env S 293. Environmental Planning. (Same as C R P 293, Dsn S 293.) (3-0) Cr. 3. Alt. F, offered 2005. *Prereq: Sophomore classification.* Comprehensive overview of the field of environmental relationships and the efforts being made to organize, control, and coordinate environmental, aesthetic, and cultural characteristics of land, air, and water.

Env S 303. Great Environmental Writings. (3-0) Cr. 3. FS. Students will read works by such authors as Thoreau, Muir, Leopold, and Abbey. Nonmajor graduate credit.

Env S 304. Biodiversity. (Same as Biol 304.) (4-0) Cr. 2. S. Second 8 weeks. *Prereq: One course in life sciences.* Survey of the major groups of organisms and biological systems. Definition, measurement, and patterns of distribution of organisms. Sources of information about biodiversity. Not intended for major credit in the biological sciences.

Env S 320. Ecofeminism. (Same as W S 320.) (3-0) Cr. 3. Alt. F, offered 2005. *Prereq: W S 201 or 3 credits in W S at the 300 level or above.* Women's relationships with the earth, non-human nature, and other humans. The course explores the connection between the mastery of women and the mastery of nature; origins of ecofeminism and its relation to the science of ecology and to other branches of feminist philosophies. Critique of modern science, technology, political systems as well as solutions will be included.

Env S 324. Energy and the Environment. (Same as Geol 324, Mteor 324.) (3-0) Cr. 3. S. Renewable and non-renewable energy resources. Origin, occurrence, and extraction of fossil fuels. Nuclear, wind, and solar energy. Energy efficiency. Environmental effects of energy production and use, including air pollution, acid precipitation, groundwater contamination, and nuclear waste disposal, and global climate change.

Env S 334. Environmental Ethics. (Same as Phil 334.) (3-0) Cr. 3. F. *Prereq: Three credits in philosophy or junior classification.* Thorough study of some of the central moral issues arising in connection with human impact on the environment, e.g., human overpopulation, species extinction, forest and wilderness management, pollution. Several world views of the proper relationship between human beings and nature will be explored. Nonmajor graduate credit.

Env S 342. World Food Issues: Past and Present. (Same as Agron 342, FS HN 342, T SC 342, U St 342.) (3-0) Cr. 3. S. Salvador. World food problems in context of historical development of agriculture in major cradles of civilization. Emphasis on population trends and socioeconomic policies to understand disparities between potential agricultural production and present energy and nutritional deficiencies in key areas of the developing world. Team projects. Nonmajor graduate credit.

Env S 345. Population and Society. (Same as Soc 345.) (3-0) Cr. 3. F. *Prereq: Soc 130 or 134.* Human population growth and structure; impact on food, environment, and resources; gender issues; trends of births, deaths, and migration; projecting future population; population policies and laws; comparison of the United States with other societies throughout the world.

Env S 380. Environmental and Resource Economics. (Same as Econ 380.) (3-0) Cr. 3. F. *Prereq: Econ 101.* Natural resource availability, use, conservation, and government policy, including energy issues. Environmental quality and pollution control policies.

Env S 381. Environmental Systems. (Same as Biol 381, EnSci 381, Micro 381.) (2-4) Cr. 4. F. *Prereq: Biol 212 or Micro 201, Chem 164, 167 or 178, Math 160, 165 or 181.* Crumpton. Introduction to the dynamics of metabolic and biogeochemical processes in environmental systems, emphasizing microbial processes. Environmental factors controlling major autotrophic and heterotrophic processes of microbes and higher organisms. Laboratory emphasizes mass balance analysis and environmental simulation modeling. Nonmajor graduate credit.

Env S 382. Environmental Sociology. (Same as Soc 382.) (3-0) Cr. 3. FS. *Prereq: Soc 130, 134, or Env S 201.* Environment-society relations; social construction of nature and the environment; social and environmental impacts of resource extraction, production, and consumption; environmental inequality; environmental mobilization and movements; U.S. and international examples.

Env S 384. Religion and Ecology. (Same as Relig 384.) (3-0) Cr. 3. Introduction to concepts of religion and ecology as they appear in different religious traditions, from both a historical and contemporary perspective. Special attention to religious response to contemporary environment issues. Nonmajor graduate credit.

Env S 390. Internship in Environmental Studies. Cr. var. *Prereq: Approval of the Environmental Studies Coordinator.* Practical experience with nature centers, government agencies, schools, private conservation groups, and other organizations. Offered on a satisfactory-fail grading basis only.

Env S 404. Global Change. (Same as Agron 404, EnSci 404, Mteor 404.) (3-0) Cr. 3. S. *Prereq: 4 courses in physical or biological sciences or engineering; junior standing.* Tackle. Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. Nonmajor graduate credit.

Env S 407. Watershed Management. (Same as EnSci 407, NREM 407.) (3-3) Cr. 4. S. *Prereq: A course in general biology.* Managing human impacts on the hydrologic cycle. Field and watershed landscape best management practices for modifying the impacts on water quality, quantity and timing are discussed. Field project includes developing a management plan using landscape buffers.

Env S 424. Sustainable and Environmental Horticulture Systems. (Same as Hort 424.) (2-0) Cr. 2. F. Inquiry into ethical issues and environmental consequences of horticultural cropping systems and production practices. Emphasis on production systems that are resource efficient, environmentally sound, socially acceptable, and profitable.

Env S 442. The Policy and Politics of Coastal Areas. (Same as Pol S 442.) (3-0) Cr. 3. SS. Exploration of political implications of coastal policy. Issues include: "Carrying capacity," zoning, regulation of human development activities, trade-offs between conservation and jobs, the quality of coastal lifestyle, ways in which citizens participate in policy for coastal areas.

Env S 450. Issues in Sustainable Agriculture. (Same as Agron 450.) (2-0) Cr. 2. F. Salvador. Agricultural science as a human activity; contemporary agricultural issues from agroecological perspective. Comparative analysis of intended and actual consequences of development of industrial agricultural practices.

Env S 460. Controversies in Renewable Resource Management. (Same as NREM 460.) (3-0) Cr. 3. F. *Prereq: 120, and A Ecl 312 or NREM 301. Junior classification.* Analysis of controversial renewable resource issues using a case approach that considers uncertainty and adequacy of information and scientific understanding. Ecological, social, political, economic, and ethical implications of each issue will be analyzed. Nonmajor graduate credit.

Env S 461I. Introduction to GIS. (Same as Ia LL 461I.) See *Iowa Lakeside Laboratory*. Nonmajor graduate credit.

Env S 472. American Environmental History. (Same as Hist 472.) (3-0) Cr. 3. F. *Prereq: Sophomore classification.* Conceptual approach to human history in North America by examining the impact of nature from precontact through the 20th century. Explores material interactions; intellectual modes; aesthetic relationships; and management strategies from aboriginal society through the environmental age. Nonmajor graduate credit.

Env S 480I. Introduction to Environmental Planning. (Same as Ia LL 480I.) See *Iowa Lakeside Laboratory*. Nonmajor graduate credit.

Env S 482. Environmental Politics and Policies. (Same as Pol S 482.) (3-0) Cr. 3. F. *Prereq: 3 credits in Political Science or 3 credits in Environmental Studies; junior classification.* Major ideologies relation to conservation and ecology. Processes, participants, and institutions involved in state, national, and global environmental policymaking. Case studies of environmental controversies and proposals for policy reform. Nonmajor graduate credit.

Env S 484. Sustainable Communities. (Same as C R P 484, Dsn S 484.) (3-0) Cr. 3. S. *Prereq: Senior status.* The theory and application of sustainability to the physical and social planning of communities. We will examine environmental ethics as a basis for sustainability, the history of the idea itself, and the movement toward indicators as outcome measurements both in the U.S. and internationally. We then explore how these ideas have been or might be applied in communities here and abroad.

Env S 490. Independent Study. Cr. var. *Prereq: Permission of instructor and approval of Environmental Studies coordinator.*

Env S 491. Environmental Law and Planning. (Same as C R P 491, Dsn S 491.) (3-0) Cr. 3. S. *Prereq: 6 credits in natural sciences.* Environmental law and policy as applied in planning at the local and state levels. Brownfields, environmental justice, water quality, air quality, wetland and floodplain management, and local government involvement in ecological protection through land use planning and other programs.