

## Program Proposal for a Minor

1. Name of the proposed minor.

**Sustainability**

2. Name of the department(s)/program(s) involved.

Anthropology, Architecture, Community and Regional Planning, Environmental Studies, Global Resource Systems, Materials Science and Engineering, Mechanical Engineering, Landscape Architecture, Sociology, Technology and Social Change.

3. Name of contact person(s).

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4. General description of the minor.

Sustainability is often defined as “meeting the needs of today without compromising the ability of future generations to meet their own needs.” Food, water, shelter, and clothing are “basic needs” on which there is universal agreement. There is also general agreement that all individuals should have access to proper sanitation, primary and secondary education, and basic health care. Current discussions of sustainability also include items such as: 1) a clean, healthy, and appealing environment, 2) meaningful and rewarding work, and 3) full participation in a just and equitable society.

Sustainability is based on natural and social processes. **Physical sustainability** is the ability of a natural system to more or less reproduce itself over time without significant external injections of energy or increases in entropy. **Economic sustainability** refers to the ability of an economic system to produce a constant or increasing standard of living over time. Physical sustainability is a prerequisite for economic sustainability, though man-made improvements in technology may enhance the ability of both physical and economic systems to reproduce or grow.

A concept closely related to sustainability is resilience. **Resilience** is the capacity of a system to undergo change and still retain its basic function and structure. Psychological resilience refers to an individual’s capacity to withstand stressors and not manifest psychology dysfunction. Ecosystem resilience is the capacity of an ecosystem to tolerate disturbance without collapsing into a qualitatively different state that is controlled by a different set of processes. One of the key issues in sustainability is the way in which systems and subsystems with varying levels of resilience interact in adjusting to external shocks. Some subsystems become more prominent, others fall away, some morph into completely new entities. Whether resilience of a given organism or subsystem is “good” or “bad” depends on the objective of the observer. Resilience of a worker to unemployment is usually viewed as “good” while resilience of Canada thistle (*Cirsium arvense*) is generally viewed as “bad”.

Sustainability and resilience are inherently holistic global concepts. Interactions between chemical and physical processes and the constraints they imply, between plants, animals and natural resources, between human beings and their local environment, and between industrial policies on different continents all affect natural and human flourishing on the planet. From symbiosis between aphids and ants to trans-boundary movement of water, sustainability must consider the competition and complementarity between living organisms to understand the constraints and challenges of creating a sustainable future.

Sustainability of human flourishing is inherently a social process. The natural, built, and cultural environment in which humans live and thrive is the outcome of generations of human interaction with the environment. For example, norms that are used by any group to assign relative values to such things as technological change, scientific inquiry, economic activity including profits and costs, risk, the natural world, and human and nonhuman life dramatically affect the decisions those groups take and thereby the opportunities they allow to future generations.

The goal of the minor in sustainability is to expose a large number of students at Iowa State University to ideas and issues related to a sustainable, resilient, balanced, and ethical future for the planet and its inhabitants, help them make wise decisions in their personal lives, and prepare themselves, if desired for, careers where sustainability is a major focus.

#### 5. Need for the proposed minor.

The idea that we should live sustainably, which was shoved from the back burner by the publication of *Silent Spring*, and heated up by the environmental movement of the 1970s, has been brought to a full rolling boil by research on climate change, ever falling water tables, and dramatic increases in the price of energy over the past decade. Discussions that started with *Limits to Growth*, and then quieted by rapid technological change and economic adjustment, have moved to the forefront of scientific and political debate once again.

Iowa State University has a long tradition in research and coursework related to stewardship of natural resources, particularly water and land. Courses and programs related to water resources, soil conservation and environmental issues have been around for decades. Iowa State kicked off a “Live Green” initiative in 2008. The current draft (22 April 2010) of the Strategic Plan for ISU for 2010-2015 states, “Iowa State will lead in developing more **sustainable** ways to produce and deliver food, water, materials, and energy; protect plant, animal, and human health; and care for our environment.” While the exact wording of the plan may change, it is certain that sustainability will be a major theme.

Current students will necessarily make many decisions over the course of their lifetime that will affect the sustainability of life on earth. There are a number of upper division courses on campus (many of recent origin) that address sustainability in natural and human effected systems but few if any at the introductory level that address sustainability in an integrative and inclusive manner.

T SC 220, a required course in the proposed minor, is a new course designed to make a broad multidisciplinary introduction to global sustainability issues available to students across the campus and prepare them to think holistically about sustainability issues in other more specialized courses and in their lives in general. T SC 220 will encourage students to think about sustainability issues as they pursue careers in science, engineering, agriculture, business, and the arts. Human flourishing in the centuries ahead depends on decisions made now, T SC 220 is an attempt to prepare them to make more informed and rational choices.

Anthropology 230, another required course in the proposed minor, has a renewed focus on linkages between individuals, communities, and the outside world, provides a broad introduction to the social issues so important in sustainability in a global context, focusing not on any one country or system, but on general aspects of culture, kinship, social organization and stratification, political structure, rudimentary economics, globalization.

#### 6. Objectives of the proposed minor including the student learning outcomes and how the learning outcomes will be assessed.

The goal of the minor in sustainability is to expose a large number of students at Iowa State University to ideas and issues related to a sustainable, balanced, and ethical future for the planet and its inhabitants, and the interplay between environmental, social and economic factors in creating improvement

in the quality of human life within the carrying capacity of supporting ecosystems. The learning objectives may be summarized in four broad statements.

- a. The minor will help students understand 1) the dynamics of biological population growth and decline in the natural world, predator-prey models, over-exploitation of natural resources, energy balances, and so forth, 2) how human behavior affects the natural world and the ability of earth to sustain life, and 3) the stochastic interplay of human and natural factors in determining the long run population growth and welfare path for human and non-human species.
- b. The minor will guide students to an understanding of how the decisions they make as consumers, workers, resource owners, citizens and policymakers affect human welfare in this and future generations.
- c. Students completing the minor will be able to articulate why some environmental, social and economic profiles are sustainable and others are not.
- d. The minor will provide students knowledge sufficient to apply sustainable practices in their personal and professional lives.

The specific learning outcomes are summarized in Table 1.

**Table 1: Learning Objectives for the Sustainability Minor**

Students completing the minor in Sustainability will

- a. understand 1) the dynamics of biological population growth and decline in the natural world, predator-prey models, over-exploitation of natural resources, energy balances, and so forth, 2) how human behavior affects the natural world and the ability of earth to sustain life, and 3) the stochastic interplay of human and natural factors in determining the long run population growth and welfare path for human and non-human species.
- b. develop an understanding of how the decisions they make as consumers, workers, resource owners, citizens, and policymakers affect human welfare in this and future generations.
- c. be able to articulate using the concepts listed here why some environmental, social and economic profiles are sustainable and others are not.
  - i. sustainable harvest levels for bio-renewable resources
  - ii. appropriate extraction levels for non-renewable resources
  - iii. competition and complementarity between living organisms, symbiosis, identity and number of species (biodiversity), functional attributes, resource constraints, and carrying capacity
  - iv. sustainable agricultural practices
  - v. efficient use of renewable and non-renewable energy
  - vi. appropriate accounting for environmental externalities in the production of goods and services
  - vii. appropriate cultural practices for sustainable production and consumption
  - viii. sustainable habitats and communities
  - ix. sustainable engineering design and construction
  - x. sustainable architectural design and construction
  - xi. sustainable economic development
  - xii. sustainable social systems
  - xiii. climate change and sustainability
- d. will obtain knowledge (if not necessarily the motivation) sufficient to apply sustainable practices in their personal and professional lives.

Students will achieve these learning objectives as they complete the required courses for the minor. Two courses are required to complete the minor in Sustainability: T SC 220 and Anthropology 230. Course description for these two courses follow.

**T SC 220.** Globalization and Sustainability. (Cross-listed with ANTHR, ENV S, GLOBE, MAT E, M E, SOC.) (3-0) Cr. 3. An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world.  
Graduation Messages: Cannot be used for technical elective credit in any engineering department.

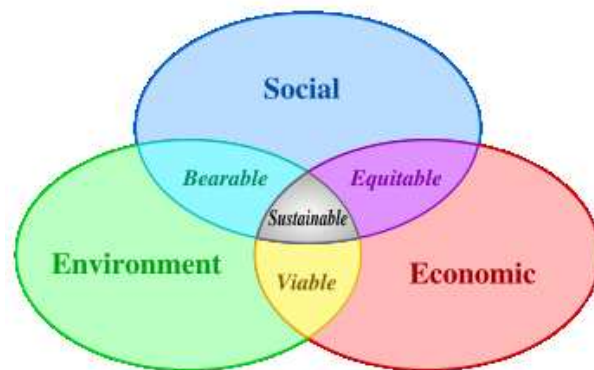
**ANTHR 230.** Globalization and the Human Condition. (3-0) Cr. 3. An introduction to

understanding key global issues in the contemporary world. Focuses on social relations, cultural practices and political-economic linkages among Africa, the Americas, Asia, Europe and the Pacific.

T SC 220 provides an overview of sustainability, issues acquainting students with holistic approaches to sustainability problems. Examples are taken from around the world, comparing and contrasting the potential for sustainable systems in the industrialized world, developing countries, small villages, and the natural system where there is little human intervention. Complex system concepts are introduced and applied to natural and human systems. Resilience as a property of organisms and systems is discussed. The effects of the distribution of power and wealth on meeting the basic needs of all individuals, on social justice, and on human rights are analyzed. The effects of individual human, plant, animal and natural resource interactions on overall system sustainability are emphasized.

Anthropology 230 introduces students to the global human condition, emphasizing the role that social and cultural relations and practices have on individual and group choices and welfare. While TSC 220 focuses on sustainability in a global context, Anthropology 230 focuses on globalization and differences in worldviews and social structures. Interdependence is the key concept is sustainability, interdependence between input availability and cost and output, between decisions now and the welfare future, between alternative production inputs and production processes, between decisions in OECD<sup>1</sup> countries and the rest of the world, and between individuals competing for resource use all over the planet.

T SC 220 and Anthropology 230 between them provide the basic framework for the study of sustainability as outlined by Goodland<sup>2</sup> in which he argues that sustainability is based on the interactions of three key realms: Environmental (or ecologic), Social, and Economic.



**Figure 1:** Aspects of Sustainability

Students will be exposed to all of the topics in Table 1 in TSC 220, the gateway course to the major. The course uses multiple instructors from multiple disciplines to provide the latest research and policy relevant information related to sustainability topics. Students will not only learn about these issues

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<sup>1</sup>Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.

<sup>2</sup>Goodland, Robert. 1995. "The Concept of Environmental Sustainability." *Annual Review of Ecology and Systematics* 26: 1-24.

but become aware of conflicting options and evidence as to the key factors in developing sustainable systems, the evidence on current issues of sustainability, and alternative policy options and their likelihood of success in meeting various sustainability targets. Understanding of these basic topics will be assessed through assignments, examinations, and papers in T SC 220.

Anthropology 230 is primarily about the social aspects of sustainability and pays particular attention to items **i.**, **ii.**, **vii.**, **ix.**, **xi.**, and **xii.** in Table 1. Anthropology 230 emphasizes how sustainability in any one part of the world is linked economically and socially to both local, national and international relationships between peoples and cultures.

More advanced understanding of the learning objectives will be assessed through the recommended courses.

7. Relationship of the minor to other programs at Iowa State University.

The minor in Sustainability is related to the new major in Global Resource Systems and students may take some courses in common in completing the sustainability minor. The minor in sustainability is campus wide in scope as compared to the Global Resource Systems major which has a relatively small number of required courses, but requires a minor of the College of Agriculture and Life Sciences.

There is some similarity between the minor in Sustainability and the minor in Technology and Social Change. The focus of the minor in Sustainability is broader than the minor in Technology and Social Change as outlined in the Table 2. As is clear from Table 2, the minor in Sustainability encompasses some portions of the minor in Technology and Social Change, but is different in its focus and more eclectic in the courses that will satisfy the requirements.

**Table 2: Comparison of Sustainability and Technology and Social Change Minors**

	Sustainability	Technology & Social Change
Required Course	T SC 220	T SC 341
Required Course	Anthr 230	Three credits from: T SC 342, 343, 474, 490, 543, 574, 580
Recommended Courses	See the list contained in the document entitled “Interdisciplinary Minor in Sustainability” and attached as SustainabilityMinor-ReqCoursesC.pdf. No more than nine credits can come from any one curriculum.	Nine non-overlapping credits from T SC 342, 343, 474, 490, 543, 574, 580 or other courses approved by the T SC faculty,

The four cross-listed undergraduate T SC courses (341, 342, 343, 474) are all on the recommended list for the Sustainability minor. A student could therefore complete the Sustainability minor by taking only two courses or six credits outside T SC. A student could also complete the Sustainability minor by taking only one T SC course, that is T SC 220.

The proposed undergraduate minor in Sustainability has many things in common with the interdisciplinary graduate program in Sustainable Agriculture, considering many of the same issues in other sectors of the economy and from a wider range of disciplinary perspectives and worldviews. The Sustainable Agriculture program grants only graduate degrees and so is not directly comparable, though

students in the Sustainable Agriculture program may take some courses on the recommended list for the Sustainability minor.

Some of required material in the proposed minor in Sustainability is covered in more detail in some courses required for the major in environmental science and the major in environmental studies. Many of those courses are electives in the proposed minor.

The proposed undergraduate minor in Sustainability fills an important educational need at Iowa State while complementing and building on existing programs. The attached list of elective courses makes clear the intent of the program to build upon and not duplicate existing programs.

8. Relationship of the minor to the strategic plans of the university, of the college, and of department or program. In developing a strategic plan for 2010–2015, the second draft of the plan for Iowa State University mentions emphases in six areas of strength.

- Ensuring an adequate supply of safe, nutritious food for the world’s population.
- Providing sustainable sources of energy to meet the world’s needs.
- Providing sustainable world infrastructures (transportation, cyber, etc.).
- Addressing water quality and water availability for the world’s population.
- Ensuring the sustainability of our planet in the face of climate change, agricultural development, and the transformation to a biologically based economy.
- Improving the health of plants, animals and humans.

Three of the six items contain the word sustainable or sustainability, two others use the words “adequate supply and” and “availability”. ISU has recently initiated a Live Green! Initiative, there is university wide Council on Sustainability, the College of Agriculture and Life Sciences has a major program in Uganda under the title Sustainable Rural Livelihoods, the College of Liberal Arts and Sciences has a newly constituted committee on Sustainability, The Engineering Policy and Leadership Institute rolled out the first Engineering Thematic Year on Energy Security and Sustainability in the fall of 2008 and held a Thematic Year Capstone Summit in the fall of 2009. There was a university wide symposium in the spring of 2009 and again in the spring of 2010 on Enhancing Sustainability at Iowa State University, and so on.

9. Comparison of the proposed minor with similar programs at other universities, including the Regent’s universities.

The University of Iowa (UI) issued a call in the spring of 2008 to consider a sustainability curriculum. Faculty were asked both to assess what current courses, programs, certificates and degrees address issues of sustainability, and to assess the need for coordinated, University-wide efforts in this area. UI also committed to create five new tenure-track faculty lines dedicated to supporting interdisciplinary sustainability efforts. Beginning fall 2009, UI will offer a Certificate in Sustainability. Students must complete 24 semester hours of course work that includes three introductory core courses, four electives from a designated list and one project course. The required courses include “Introduction to Sustainability,” “Introduction to Environmental Science” and “Contemporary Environmental Issues.” For their electives students may select from a wide array of courses offered across the disciplines, from “Glacial and Pleistocene Geology” and “Wetlands: Function, Geography and Management” to “History and Environment in Africa” and “Planning Livable Cities.” The certificate at Iowa is very similar to the proposed minor at ISU with the addition of one more introductory course, one more elective course, and a student project.

The University of Northern Iowa offered a new course entitled, “Introduction to Sustainability” in the fall of 2009! This course is an introduction to sustainability, providing a broad overview of challenges posed by environmental degradation and resource depletion, and potential ways societies can respond to ensure that these problems are not left for future generations to solve. The course explores the multi-faceted dimensions of sustainability as a web of interactions between the environment, technology, economy, and society. The course is solution-oriented, surveying the numerous options put forward as pathways toward sustainability. Students are required to partake in service projects that promote local sustainability in the Cedar Falls/Waterloo area.

A number of universities nationwide offer majors and minors in sustainability. Most are of recent origin.

University of Minnesota (minor)

<http://sustainabilitystudies.umn.edu>

[http://www.unm.edu/\\$\sim\\$sust/minor.html](http://www.unm.edu/$\sim$sust/minor.html)

University of North Carolina, Chapel Hill

<http://cf.unc.edu/ecology/sustainability{ }minor.cfm>

University of California, Irvine (minor)

[http://www.dbc.uci.edu/\\$\sim\\$sustain/global/global.htm](http://www.dbc.uci.edu/$\sim$sustain/global/global.htm)

Arizona State University (major)

<http://schoolofsustainability.asu.edu/prospective/degrees/>

University of Florida (minor)

<http://www.clas.ufl.edu/sustainability/>

Missouri Southern State University (minor and certificate)

<http://www.mssu.edu/catalog04-06/InterdisciplinaryStudies.pdf>

University of Massachusetts, Dartmouth (minor)

<http://www.umassd.edu/sustainability/curriculum.cfm>

The curricula in these programs as well as information provided by the Association for the Advancement of Sustainability in Higher Education (AASHE) (<http://www.aashe.org/>) was used in developing the proposed requirements and curriculum for the minor in sustainability at ISU.

#### 10. Program requirements and procedures.

Once the minor is approved, the minor will be administered by a multidisciplinary, multi-college steering committee appointed jointly by the Deans from the Colleges of Agriculture and Life Sciences, Design, Engineering, and Liberal Arts and Sciences. This steering committee will also serve as the curriculum committee for the minor. For more on this topic see item 12..

- a. prerequisites for prospective students;  
Undergraduate enrollment at Iowa State University
- b. application and selection process;  
Complete form for addition of minor
- c. language requirements;  
None
- d. courses and seminars presently available for credit toward the program;  
See attached list.



**Table 3: Requirements for the Minor in Sustainability**

The minor in Sustainability may be earned by completing a total of 15 credits including two required courses and nine elective credits from an approved list. Of the nine elective credits at least six credits must be at the 300 level or higher.

**Required courses:**

**T SC 220.** Globalization and Sustainability. (Cross-listed with ANTHR, ENV S, GLOBE, MAT E, M E, SOC.) (3-0) Cr. 3. An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world.

Graduation Messages: Cannot be used for technical elective credit in any engineering department.

**ANTHR 230.** Globalization and the Human Condition. (3-0) Cr. 3. An introduction to understanding key global issues in the contemporary world. Focuses on social relations, cultural practices and political-economic linkages among Africa, the Americas, Asia, Europe and the Pacific.

Depending on interests, students may chose to focus the upper division courses in a particular major or track in order to prepare for more specialized work in a given area, or to select courses from a broad range of fields, preparing them to be effective members of interdisciplinary teams addressing sustainability problems.

- e. proposed new courses or modifications of existing courses;  
T SC 220 is in the 2011-2013 catalog.
  - f. advising of students;  
Will be handled by existing advisers in primary major and members of the steering/advisory committee.
  - g. implications for related areas within the university.
    - Will enhance the demand for currently offered courses.
    - Will provide an additional certification of knowledge for students in a large number of current majors, some closely related to sustainability such as environmental science and some more distantly related such as political science.
11. General description of the resources currently available and future resource needs, in terms of:
- a. faculty members;  
All courses proposed for the minor are currently being taught.
  - b. computers, laboratories, and other facilities;  
Existing facilities associated with existing courses.

- c. library facilities (journals, documents, etc.) in the proposed area;  
Existing facilities associated with existing courses.
  - d. supplies, field work, student recruitment, etc.  
Existing facilities associated with existing courses.
12. Describe the needs for new resources and/or reallocated resources. Attach to the program proposal memos from the department chair(s), the college dean(s), and other appropriate persons, agreeing to the allocation of new resources and/or the reallocation of resources.

At this time the only reallocation of resources will be the time committed by the steering committee.

### **Administration of the Minor**

A Steering Committee for the minor in sustainability will consist of nine individuals appointed to three-year overlapping terms by the Deans of the College of Liberal Arts and Sciences, Engineering, Design, and Agriculture and Life Sciences. The chair of the committee will be from the College of Liberal Arts and Science. The members will be as follows.

- a. One faculty member from the College of Liberal Arts and Sciences.
- b. One faculty member from the College of Engineering.
- c. One faculty member from the College of Design.
- d. One faculty member from the College of Agriculture and Life Sciences.
- e. Five faculty members from any college including the above.

The College of Liberal Arts and Sciences will serve as the Administering College for the minor.

The Steering Committee will serve as the curriculum committee for the minor, will initiate and approve all changes to the minor, and will approve substitutions for courses required to complete the minor. The Steering Committee will also develop and produce information sheets and publications related to the minor, will work directly with advisers in individual departments and programs to encourage students to pursue the minor, and with faculty and staff across campus to promote educational activities with a sustainability focus. When appropriate members of the steering committee will advise individual students pursuing the minor.

13. Attach to the program proposal, letters of support, recommendations, and statements when appropriate, from programs and departments at ISU which are associated with the proposed program or have an interest in the proposed program.

See attached memos from:

- College of Liberal Arts and Sciences
- College of Engineering
- College of Design
- College of Agriculture and Life Sciences
- Department of Anthropology
- Major in Environmental Studies
- Major in Global Resource Systems

- Department of Materials Science and Engineering
- Department of Mechanical Engineering
- Department of Sociology
- Cross-disciplinary program in Technology and Social Change

14. If the new program is interdisciplinary, a governance document should be created and submitted to the Associate Provost for Academic Programs. Indicate here that it has been completed.

Governance document submitted on 22 March 2010.

# Requirements for the Interdisciplinary Minor in Sustainability

The minor in Sustainability may be earned by completing a total of 15 credits including two required courses and nine elective credits from an approved list. Of the nine elective credits at least six credits must be at the 300 level or higher.

## Required courses:

**T SC 220** Globalization and Sustainability. (Cross-listed with ANTHR, ENV S, GLOBE, MAT E, M E, SOC.) (3-0) Cr. 3. An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world.

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**ANTHR 230.** Globalization and the Human Condition. (3-0) Cr. 3. An introduction to understanding key global issues in the contemporary world. Focuses on social relations, cultural ‘practices and political-economic linkages among Africa, the Americas, Asia, Europe and the Pacific.

Depending on interests, students may chose to focus the upper division courses in a particular major or track in order to prepare for more specialized work in a given area, or to select courses from a broad range of fields, preparing them to be effective members of interdisciplinary teams addressing sustainability problems.

## Some Example Minor Programs

Emphasis	Required	Required	Elective 1	Elective 2	Elective 3
Agriculture 1	T SC 220	ANTHR 230	GEOL 160	AGRON 342	AGRON 450
Agriculture 2	T SC 220	ANTHR 230	NREM 120	ENV S 324	BIOL 355
Planning	T SC 220	ANTHR 230	C R P 425	C R P 484	Dsn S 491
Ecology 1	T SC 220	ANTHR 230	Biol 355	Biol 471	Biol 484
Ecology 2	T SC 220	ANTHR 230	Agron 120	NREM 452	NREM 471
Earth Science	T SC 220	ANTHR 230	Geol 101	Geol 324	Env S 334
Engineering	T SC 220	ANTHR 230	ME 388	ME 389	ME 433
Design	T SC 220	ANTHR 230	Arch 351	L A 302	C R P 417
Environment	T SC 220	ANTHR 230	Env S 324	EnSci 381	EnSci 382
Humanities	T SC 220	ANTHR 230	Env S 334	Engl 355	Soc 382
T SC	T SC 220	ANTHR 230	ENV S 324	T SC 341	T SC 343
Social Science I	T SC 220	ANTHR 230	Econ 380	Econ 385	Soc 411
Social Science II	T SC 220	ANTHR 230	Soc 345	Soc 382	Anthr 436

## Elective Courses Approved for the Minor in Sustainability

This list is based more or less on the 2011–2013 catalog. Note that the use of capital letters is not consistent between the 2009–2011 catalog and the 2011–2013 proof copy on the web.

We expect that courses will be added regularly to this list over time as sustainability concepts permeate our discourse and new courses are developed. We are aware of a number of courses in the works including new offerings in Biology, Chemistry, Geology and Physics.

### Agricultural Engineering

**A E 388. Sustainable Engineering and International Development.** (Cross-listed with C E, E E, M E, MAT E.) (2-2) Cr. 3. F. *Prereq: Junior classification in engineering.* Multi-disciplinary approach to sustainable engineering and international development, sustainable development, appropriate design and engineering, feasibility analysis, international aid, business development, philosophy and politics of technology, and ethics in engineering. Engineering-based projects from problem formulation through implementation. Interactions with partner community organizations or international partners such as nongovernment organizations (NGOs). Course readings, final project/design report.  
Major Teaching Department: C E

### Agronomy

**AGRON 120. Introduction to Renewable Resources.** (Cross-listed with ENV S, NREM.) (3-0) Cr. 3. F.S. 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.  
Major Teaching Department: NREM

**AGRON 160. Water Resources of the World.** (Cross-listed with GEOL, MTEOR, ENV S.) (3-0) Cr. 3. S. Study of the occurrence, history, development, and management of world water resources. Basic hydrologic principles including climate, surface water, groundwater, and water quality. Historical and current perspectives on water policy, use, and the role of water in society and the environment.  
Major Teaching Department: GEOL

**AGRON 342. World Food Issues: Past and Present.** (Cross-listed with ENV S, FS HN, T SC.) (3-0) Cr. 3. F.S. *Prereq: Junior classification.* Zdorkowski, Ford. Issues in the agricultural and food systems of the developed and developing world. Emphasis on economic, social, historical, ethical and environmental contexts. Causes and consequences of overnutrition/undernutrition, poverty, hunger and access/distribution. Explorations of current issues and ideas for the future. Team projects.  
Nonmajor Graduate Credit  
Topics: H. Honors Section. (Honors Program students only.)  
Major Teaching Department: AGRON

**AGRON 404. Global Change.** Dual-listed with 504; (Cross-listed with ENSCI, ENV S, MTEOR.) (3-0) Cr. 3. S. *Prereq: Four courses in physical or biological sciences or engineering; junior standing.* 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  
Major Teaching Department: MTEOR

**AGRON 446. International Issues and Challenges in Sustainable Development.** (Cross-listed with GLOBE, INTST.) Cr. 4. S. *Prereq:* 3-credit biology course, Sophomore or higher classification, permission of Instructor. Mullen. Interdisciplinary study and analysis of agricultural, biophysical, environmental, sociological, economical, political, and historical factors affecting sustainable development of communities and countries from art and science perspectives. International field experience with foreign language training required. A program fee is charged to students for international study abroad.

Major Teaching Department: AGRON

**AGRON 450. Issues in Sustainable Agriculture.** (Cross-listed with ENV S.) (3-0) Cr. 3. F. Zdorkowski. 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.

Major Teaching Department: AGRON

## Anthropology

**ANTHR 336. Global Development.** Dual-listed with 536; (3-0) Cr. 3. Alt. F., offered 2011. *Prereq:* *Anthr 201 or 306.* Cross-cultural analysis of current development practices from an anthropological perspective; focus on international aid, development institutions, agrarian reform, indigenous knowledge, humanitarianism and human rights; introduction to main theories of political and economic anthropology.

## Architecture

**ARCH 351. Solar Home Design.** (Cross-listed with DSN S.) (3-0) Cr. 3. S. *Prereq:* 202. Architectural design and technical analysis of residential structures with emphasis on energy construction and solar energy utilization.

Major Teaching Department: ARCH

## Biology

**BIOL 204. Biodiversity.** (Cross-listed with ENV S.) (4-0) Cr. 2. S. *Prereq:* *One course in life sciences.* Survey of the major groups of organisms and biological systems. Definition, measurements, and patterns of distribution of organisms. Sources of information about biodiversity. Not intended for major credit in the biological sciences. Half semester course.

Major Teaching Department: BIOL

**BIOL 355. Plants and People.** (3-0) Cr. 3. S. *Prereq:* *Credit in 211 and 211L.* Uses of plants and fungi by humans and the importance of plants in the past, present and future. Discussion of fruits, vegetables, grains, herbs, spices, beverages, oils, fibers, wood, medicines, and drugs, in the context of their agricultural, cultural, and economic roles in modern societies. Emphasis on origins and worldwide diversity of culturally important plants, their characteristics, and uses.

**BIOL 381. Environmental Systems I: Introduction to Environmental Systems.** (Cross-listed with EN-SCI, ENV S, MICRO.) (2-1) Cr. 3. F. *Prereq:* *12 credits of natural science including biology and chemistry.* Introduction to the structure and function of natural environmental systems. Systems approach to the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

Nonmajor Graduate Credit

Major Teaching Department: ENSCI

**BIOL 382. Environmental Systems II: Analysis of Environmental Systems.** (Cross-listed with EN-SCI.) (2-4) Cr. 4. S. *Prereq:* *EnSci 381.* Continuation of EnSci 381. Systems approach to the analysis of

material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

Nonmajor Graduate Credit

Major Teaching Department: ENSCI

**BIOL 471. Introductory Conservation Biology.** Cr. 3. *Prereq: Biol 312.* Examination of conservation issues from a population and community perspective. The role of genetics, demography, and environment in determining population viability, habitat fragmentation, reserve design, biodiversity assessment, and restoration ecology.

**BIOL 472. Community Ecology.** (2-2) Cr. 3. *S. Prereq: Biol 312.* The effect of interspecific interactions on the structure and dynamics of natural and managed communities; including concepts of guild structure and trophic web dynamics and their importance to the productivity, diversity, stability, and sustainability of communities. The implications of interspecific interactions in the management of wild species will be emphasized with illustrative case histories of interactions between plants, invertebrates, and vertebrates. Nonmajor Graduate Credit

**BIOL 484. Ecosystem Ecology.** (Cross-listed with ENSCI.) (3-0) Cr. 3. *S. Prereq: Combined 12 credits in biology and chemistry.* Introduction of the study of ecosystems and the factors that influence their properties and dynamics. Conceptual foundations for ecosystem studies. Quantitative analyses of accumulations, transformations, and fluxes of nutrients, water, and energy within and among ecosystems.

Major Teaching Department: BIOL

## Community and Regional Planning

**C R P 417. Urban Revitalization.** Dual-listed with 517; (Cross-listed with DSN S.) (3-0) Cr. 3. Alt. S., offered 2012. *Prereq: 253 or 270.* Planning methods available to further revitalization and preservation efforts, with particular attention to housing and neighborhoods. Relationship between neighborhood change and urban development process; public policy implications.

Major Teaching Department: C R P

**CC R P 425. Growth Management.** Dual-listed with 525; (Cross-listed with DSN S.) (3-0) Cr. 3. Alt. F., offered 2011. *Prereq: Junior classification.* Review of techniques used to manage growth-related change and to implement plans. Capital investment strategies; public land acquisition and protection; development impact analysis; impact mitigation, including impact fees; phased growth systems; urban, suburban and rural relationships; and land preservation. Major Teaching Department: C R P

**C R P 484. Sustainable Communities.** Dual-listed with 584; (Cross-listed with DSN S, ENV S.) (3-0) Cr. 3. Alt. S., offered 2013. *Prereq: Junior classification.* The history and theory of sustainable community planning. Procedural and substantive dimensions. Case studies of communities engaged in sustainability planning. Use and development of indicators.

Major Teaching Department: C R P

**C R P 491. Environmental Law and Planning.** Dual-listed with 591; (Cross-listed with DSN S, ENV S, L A.) (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.

Major Teaching Department: C R P

## Design Studies

**DSN S 351. Solar Home Design.** (Cross-listed with ARCH.) (3-0) Cr. 3. S. *Prereq:* Arch 202. Architectural design and technical analysis of residential structures with emphasis on energy construction and solar energy utilization.

Major Teaching Department: ARCH

**DSN S 491. Environmental Law and Planning.** Dual-listed with 591; (Cross-listed with C R P, ENV S, L A.) (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.

Major Teaching Department: C R P

## Economics

**ECON 380. Environmental and Resource Economics.** (Cross-listed with ENV S.) (3-0) Cr. 3. *Prereq:* 101. Natural resource availability, use, conservation, and government policy, including energy issues. Environmental quality and pollution control policies.

Major Teaching Department: ECON

**ECON 385. Economic Development.** (Cross-listed with GLOBE.) (3-0) Cr. 3. *Prereq:* 101, 102. Current problems of developing countries, theories of economic development, agriculture, and economic development, measurement and prediction of economic performance of developing countries, alternative policies and reforms required for satisfying basic needs of Third World countries, interrelationships between industrialized countries and the developing countries, including foreign aid.

Nonmajor Graduate Credit

Major Teaching Department: ECON

## English

**ENGL 355. Literature and the Environment.** (Cross-listed with ENV S.) (3-0) Cr. 3. *Prereq:* 250. Study of literary texts that address the following topics, among others: the relationship between people and natural/urban environments, ecocriticism, and the importance of place in the literary imagination.

Nonmajor Graduate Credit

Major Teaching Department: ENGL

## Environmental Science

**ENSCI 201. Introduction to Environmental Issues.** (Cross-listed with ENV S.) (2-0) Cr. 2. F.S. Discussion of current and emerging environmental issues such as human population growth, energy use, loss of biodiversity, water resources, and climate change.

Major Teaching Department: ENV S

**ENSCI 381. Environmental Systems I: Introduction to Environmental Systems.** Dual-listed with 581; (Cross-listed with BIOL, ENV S, MICRO.) (2-1) Cr. 3. F. *Prereq:* 12 credits of natural science including biology and chemistry. Introduction to the structure and function of natural environmental systems. Systems approach to the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

Nonmajor Graduate Credit

Major Teaching Department: ENSCI

**ENSCI 382. Environmental Systems II: Analysis of Environmental Systems.** Dual-listed with 582; (Cross-listed with BIOL.) (2-1) Cr. 3. S. *Prereq:* EnSci 381. Continuation of EnSci 381. Systems approach to the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.



Nonmajor Graduate Credit

**ENSCI 404. Global Change.** Dual-listed with 504; (Cross-listed with AGRON, ENV S, MTEOR.) (3-0) Cr. 3. S. *Prereq:* Four courses in physical or biological sciences or engineering; junior standing. 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

Major Teaching Department: MTEOR

**ENSCI 484. Ecosystem Ecology.** (Cross-listed with BIOL.) (3-0) Cr. 3. S. *Prereq:* Combined 12 credits in biology and chemistry. Introduction of the study of ecosystems and the factors that influence their properties and dynamics. Conceptual foundations for ecosystem studies. Quantitative analyses of accumulations, transformations, and fluxes of nutrients, water, and energy within and among ecosystems.

Major Teaching Department: BIOL

## Environmental Studies

**ENV S 101. Environmental Geology: Earth in Crisis.** (Cross-listed with GEOL.) (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.

Major Teaching Department: GEOL

**ENV S 108. Introduction to Oceanography.** (Cross-listed with GEOL.) (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.

Major Teaching Department: GEOL

**ENV S 120. Introduction to Renewable Resources.** (Cross-listed with AGRON, NREM.) (3-0) Cr. 3. F.S. 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.

Major Teaching Department: NREM

**ENV S 160. Water Resources of the World.** (Cross-listed with AGRON, GEOL, MTEOR.) (3-0) Cr. 3. S. Study of the occurrence, history, development, and management of world water resources. Basic hydrologic principles including climate, surface water, groundwater, and water quality. Historical and current perspectives on water policy, use, and the role of water in society and the environment.

**ENV S 201. Introduction to Environmental Issues.** (Cross-listed with ENSCI.) (2-0) Cr. 2. F.S. Discussion of current and emerging environmental issues such as human population growth, energy use, loss of biodiversity, water resources, and climate change.

Major Teaching Department: ENV S

**ENV S 324. Energy and the Environment.** (Cross-listed with GEOL, MTEOR.) (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, nuclear waste disposal, and global climate change.

Major Teaching Department: GEOL

**ENV S 334. Environmental Ethics.** (Cross-listed with PHIL.) (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

Major Teaching Department: PHIL

**ENV S 342. World Food Issues: Past and Present.** (Cross-listed with AGRON, FS HN, T SC.) (3-0) Cr. 3. F.S. *Prereq: Junior classification.* Zdorkowski, Ford. Issues in the agricultural and food systems of the developed and developing world. Emphasis on economic, social, historical, ethical and environmental contexts. Causes and consequences of overnutrition/undernutrition, poverty, hunger and access/distribution.

Explorations of current issues and ideas for the future. Team projects.

Nonmajor Graduate Credit

Topics: H. Honors Section. (For students in the University Honors Program only.)

Major Teaching Department: AGRON

**ENV S 345. Population and Society.** (Cross-listed with SOC.) (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.

Major Teaching Department: SOC

**ENV S 355. Literature and the Environment.** (Cross-listed with ENGL.) (3-0) Cr. 3. *Prereq: Engl 250.*

Study of literary texts that address the following topics, among others: the relationship between people and natural/urban environments, ecocriticism, and the importance of place in the literary imagination.

Nonmajor Graduate Credit

Major Teaching Department: ENGL

**ENV S 380. Environmental and Resource Economics.** (Cross-listed with ECON.) (3-0) Cr. 3. *Prereq: Econ 101.* Natural resource availability, use, conservation, and government policy, including energy issues. Environmental quality and pollution control policies.

Major Teaching Department: ECON

**ENV S 381. Environmental Systems I: Introduction to Environmental Systems.** (Cross-listed with BIOL, ENSCI, MICRO.) (2-1) Cr. 3. F. *Prereq: 12 credits of natural science including biology and chemistry.* Introduction to the structure and function of natural environmental systems. Systems approach to the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

Nonmajor Graduate Credit

Major Teaching Department: ENSCI

**ENV S 382. Environmental Sociology.** (Cross-listed with SOC.) (3-0) Cr. 3. F.S. *Prereq: Soc 130, 134, or 3 credits of Env S.* 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.

Major Teaching Department: SOC

**ENV S 404. Global Change.** (Cross-listed with AGRON, ENSCI, MTEOR.) (3-0) Cr. 3. S. *Prereq: Four courses in physical or biological sciences or engineering; junior standing.* 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  
Major Teaching Department: MTEOR

**ENV S 424. Sustainable and Environmental Horticulture Systems.** (Cross-listed with HORT.) (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.  
Major Teaching Department: HORT

**ENV S 491. Environmental Law and Planning.** (Cross-listed with C R P, DSN S, L A.) (3-0) Cr. 3. S. *Prereq:* Six 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.  
Major Teaching Department: C R P

## Food Science and Human Nutrition

**FS HN 342. World Food Issues: Past and Present.** (Cross-listed with AGRON, ENV S, T SC.) (3-0) Cr. 3. F.S. *Prereq:* Junior classification. Issues in the agricultural and food systems of the developed and developing world. Emphasis on economic, social, historical, ethical and environmental contexts. Causes and consequences of overnutrition/undernutrition, poverty, hunger and access/distribution. Explorations of current issues and ideas for the future. Team projects.  
Nonmajor Graduate Credit  
Topics: H. Honors Section. (Honors Program students only.)  
Major Teaching Department: AGRON

## Geology

**GEOL 101. Environmental Geology: Earth in Crisis.** (Cross-listed with ENV S.) (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.  
Major Teaching Department: GEOL

**GEOL 108. Introduction to Oceanography.** (Cross-listed with ENV S.) (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.  
Major Teaching Department: GEOL

**GEOL 160. Water Resources of the World.** (Cross-listed with MTEOR, ENV S, AGRON.) (3-0) Cr. 3. S. Study of the occurrence, history, development, and management of world water resources. Basic hydrologic principles including climate, surface water, groundwater, and water quality. Historical and current perspectives on water policy, use, and the role of water in society and the environment.  
Major Teaching Department: MTEOR

**GEOL 324. Energy and the Environment.** (Cross-listed with ENV S, MTEOR.) (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, nuclear waste disposal, and global climate change.

Graduation Messages: Geol 324 does not count toward credits required in the Geology major.  
Major Teaching Department: GEOL

## Global Resource Systems

**GLOBE 201. Global Resource Systems.** (3-0) Cr. 3. F.S. A comparative analysis of global resources and the various natural and human systems affecting those resources.

**GLOBE 301. Resource Systems of Industrialized Nations.** (2-2) Cr. 3. S. *Prereq:* 201, Econ 101 or 102. In-depth analysis of the opportunities, constraints and consequences of the resource systems common in industrialized nations. Topics integrate natural resources with land tenure, societal structure, food security, agriculture, shelter, energy and wealth dynamics.

**GLOBE 302. Resource Systems of Developing Nations.** (2-2) Cr. 3. F. *Prereq:* 201, ECON 101 or 102. In depth appraisal of resource systems common throughout the developing world. Topics integrate natural resources with land tenure, societal structure, food security, agriculture, shelter, energy and wealth dynamics.

## Horticulture

**HORT 424. Sustainable and Environmental Horticulture Systems.** Dual-listed with 524; (Cross-listed with ENV S.) (3-0) Cr. 3. Alt. S., offered 2013. Inquiry into ethical issues and environmental consequences of horticultural cropping systems, production practices and managed landscapes. Emphasis on systems that are resource efficient, environmentally sound, socially acceptable, and profitable.

Major Teaching Department: HORT

## Landscape Architecture

**L A 302. Ecological Design at the Regional Scale.** (1-15) Cr. 6. S. *Prereq:* 301, 381, 465 and Agronomy 156. Application of ecological theories and processes in design and planning at the hundred plus-acre scale specifically focusing on urban and urban fringe landscapes. Apply advanced landscape analysis of soil, water, and vegetation utilizing geographic information systems. Particular focus on stream and wetland restoration, mitigation, and regulations and developing design representations for public use.

## Mechanical Engineering

**M E 388. Sustainable Engineering and International Development.** (Cross-listed with A E, C E, E E, MAT E.) (2-2) Cr. 3. F. *Prereq:* Junior classification in engineering. Multi-disciplinary approach to sustainable engineering and international development, sustainable development, appropriate design and engineering, feasibility analysis, international aid, business development, philosophy and politics of technology, and ethics in engineering. Engineering-based projects from problem formulation through implementation. Interactions with partner community organizations or international partners such as nongovernment organizations (NGOs). Course readings, final project/design report.

Major Teaching Department: C E

**M E 388. Sustainable Engineering and International Development.** (Cross-listed with A E, C E, E E, MAT E.) (2-2) Cr. 3. F. *Prereq:* Junior classification in engineering. Multi-disciplinary approach to sustainable engineering and international development, sustainable development, appropriate design and engineering, feasibility analysis, international aid, business development, philosophy and politics of technology, and ethics in engineering. Engineering-based projects from problem formulation through implementation. Interactions with partner community organizations or international partners such as nongovernment organizations (NGOs). Course readings, final project/design report.

Major Teaching Department: C E

**M E 433. Alternative Energy Conversion.** (3-0) Cr. 3. F. *Prereq: Phys 221/222 and Chem 167.* Basic principles, thermodynamics, and performance of practical alternative energy conversion technologies including fuel cells, photovoltaics, wind energy, biomass energy, and non-combustion thermal sources. Performance analysis and operating principles of systems and components, economic analysis for system design and operation. Nonmajor graduate credit.

Nonmajor Graduate Credit

**M E 484. Technology, Globalization and Culture.** Dual-listed with 584; (Cross-listed with WLC.) (3-0) Cr. 3. F. *Prereq: senior classification for 484; graduate classification for 584.* Cross-disciplinary examination of the present and future impact of globalization with a focus on preparing students for leadership roles in diverse professional, social, and cultural contexts. Facilitate an understanding of the threats and opportunities inherent in the globalization process as they are perceived by practicing professionals and articulated in debates on globalization. Use of a digital forum for presenting and analyzing globalization issues by on-campus and off-campus specialists.

Major Teaching Department: M E

**M E 486. Appropriate Technology Design.** (3-0) Cr. 3. F. *Prereq: M E 231, M E 270, current enrollment in M E 335; or permission of instructor.* Hands-on design experience utilizing knowledge acquired in core mechanical engineering courses. Emphasis with engineering problem formulation and solution, oral and written communication, team decision-making and ethical conduct. Design projects include engineering considerations in appropriate technology which have multidisciplinary components in economics and sociology. Major Teaching Department: M E

## Meteorology

**MTEOR 160. Water Resources of the World.** (Cross-listed with GEOL, ENV S, AGRON.) (3-0) Cr. 3. S. Study of the occurrence, history, development, and management of world water resources. Basic hydrologic principles including climate, surface water, groundwater, and water quality. Historical and current perspectives on water policy, use, and the role of water in society and the environment.

Major Teaching Department: MTEOR

**MTEOR 324. Energy and the Environment.** (Cross-listed with ENV S, GEOL.) (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, nuclear waste disposal, and global climate change. Graduation Messages: Mteor 324 does not count toward credits required in the meteorology major. Major Teaching Department: GEOL

**MTEOR 404. Global Change.** Dual-listed with 504; (Cross-listed with AGRON, ENSCI, ENV S.) (3-0) Cr. 3. S. *Prereq: Four courses in physical or biological sciences or engineering; junior standing.* 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

Major Teaching Department: MTEOR

## Natural Resource Ecology and Management

**NREM 120. Introduction to Renewable Resources.** (Cross-listed with AGRON, ENV S.) (3-0) Cr. 3. F.S. 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.

Major Teaching Department: NREM

**NREM 452. Ecosystem Management.** (Cross-listed with FOR.) (2-3) Cr. 3. F. *Prereq: Junior classification, and NREM 301 or A Ecl 312.* Principles of planning, regulating, and decision-making associated with public and private lands, with consideration of forest, grassland, wetland, and freshwater aquatic ecosystems. Integrated natural resources management within ecological, social, economic and policy constraints. Nonmajor Graduate Credit  
Major Teaching Department: FOR

**NREM 471. Agroforestry Systems; Local and Global Perspectives.** Dual-listed with 571; (2-3) Cr. 3. Alt. S., offered 2012. *Prereq: 6 credits in biological science at 300 level or above.* Concepts of sustainable land use, agroecological dynamics, and component interactions of agroforestry systems. Agroforestry systems in temperate and tropical regions. Design and evaluation techniques for agroforestry systems. Ecological, socioeconomic and political aspects of agroforestry.

## Philosophy and Religious Studies

**PHIL 334. Environmental Ethics.** (Cross-listed with ENV S.) (3-0) Cr. 3. F. *Prereq: 3 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  
Major Teaching Department: PHIL

## Sociology

**SOC 345. Population and Society.** (Cross-listed with ENV S.) (3-0) Cr. 3. F. *Prereq: 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. Major Teaching Department: SOC

**SOC 382. Environmental Sociology.** (Cross-listed with ENV S.) (3-0) Cr. 3. F.S. *Prereq: Soc 130, 134 or 3 credits of Env S.* 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. Major Teaching Department: SOC

**SOC 411. Social Change in Developing Countries.** (3-0) Cr. 3. S. *Prereq: 130 or 134 plus 3 credits in social sciences.* Social change and development in developing countries; international interdependence; causes and consequences of persistent problems in agriculture, city growth, employment, gender equality, basic needs; local and worldwide efforts to foster social change and international development. Nonmajor Graduate Credit

## Technology and Social Change

**T SC 341. Technology: International, Social, and Human Issues.** (3-0) Cr. 3. F. *Prereq: Junior classification.* An interdisciplinary study of the international significance of technology and of the societal and human issues attending its development and adoption.

**T SC 342. World Food Issues: Past and Present.** (Cross-listed with AGRON, ENV S, FS HN.) (3-0) Cr. 3. F.S. *Prereq: Junior classification.* Zdorkowski, Ford. Issues in the agricultural and food systems of the

developed and developing world. Emphasis on economic, social, historical, ethical and environmental contexts. Causes and consequences of overnutrition/undernutrition, poverty, hunger and access/distribution. Explorations of current issues and ideas for the future. Team projects.

Nonmajor Graduate Credit

Topics: H. Honors Section. (Honors Program students only.)

Major Teaching Department: AGRON

**T SC 343. Philosophy of Technology.** (Cross-listed with PHIL.) (3-0) Cr. 3. F.S. *Prereq:* 6 credits of social science or T SC 341 and 3 credits of social science. Moral and other philosophical problems related to developments in technology. Topics may include conditions under which technological innovations contribute to human emancipation, relationship of technology and democracy, utility and limits of technical rationality, and problems of ensuring that benefits of technological advance are communally shared. Topics discussed with reference to such issues as contemporary developments in microelectronics, technology transfer to the Third World, etc.

Nonmajor Graduate Credit

Major Teaching Department: PHIL

**T SC 474. Communication Technology and Social Change.** (Cross-listed with JL MC.) (3-0) Cr. 3. *Prereq:* Junior classification. Examination of historical and current communication technologies, including how they shape and are shaped by the cultural and social practices into which they are introduced.

Major Teaching Department: JL MC

## **Global Resource Systems**

31 March 2010

Dear Dr. Hallam:

I am writing to formally indicate my strong support of the Minor in Sustainability at Iowa State University. Students majoring in Global Resource Systems learn about physical, biological and socio-economic resources in a global context, including their sustainability. I envision a keen interest in the proposed Sustainability Minor from students majoring in Global Resource Systems and expect that students will enroll in and complete the new minor.

Thank you for your leadership in developing the minor. I sincerely hope that the minor will be approved and available to Global Resource Systems students and all Iowa State University students as a university-wide minor.

Sincerely,

Gail Nonnecke  
Faculty Coordinator for Global Resource Systems major.



**College of Agriculture and Life Sciences**

26 March 2010

Arne

The purpose of this email is to provide evidence of support for the proposed minor in Sustainability.

We appreciate the way you have been highly consultative throughout the process and that you have come up with a program that takes advantage of existing resources on campus, configuring them in a creative and highly useful manner and coupling them with an innovative new course. This subject is one that lends itself to university-wide cooperation and you have successfully established the links necessary to carry this out. We look forward to supplying speakers to the new course, to participating on the steering committee and to advising students about the option of a minor in Sustainability.

Regards,

David Acker

Endowed Chair of Global Agriculture and Associate Dean College of Agriculture and Life Sciences

## Memorandum

**Date:** 6 April 2010  
**To:** Arne Hallam  
Associate Dean, College of Liberal Arts and Sciences  
**From:** Mark Chidister  
Chair, College of Design Academic Affairs Council  
**Subject:** Proposed Minor in Sustainability

The College of Design's Academic Affairs Council endorses the proposed Minor in Sustainability. The Council reviewed both an earlier version of the proposal as well as the one you distributed in March. Each time we appreciated the way you addressed the college's questions, concerns, and suggestions.

Last Friday, the Council voted unanimously in support of the proposed Minor in Sustainability.

We anticipate that the minor will prove interesting to many design students as issues of sustainability have been integral components in Design curricula for over three decades. Indeed they are issues must be addressed. We look forward to working with the College of Liberal Arts and Sciences to implement this program and contribute to the array of courses associated with the minor.

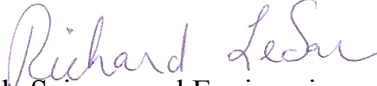
**IOWA STATE UNIVERSITY**  
OF SCIENCE AND TECHNOLOGY

College of Engineering  
Materials Science & Engineering  
2220 Hoover Hall  
Ames, IA 50011-2300  
Phone: 515 294-1841  
FAX: 515 294-0999  
lesar@iastate.edu  
<http://www.mse.iastate.edu>

**Interoffice Communication**

**DATE:** 1 April 2010

**TO:** Arne Hallam  
Associate Dean, College of Literature, Arts and Sciences

**FROM:** Richard LeSar, Chair   
Department of Materials Science and Engineering  
2220 Hoover hall

**RE:** Support for the new Sustainability Minor

The Department of Materials Science and Engineering strongly supports the creation of a Minor in Sustainability. Introducing our students to the challenges of creating a sustainable society is critical for them as they take their place in the global marketplace. The proposed minor, with its wide range of applicable courses from across the University, will enable our students to tailor their studies to best meet their educational needs. Equally important, the core classes of the minor will bring our students together with students from all the Colleges of the University, which will broaden their view of sustainability and give them a better understanding of the complexity of creating a sustainable society.

**IOWA STATE UNIVERSITY**  
OF SCIENCE AND TECHNOLOGY

Theodore (Ted) J. Heindel  
Department of Mechanical Engineering  
2025 Black Engineering Building  
Ames, Iowa 50011-2161  
Tel (515) 294-7121  
Fax (515) 294-3261  
theindel@iastate.edu  
<http://www.me.iastate.edu/>

**Interoffice Memorandum**

**Date:** March 26, 2010

**To:** Arne Hallam

**From:** Ted Heindel  
Interim Chair, Department of Mechanical Engineering




**Re:** Mechanical Engineering Support for the proposed Sustainability Minor

Many of the issues related to sustainability involve engineering, and mechanical engineers can play a significant role in this area. For this reason, the Department of Mechanical Engineering at ISU supports the approval of a Sustainability Minor. Several of the approved courses for this minor have a home in mechanical engineering, and one of our faculty is involved in the team-teaching overload of T SC 220X.

We are proud to be involved in ISU's sustainability efforts and support the approval of this minor.

Date: April 1, 2010

To: Arne Hallam  
Associate Dean, College of Liberal Arts and Sciences

From: Diane Rover   
Associate Dean for Academic and Student Affairs  
College of Engineering

Re: Proposed Minor in Sustainability

The College of Engineering endorses the proposed Minor in Sustainability. The Engineering College Curriculum Committee reviewed the proposal, and through the chair of the committee, brought questions to your attention. Thank you for your prompt responses to address the issues. The chair of the committee has indicated their support. Thus the program has the support of both faculty and administration in the College of Engineering.

The proposed interdisciplinary minor demonstrates all of the characteristics that we deem important to support a minor in the college. We look forward working with the College of Liberal Arts and Sciences on the implementation of the program.

**College of Liberal Arts and Sciences  
Department of Anthropology  
324 Curtiss Hall  
Ames, Iowa 50011-1050  
515 294-7139  
FAX 515 294-1708  
[www.anthr.iastate.edu](http://www.anthr.iastate.edu)**

**Interoffice Communication**

5 April 2010

To: Arne Hallam  
Associate Dean, College of Literature, Arts and Sciences

From: Max Viatori  
Curriculum Coordinator, Department of Anthropology

Re: Sustainability Minor

One of Anthropology's central missions is to further a global perspective on contemporary issues and encourage sustainable solutions to them through the application of cross-cultural and interdisciplinary studies. As such, the Anthropology department strongly endorses the Sustainability Minor, which gives our students another avenue for becoming more aware global citizens. Additionally, one of the two required courses for this minor is Anthropology 230 (Globalization and the Human Condition).

**IOWA STATE UNIVERSITY**  
OF SCIENCE AND TECHNOLOGY

Environmental Programs  
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**Interoffice Memorandum**

Date: April 7, 2010

To: Arne Hallam  
Associate Dean, College of Liberal Arts and Sciences

From: William G. Crumpton,  
Coordinator, Environmental Studies major

Re: Proposed Minor in Sustainability

Environmental Studies is a university-wide, interdepartmental major serving students with primary majors ranging from Architecture to Zoology. Environmental Studies provides students an understanding of major regional and global environmental issues and an appreciation of different perspectives regarding these issues. Environmental Studies does of course address issues related to sustainability and there would be some overlap with the Minor in Sustainability minor. However, the proposed minor would focus on sustainability in a way that would be less appropriate for the broader Environmental Studies program and we support the proposed Minor in Sustainability.

## **Sociology**

April 2010

Professor Hallam

I am writing to indicate my strong support of the Minor in Sustainability at Iowa State University. Global resource management and conservation of natural resources are going to remain significant forces across the globe as world population moves towards 10 billion people. This should be a minor that is attractive to many of our students. Thank you and the team for your leadership in this initiative.

Paul Lasley


Professor and Chair, Department of Sociology and Chair Department of Anthropology



***Interoffice Communication***

**DATE:** April 29, 2010

**TO:** Arne Hallam, Associate Dean  
College of Liberal Arts & Sciences  
202 Catt Hall

**FROM:**   
Michael B. Whiteford, Dean

**SUBJECT:** Proposed minor in Sustainability

I am delighted to give my unequivocal endorsement to the proposed minor in Sustainability. You and your colleagues have identified a suite of courses that will make the program attractive and accessible to students from every segment of the campus. Carefully managed, this could easily develop into a real point of pride for the university. More importantly, this will give students an opportunity to add something to their degree programs that will be of real value to them and to potential employers.

Best wishes in getting this off the ground. Please let me know how I can assist in this initiative.