

**Global Learning Curriculum Strategy**  
Environmental Sciences BS Program  
School of Earth Sciences and Environmental Sustainability  
11/16/2010

**Summary**

This proposed strategy to better elucidate global learning outcomes for the Environmental Science BS program resulted from our program review and consultation with contributing faculty members. Based on this review we conclude that:

- 1) Our core curriculum and faculty are integrating global engagement, diversity and sustainability activities and related learning outcomes into the curriculum however these are not always explicitly stated in course and program learning outcomes.
- 2) We have a very strong and effective course emphasis on sustainability that may be strengthened with more emphases on the broader (i.e. linked cultural and natural systems) requirements for sustainability. We also promote co and extra-curricular opportunities through internships, attendance at community and university speaker series and seminars, involvement in earth day, student campus climate challenge, student environmental caucus and support for community engagement.
- 3) We have a strong range of curricular and co-curricular learning opportunities in international issues and perspectives that could be strengthened through more opportunities for international studies; however our existing curriculum makes it difficult for students to stay on track for degree completion when studying abroad.
- 4) Existing program and core course learning outcomes do not sufficiently articulate GLI related outcomes and activities actually occurring for our majors and need to be made explicit at both levels.
- 5) Our diversity outcomes are somewhat limited to studying the impacts of diversity on environmental and resource issues, but are supplemented through the university diversity requirements. They could also be strengthened with more content focused on the broader requirements for developing and maintaining sustainable biocultural communities.
- 6) Our program outcome statements should be revised to more explicitly relate to promoting healthy, sustainable communities, rather than just understanding natural systems and human impacts.
- 7) As a program we can offer sustainability related curricular content to the wider university community to help promote campus-wide global learning outcomes.

This strategy document reviews the methodology utilized to assess and develop global learning within the major, outlines the major components of our strategy for strengthening global learning opportunities and outcomes, and provides supporting documentation in appendices of our existing program and course level approaches to incorporating sustainability, diversity and globalization themes within the curriculum.

**Methodology**

Utilizing reports, self-studies, and recommendations approved in SESES faculty meetings, we have pulled together an overview of the desired learning outcomes, understandings, knowledge bases and abilities related to the Global Learning Initiative that we desire from our BS degree program in environmental sciences. We have examined all components of the major including liberal studies requirements, diversity requirements and required courses for the major. Based upon this information formulated a series of discussion questions we have shared with instructors of our undergraduate curriculum. We discussed these concepts and recommendations with ENV faculty on August 24, 2010 and with the environmental program faculty on September 14<sup>th</sup> and October 25<sup>th</sup> to discuss our draft strategy. The present document reflects the feedback and input from these meetings. Approved by a unanimous vote of the faculty 11-0 on 11/15/2010. Appendices A-F documents our assessment of the current program in relation to the GLI.

## **Environmental Science BS Program Global Learning Strategy**

Our strategy identifies three new learning outcomes for the Environmental Science BS program, initiates a process for refining course level GLI related learning objectives, promotes select use of the university diversity requirements, expands opportunities for international study, and refines an assessment plan for the program and new global learning outcomes.

### **1. New proposed GLI related learning outcomes**

#### Global Engagement:

- Understand how technology, economics, and culture impact the global environment and approaches to mitigating negative impacts at multiple scales.

#### Diversity

- Understand relationships between human society and the environment, such as human-induced environmental degradation, disproportional impacts on different human populations, biocultural diversity, and different perspectives on environmental issues

#### Sustainability

- Understand key environmental sustainability principles from a science perspective.

### **2. Refine and make explicit existing GLI related core course learning objectives**

- Over the course of the 2010-2011 academic year we will work with instructors and undergraduate curriculum committee to further articulate, refine and link GLI related outcomes in core course and program learning objectives and make appropriate changes when necessary in course syllabi.

### **3. Define Environmental Sustainability from Environmental Science Perspective**

- Work with SESES environmental faculty to develop a working definition or definitions of sustainability.

### **4. Develop and Promote Diversity opportunities**

- Through undergraduate advising, promote university global and US diversity courses in such areas as ethnic studies, applied indigenous studies, politics and international affairs, comparative cultural studies, and study abroad to strengthen diversity learning outcomes.

### **5. Increase Opportunities for Co-Curricular Global learning**

- Over the course of the 2010-2011 academic year, work with the Center for International Education to identify and promote international study through an increased number of NAU international courses and through international research and internship opportunities. We should better utilize the internship coordinator in the Center for International Education to get more majors completing their internship requirements abroad.
- Over the course of the 2010-2011 academic year, work with the Center for International Education to identify compatible study abroad programs that can effectively transfer courses to the major program of study and keep students on track for graduation.

## **6. Maintain extracurricular and co-curricular learning opportunities**

- We currently provide many opportunities and encourage students to engage in co-curricular and extracurricular activities to promote global engagement, sustainability and diversity. These include instructors requiring attendance at community and university lectures, internships, and campus extracurricular involvement. We should continue to promote and strengthen these opportunities.

## **7. Revise program assessment plan**

- By the end of Spring 2010, will revise our program assessment plan to include GLI learning outcomes. To create the revision to the plan, we will
  - a. Incorporate language for the new GLI-related learning outcomes (knowledge, understandings, abilities and dispositions for the program).
  - b. Identify where in the program students produce (or will produce) evidence of these learning outcomes. Specifically, evidence of GLI related learning outcomes can currently be found in group projects and self-reflective assignments in ENV 490C, self-reflective assignments in ENV 230, targeted assignments from ENV 280 and 385W. Evidence of GLI learning outcomes may also possibly be found in student work that will develop out of expanding the GLI content in ENV courses.
  - c. We need to strengthen the dispositional learning outcomes by having majors explicitly articulate GLI-related values near the beginning and end of their studies.
  - d. Create a plan that involves sampling student work so that the evidence of GLI outcomes may be separately evaluated to determine whether the GLI outcomes are being met.
  - e. Integrate the evaluation of GLI learning outcomes into the annual program assessment report.

## **8. Promote ENV 101 and ENV 115 to university community**

- These two courses address sustainability and globalization learning outcomes through the study of environmental science and climate change. These courses should be considered and promoted to the wider university community as lower division service courses that can assist their students to address sustainability and globalization learning outcomes.

## **Appendix A: Assessment of current program objectives and outcomes related to GLI learning outcomes already integrated into the major**

We used the McTighe and Wiggin's Understanding by Design approach to describe our current learning objectives and outcomes for the BS in environmental sciences.

1. Program Learning goals related to GLI (course-specific learning outcomes are described for our core sequence: ENV 230, 326, 280, POS 359, 385W, 408/485, and 490C). These current program goals are a result of the recent external review and self study of ENV programs.
  - a. Enhance awareness of relationships between human and non-human components of the environment at local to global scales (sustainability and global engagement)
  - b. Generate environmentally aware citizen who are inspired, committed, active, participatory, persuasive and influential (global engagement)
2. Current understandings and knowledge outcomes related to GLI
  - a. understanding of system structure, function, resilience and stability/sustainability across all scales from the local to the global, including biotic, abiotic, and cultural components (sustainability, global engagement and diversity)
  - b. understanding the science/policy interface (sustainability, global engagement and diversity)
  - c. understanding principles and applications of biogeochemical cycling (sustainability)
3. Current Ability Outcomes related to GLI
  - a. Systems modeling based upon quantitative reasoning including basic statistical analysis, error analysis (sustainability)
  - b. Understand and explain the science behind our understanding of environmental change (sustainability and global engagement)
  - c. Demonstrate and apply an understanding of principles of resource management and environmental policy at all scales (sustainability and global engagement)
  - d. Demonstrate and apply an understanding of ecosystem services (sustainability)
4. Current Dispositional Outcomes related to GLI
  - a. The existing environmental sciences curriculum provides students with an opportunity to develop their awareness of personal place and responsibility. Most students work toward these goals in the process of completing their internship or undergraduate research project and subsequent public presentation.

## Appendix B: Assessment of Current GLI related core course learning outcomes/objectives

- ENV 230
  - Develop an interdisciplinary understanding of the fundamental principles of environmental science
- ENV 280
  - Outline the steps that led to the formation of the Antarctic ozone hole
  - Outline the steps that led to the formation of photochemical smog
  - List the leading causes of haze in the Grand Canyon and describe how haze is monitored in the national parks.
  - Explain the negative effects of excessive groundwater withdrawal
  - Know how acid mine drainage forms
  - Understand how human-caused pollution is remediated
  - Describe how the many parts of Earth's climate system interact
- ENV 326
  - Introduce key ecological concepts and their applications.
  - Illustrate the relevance of ecology in the resolution of real-world problems.
  - Expand our perspectives of the earth and humanity's place within it.
- ENV 385
  - To learn how society integrates science and politics in the development of energy policy.
  - To understand and apply policy analysis to energy resources
  - To understand the geology associated with energy and mineral resources, especially of the desert southwest and their environmental impacts
  - To understand the science behind some of our energy resources, and the technologies that might allow us to use less of these resources.
  - To become familiar with the intricacies of US and global energy and resource policies and politics in terms of production and conservation of energy.
  - To apply scientific information and principles to create policies guiding energy resource extraction and use.
  - To become familiar with energy issues and topics relevant to the Colorado Plateau, the US and the world.
- POS 359
  - Develop an understanding of the difference between environmental problems and environmental policy
  - Become familiar with key initiatives from the executive, legislative, and judicial branches of government
  - See the relationship between environmental legislation and environmental regulation
  - Be able to place environmental policy in historical perspective

## **Appendix C: Assessment of Current GLI related core course learning activities**

### **Current Course Activities Supporting Sustainability Outcomes**

- ENV 101
  - Personal sustainability project: Modify one part of lifestyle to become more sustainable (e.g. walk, vegan).
- ENV 230
  - Deep horizon: Oil Spill analysis from multiple perspectives: Scientific (geology, chemistry, biology), Policy, Social, and Management perspectives.
  - Begin project by lab group (23 students in each lab). The last week of class will be devoted to public hearings with the four environmental firms giving their presentation. The presentations will be generated by choosing the best individual projects. Each student is required to write a term paper (100 points) on their subject and give an individual presentation in their lab group.
- ENV 280
  - Threats to air and water systems
  - Sustainability and resilience of water and atmospheric systems resistance
- ENV 326
  - We discuss nutrient cycling in the context of terrestrial nitrogen eutrophication. We consider ecosystem restoration in the context of succession.
  - Landscape ecology is introduced as an ... to address. Conservation is an important approach.
  - Biofuel activity: Compare scientific papers with pros and cons about corn ethanol.
- ENV 385
  - Atmosphere as global commons- Kyoto/clean energy
  - Peak oil
  - Sustainable energy pathways
  - Externalities of energy extraction/use
  - Personal energy use
  - Environmental policies →renewable energy
- ENV 490c
  - Projects/Presentations - Some students specialize in each of these (i.-v.)
  - Environmental Professional Presentation and Paper (many “mentors” are involved in sustainability issues)
  - Class discussion of climate change topic (i.e. “Plows, Plagues, and Petroleum;” “Fixing Climate”)

### **Current Course Activities Supporting Global Engagement Outcomes**

- ENV 101
  - Carbon exchange and climate change IV.
- ENV 230
  - Discuss similarities of uranium mining and contamination on Tribal Lands in the U.S. and Aboriginal Lands in Australia.
- ENV 280
  - Hemispheric and global circulation patterns and processes in atmosphere and oceans v.
  - Global patterns of emissions v.
  - Global patterns of water resources availability and usage; water use conflicts (Mexico vs. U.S. and conflict in Verde Valley, film)v.
  - Global patterns of mineral resource extraction and impacts v.
  - Global climate impacts on soils and agriculture v.
- ENV 326
  - We cover “Global Ecology” during the last section of the class.

- We contrast the human responses (Montreal Protocol vs. Kyoto Protocol) to the ozone hole and warming caused by fossil fuel combustion.
- ENV 385 ii/iv/v
  - Global energy profile
  - Compare U.S. energy resources to other countries.
  - Global deposition and extraction of minerals and energy resources
  - Kyoto roles and responsibilities
- ENV 490c
  - Reading/discussion of relevant Climate Changes Book
  - University presentations: Students need 3 per semester.

### **Current Course Activities Supporting Diversity Outcomes**

- ENV 101
  - Environmental justice/Snowbowl case study (vi, v)
  - Group exam: Students represent different perspectives (rancher, biologist, wildlife enthusiast) on a conservation issue.
    - Topics include Mexican Wolves, Copenhagen, and water (iv, v)
- ENV 230
  - Biological diversity from the genetic to ecosystem scale →Evolution →Communities → Landscapes
- ENV 280
  - Native American perspectives on water use and water projects (e.g. Fossil Creek, Verde River, Colorado River, Black Mesa).
- ENV 326
  - The course explores biological diversity at a deeper level and teaches techniques to measure and compare diversity at the community scale.
- ENV 385W
  - Country energy case study (iv, v)
  - Culture/technology, energy production/consumption
  - Lecture on geopolitics/power/ responsibility for emissions
- ENV 490c
  - Engagement in university lectures.
  - Environmental Professional paper/presentation (influential environmental professional- many are from developing world).

## **Appendix D: Course-Specific recommendations for further inclusion of GLI related themes into current ENV core curriculum and learning outcomes (other opportunities may emerge)**

- **Potential New Sustainability Learning Activities**
  - ENV 101 Have students expand their personal sustainability research projects to impacts on a global scale.
  - ENV 280 Expand the discussion of ecological concepts of stability, resilience and resistance beyond natural systems to combined cultural/environmental systems.
  - ENV 326 Continue homework assignments on current issues in sustainability
  - ENV385W Develop personal strategies for energy use and conservation.
  - ENV 490C Develop more self-reflective essays/evaluations that expand upon their required assignments to identify and discuss an environmental professional role model, and their discussion of Plows, Plagues, and Petroleum.
  
- **Potential New Diversity Learning Activities**
  - ENV 101 Develop new project focusing on environmental justice and biocultural diversity.
  - ENV 230 Incorporate diversity perspectives in the Gulf /Deep Horizon disaster in the context of loss of biological diversity.
  - ENV 280 Discuss the potential role of traditional ecological knowledge in water resource planning and utilization and in salinization and sustainability of agricultural soils.
  - ENV 326 Develop discussion of cultural diversity in the unit on Mutualisms/Social Animals/Cooperation (following the section on Naked Mole Rats)
  - ENV 385W Discuss cultural diversity in the context of environmental degradation of underdeveloped nations
  - ENV 490C Could consider limiting the choices of environmental professional role models to those from developing countries or underrepresented populations.
  
- **Potential New Global Engagement Learning Activities**
  - ENV 230 Consider impacts of global economy on Gulf/Deep Horizon disaster.
  - ENV 280 Consider introducing concepts of international mineral resource economics to mesh with more detailed unit in ENV 385W
  - ENV 326 Could integrate global issues earlier in the semester
  - ENV 385W Add examination of environmental justice implications of global extraction of non-renewable resources
  - ENV 490C Open the research topic assignment to issues other than climate.



**Appendix E: Alternate language considered for potential global learning learning outcomes**

- a. Learn how to develop, conduct and describe the results from a significant independent project or research activity
- b. Understand and apply concepts of systems analysis including resilience and resistance, stability, linkages, tipping points. Use this knowledge to understand relationships between linked environmental and cultural systems.
- c. Understand the significance of biocultural diversity in the functioning of linked environmental and cultural systems.
- d. Understand the differential impacts of resource extraction and pollution emissions on different populations.
- e. Able to perceive and understand landscapes and ecosystems from a variety of perspectives
- f. Understand roles as scientist and citizen and willingness to effectively engage in interface of environmental science and policy
- a. Demonstrate critical reflection of self in relation to society and environmental problems

## **Appendix F: GLI definitions and questions for course/program assessment**

### **Global Engagement--GE**

In your class/program, how do students gain an appreciation of the interconnectedness and interdependence of the human experience on a global scale? (list course/program activities)

- i. the implications of race, racism and ethnocentrism for transnational, human, and societal interaction.
- ii. the relationship among culture, language, community and environment.
- iii. the role of ideology, spirituality, and religion in terms of human action and relationships.
- iv. the interconnectedness between and among political, cultural, personal and economic decisions and the natural world.
- v. how economic, social, and technological practices and traditions impact climate and the environment.
- vi. how historical, political, religious and economic forces have shaped the current world system and the source of global power inequalities and efforts to address them.
- vii. the roles, possibilities and implications of diverse technologies on culture and the political economy.

### **Diversity--D**

How do students in your class/program learn to appreciate diversity in its many manifestations, including cultural, ethnic, religious, linguistic and biological diversity? (list course activities)

- i. the scope of racial and ethnic diversity both in the US and globally.
- ii. race and ethnicity, gender, class, sexuality, religion, age, language and disability as key dimensions of diversity.
- iii. how ubiquitous racial and ethnic diversity is and how it intersects with other forms of diversity, such as gender, class, sexuality, religion, age, language and disability. Biological or biocultural diversity?
- iv. the relationship between diversity and survival on the planet.
- v. how the position we take on diversity can either strengthen human communities and sustain the natural environment, or lead to conflict and environmental degradation.
- vi. the role of ethnocentrism and Eurocentrism in human and societal interaction.

### **Sustainability--S**

How do students in your class/program learn to appreciate what it means to use natural resources in ethical and responsible ways that maintain a sustainable environment?

How do they learn strategies or practices that maintain or enhance sustainable ecosystems and social systems? (Please list course activities)

- i. how culture determines how we construct the appropriate use of environmental resources
- ii. the connection between responsible engagement with the environment and global citizenship.
- iii. the scientific basis of environmental sustainability.
- iv. the vocabulary and concepts around environmental sustainability (e.g., finite and renewable resources, environmental footprint, global commons, peak oil).
- v. the role of human interactions with the environment and its relation to the root causes of many global problems.