Proposal to the University Curriculum Committee / Freshman Inquiry Course

I. Cover Sheet

Course title System Earth

Date first offered Fall 2005

Sections per year 3

Statement of theme
We will examine how the "systems" approach is changing the way we view our world and our relationship to it, and use a systems-based perspective to understand how cultural models of the world shape the way humans interact with their environments.

Signatures of participating faculty

Ben Perkins	_____	
	Signature	Date
	_____	
Jeff Gerwing	Signature	Date
	_____	
Dave Ritchie	Signature	Date

Contact Faculty

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II. Course Narrative

A. Statement of course theme / topical area:

We are converging on a new view of the world as an integrated system of dynamic processes. This systems view is based on the realization that human culture is part of, and increasingly impacts upon, the biological and physical environments, and that no one aspect of the planetary environment can be understood in isolation. The objective, integrated study of System Earth is one of the outstanding intellectual challenges of the twenty-first century and absolutely critical for the future management of our home planet.

This course will begin by exploring how perspectives shape our understanding of the world, comparing personal, disciplinary, and systems-based analyses of local environments. We will then examine specific ecological systems and the processes that link the physical, biological, and cultural sub-systems in each. Ultimately, we will explore how our growing understanding of the complex connections between these realms challenges our notions of value, stability and control and how our increased awareness affects our economic and social policies on global and local levels.

B. Learning objectives specific to this theme:

By the end of this course, students should be able to:

- Explain the scientific method and apply scientific principles of observation and analysis to physical, biological, and social processes.
- Define a system and appropriate components and boundaries at various physical scales
- Appreciate how our imposed organizational schemes, models, and testing methods shape how we understand natural and social phenomena.
- Discuss the interconnectedness of the various earth system "spheres" and how feedback mechanisms operating between spheres affect processes such as chemical cycling, biologic productivity, and global warming.
- Understand the nature of various types of measurements, their basic units and associated errors and demonstrate an ability to identify and estimate key parameters of common physical, biological, and social systems.
- Utilize spreadsheets and/or other graphic tools for graphing, statistical analysis, and modeling of simple systems
- Identify ways that economic and social pressures perturb existing steady-states in natural systems at global and local scales
- Identify and discuss economic, political, social and legal issues / ethical controversies associated with attempts to regulate pressures on earth systems
- Gain an appreciation of the differences among various human cultures in the way they think about, interact with, and act upon the natural environment.
- Understand the effect of personal, religious, and political values on decisions that affect the quality and long-term sustainability of environmental systems.
- Evaluate their own values, choices, and activities in system-theoretic terms.
- Explore and discuss their own creative ways of balancing societal needs with a lessening of anthropogenic pressures on the environment
- Present the results of individual and group research projects to their peers and others in the community.

C. Assessment of student learning (specific to theme):

Assessment learning for this theme will be based on reflection papers covering assigned readings, discussions, and teamwork; participation in individual and team-based research projects; research proposals, papers, and oral presentations; and individual portfolios.

D. Description of methods to ensure coherence of theme across participating faculty:

Preliminary planning will be made in spring and early summer, 2005 via emails and infrequent meetings between interested faculty participants. A week-long block of time during mid- to late-August will be utilized for establishing a tentative course schedule and to finalize a reading list for the coming academic year. The core faculty will meet on a weekly basis throughout the academic year to exchange ideas, schedule guest speakers, and work on common problems, themes, or inter-section research projects. Required textbooks will be chosen jointly. Handouts, projects, schedules, and assignments are to be distributed electronically. Visiting presentations from other team members are given in every section of the course.

E. Interdisciplinarity of theme:

Our faculty team has expertise in geology, chemistry, environmental science, biology, ecology, communications theory, and cultural development. Indeed, we have a strong foundation in all three of the broad realms whose interconnections we propose to explore – the physical, biological, and cultural spheres.

F. Relation of course to other University Studies offerings (cohesion, ties to future learning):

"System Earth" is not formally tied to other University Studies offerings. The course focuses on the application of systems thinking and scientific methods and principles to understanding the interaction of human cultural values and activities with ecological processes. Although rooted in science and systems thinking, the course will spend considerable time in discussing the diversity of cultural perspectives on and representations of the physical and biological environment, and learn how cultural values shape our views of the environment, and in turn mediate the human impact on physical and biological sub-systems. Using a variety of case studies at local and global scales, "System Earth" will explore how researchers go about conducting scientific research on natural and human environments and how a systems perspective connects the social and natural sciences, economics and the environment, and our actions today with the shape of our children's futures. This class would serve well as a stepping-stone to the Global Environmental Change, Environmental Sustainability, Framing Two Cultures, Knowledge, Rationality, and Understanding or Science in the Liberal Arts Clusters. In addition, students should find that the basic systems concepts provide a cognitive framework for continued study in any of the sciences or social sciences, engineering, education, or urban and public affairs.

G. How this theme will address the University Studies Goals:

"System Earth" will give students opportunities to learn and experience how "new knowledge" is obtained and the role of the analytical process in filtering input and making decisions. Through this course, students will develop a sophisticated understanding both of the

concepts basic to systems theory and of the importance of taking a systems perspective that will provide a sure foundation for their continued studies, both in their own majors and in subsequent General Education courses.

University Studies Goal	**Representative Assignments**	**Assessment Plan/Type**
Communication: Writing	Each term: reflection papers and online discussions. Each term: a series of short papers on topics relevant to each term's topic. 1st term: A 4-6 page research paper on a particular ecological subsystem, applied to a particular area. 2nd term: 6-7 page observation / analysis paper comparing the way two or more distinct cultures represent and present the ideas of wilderness and of the human living environment. 2nd term: research proposal. 3rd term: 8-10 page research paper.	UNST writing assessment; theme-specific pre- and post-course writing assessment.
Communication: Oral Communication	Oral presentations of term papers in 1st term, proposals in 2nd term, and research findings in 3rd term. Student-led class discussions in 2nd term. Research-based student debates, panels each term Poster session (group or individual; assembled in Adobe Illustrator) on research findings 3rd term. Frequent class discussions and group project work.	Assess content and organization, articulation of main points, eye contact, and effective use of visual aids. Participation in class discussions is judged on preparation and contributions. Peer assessment of presentation.
Communication: Numeracy	Identification and estimation of crucial system parameters. Statistical analysis of measurement data. Spreadsheet modeling of simple (e.g., 1-D reservoir) systems.	Assess application of appropriate quantitative reasoning to solve problem at hand. Assess ability to analyze quantitative information. Assess functionality of spreadsheet-based models.

Communication: Graphics	Tabulation and graphing of measurement data.	Accurate numerical and graphical analysis of data. Correct application of statistical model in performing designs.
Communication: Visual Communication	Construction of graphical models of natural systems. Presentation of research in poster form. Communication of personal views on controversial topics in artistic fashion in portfolio website (using Photoshop).	Assess creativity, reflection, self-expression, ability to interpret and articulate value content and agenda.
Communication: Computer Literacy	Use of Excel for data analysis and graphing. Use of Word for papers. Power Point presentations. Adobe Illustrator for poster preparation. Photoshop for portfolio website graphics. Web display of projects and portfolio.	Skills judged by mentor observations and evidence from the use of these skills in projects and portfolio.
Communication: Group Process	Frequent mixing of students and sharing of ideas via in-class discussion groups. Group-based research projects. Teams conduct research for student debates and panels in each quarter.	Individual contributions to the group process assessed along with group results. Reflections on group process and individual performance within the group. Students assess each other on major group projects.
Inquiry & Critical Thinking	The ability to perform critical analysis is an essential part of the scientific process. Students will study the scientific method and apply critical analysis to readings and graphs in 1st term. They will explore research project design, including problem identification, test methods, control of variables, and analyses of findings in the 2nd and 3rd terms. Key issues from texts and case studies will be analyzed.	Effective use of problem solving techniques will be assessed by evaluating the end products as well as reflections on the process used to produce them. Projects must include thoughtful and thorough analysis of problems and creative solutions to address those problems.
Diversity of Human Experience	Students will study several different cultural representations of the environment and compare the way dominant cultural values and practices are reflected in and, in turn, shaped by their representation of the environment.	Assess their growing awareness of how their background shapes their perspective of and sense of responsibility to the environment. Assess through 2nd-term research paper their appreciation of how

	Students will explore how personal, religious, and political values impact decisions that affect the quality and long-term sustainability of environmental systems. Students will evaluate their own values, choices, and activities in system-theoretic terms.	distinct cultures represent and present the ideas of wilderness and of the human living environment. Assess understanding of how economic (including natural wealth) disparity shapes/ drives environmental problems through class discussions and assigned reflection papers.
Ethics and Social Responsibility	A key component of the course will be an examination of how our notions of social responsibility have evolved through time and, particularly, in light of our growing understanding of the interconnectedness of human activity and earth processes. Use of readings, film and debates to explore topics such as population growth, water resources, the use of pesticides and genetically modified organisms, and global warming and the associated ethical decisions that arise from trying to balance current and potential future ramifications with existing human needs, social pressures and individual choice. Related examination of the role of science – with its inherent and open uncertainties - in government policy-making. By the end of spring quarter students will reflect on the value choices facing contemporary human cultures, articulate their own environmentally-related values, and develop habits of consideration and re-examination of values as both a personal and a group process.	Initial and end-of-year reflection papers to assess perceptual changes in students'own ideas of social responsibility. Reflections on case studies and their 3rd-term research projects will be assessed by the ability to identify key ethical dimensions, highlight alternatives, reason through choices, and develop flexible and creative strategies for resolution. In addition to identifying specific connections between human activity and environmental impacts, they need demonstrate an ability to foresee interconnected societal impacts of proposed solutions to environmental problems.

III. Course Schedule and Topics

Each instructor will be covering all topics, however frequent guest lectures by other team members will be used to capitalize on the different area of expertise of each faculty member.

TERM	TOPICAL OUTLINE
First Term	*Seeing Connections, Asking Questions* ▪ Compare personal, disciplinary, and systems-based analyses of home, community and the PSU Campus. ▪ Readings about local environmental issues followed by field trip and environmental and cultural inventorying and analyses ▪ Categorizing and examination of student-raised questions from readings, analyses of home / campus environments and field trip ▪ Basic concepts of systems theory *Ways of "Knowing" / Environmental and Systems Science Background* ▪ Comparison of Everyday ways of knowing with scientific method ▪ Basic concepts and historical development of scientific method ▪ Direct observation vs knowing through proxy measurements ▪ Exploration of concept of models ▪ Highlight of science history pertinent to student-raised questions ▪ Knowing "through others" – reading, researching, mass media & critiquing sources. *Term research project "inventorying" a specific ecosystem.*
Second Term	*Cultural Perspectives* • Comparison of local "natural areas" (e.g., Chinese Garden, local park, golf course) • Movie in which landscape plays crucial role • Compare and contrast varying perspectives of man and nature from readings from the Bible, the Koran, Buddhist writings, Native American mythology, the Grimm Brothers, and modern systems science. • Compare and contrast different observationally-based models (e.g., Eastern and Western medicine). • Essay on / graphic representation of two distinctly different cultural viewpoints of nature / environment. *Systems and Society* • Readings from <u>*Collapse*</u> and <u>*Out of the Earth*</u>: Examining evidence of the role of degraded environments in the downfall of historical societies (e.g., Sumerians, Aztecs, Dust-bowl mid-west) • Detailed examination – via film and readings - of specific environmental issues of widespread concern (e.g., population growth, water quality, climate change) • Readings on environmental economics, transportation, energy, suburbanization, recreation / retirement. *Proposal for research of local/regional eco-cultural-system of concern*
Third Term	*Interconnections and Social Responsibility* • Further examination of local environmental case studies • Discussion and reflective papers on closed / open systems, examples of "self-

	sustaining" natural systems and the realities of sustainability in the framework of our current economy. • Discussions and readings to help prioritize eco- and cultural-needs • Discussion and readings about eco-economics and the roles of science and economics in setting public policy. • Cadillac Desert films *Group Research Projects on local/regional ecosystem, culminating in public poster presentations.*

IV. Preliminary List of Readings and Course Materials

Anderson, V. 1997, *Systems Thinking Basics: From Concepts to Casual Loops*
Berry, Thomas, 2000, *The Great Work*
Capra, F., 2004, *The Hidden Connections: A Science for Sustainable Living*
Diamond, J., 2004, *Collapse: How Societies Choose to Fail or Succeed*
Ernst, W.G., (ed.), 2000, *Earth Systems, Processes and Issues*
Harden, G., *Tragedy of the Commons*
Hillel, D. 1992, *Out of the Earth: Civilization and the Life of the Soil*
Kuhn, T. 1996, *The Structure of Scientific Revolutions*
Latour, B., 2004, *Politics of Nature*
James Lovelock, 2000, *Gaia: A New Look at Life on Earth*
Macy, J., 1991, *Mutual Causality in Buddhism and the General Systems Theory*
Reisner, Marc, 1993, *Cadillac Desert (and PBS Film Series)*
Spieldberg, N. and Anderson, B., 1995, Seven Ideas that Shook the Universe
Wheatley, M., 2001, *Leadership and the New Science: Discovering Order in a Chaotic World*