LAYING THE FOUNDATION FOR A NEW GREAT PROBLEMS SEMINAR WITH AN ENVIRONMENTAL FOCUS

An Interactive Qualifying Project Report

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ROSEANN S. GAMMAL

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Approved:

Arthur Heinricher, Dean of Undergraduate Studies - Advisor

Jeanine Plummer, Director, Environmental Engineering - Co-Advisor

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ABSTRACT

WPI's commitments to environmental initiatives and introducing project work in the first year justify the creation of a new Great Problems Seminar with an environmental focus. The overarching objective of this interdisciplinary course is to produce environmentally-literate students. This project provides the foundation for this new seminar, including an analysis of the components of environmental literacy, a recommended approach for the course, sample course materials, and an extensive bibliography of resources.

INTRODUCTION

The WPI Plan

In 1970, the WPI Plan transformed undergraduate education at Worcester Polytechnic Institute (WPI).[1] It called for the incorporation of three novel, inquiry-based projects into every WPI undergraduate's academic curriculum: the Humanities and Arts Project (originally called the Sufficiency), the Interactive Qualifying Project (IQP), and the Major Qualifying Project (MQP). These projects are typically completed in the Sophomore, Junior and Senior years, respectively. The Humanities and Arts Project requirement involves the completion of five humanities courses across several subject areas and concludes with a capstone inquiry seminar or practicum in a particular area of interest. The IQP gives students an opportunity to address an issue at the intersection of science/technology and society.[2] The MQP is a capstone project in a student's major; with the MQP, students have the opportunity to apply their knowledge and skills to a specific problem or research question in their particular field of study.

With emphasis on the importance of real-world project experience, WPI upholds its commitment to the university motto: "Theory and Practice." A WPI education consists of not only learning specific concepts within a discipline, but applying the tools of the discipline to real-world problems.

In 2005, WPI established Presidential Commission A1: General Education and the First Year to study ways to better engage first year students and help them to achieve WPI educational outcomes more effectively. Up until very recently, first-year students typically did not experience any type of project work. Instead, the first year at WPI looked very much like an extension of high school, involving a basic math class, a basic science class, and a humanities class each term. Commission A1 argued that "first-year students would achieve the educational

[1] "The WPI Plan." *Undergraduate Catalog, 2008-2009.* 2008. <http://www.wpi.edu/Pubs/Catalogs/Ugrad/Current/wpiplan.html>.
[2] For an example of an IQP report, continue reading!

outcomes of WPI much more effectively if we required an inquiry-based project in the first year of college."[3]

The Great Problems Seminars

In August 2007, WPI launched two new experimental courses designed to challenge and engage first-year students with compelling global problems. The first of the Great Problems Seminars (GPS), *Feed the World* and *Power the World*, focused on major issues related to food and energy, respectively. While focusing on issues of global importance, the seminars also place a heavy emphasis on the development of critical thinking, teamwork, writing, and oral presentation skills. In establishing the first-year seminars, WPI is upholding its hallmark commitment to real-world project work and is taking strides to effectively integrate project-based learning into the first-year experience. The effects of this are twofold: WPI first-year students are better prepared for the project work in the IQP and the MQP, and the first-year educational experience is stimulated with an engaging new, interdisciplinary curriculum offering.

The primary learning goals of the Great Problems Seminars were defined as:

1. To engage first-year students with current events, societal problems, and human needs;
2. To encourage critical thinking, information literacy, and evidence-based writing;
3. To develop personal responsibility, organization, effective teamwork, and time management skills. [4]

Achieving student engagement is a key goal for the GPS – if the students are genuinely intrigued with the issues the course addresses, they will be more likely to meet the other GPS learning goals and benefit from the overall course experience. It is important to note that these courses are defined by problems, not disciplines. Unlike other first-year courses, the answers to the problems posed in the GPS cannot be found in the back of the textbook. As such, first year students are challenged to think creatively about feasible solutions to some of the world's toughest problems. Another difference between typical first-year courses and the GPS is that the GPS spans two WPI terms instead of just one. This allows a more thorough investigation of the

[3] "WPI Plan for General Education in the Twenty-First Century." *Report of the CAP Subcommittee on General Education and the First Year.* 25 March 2008.
[4] Arthur Heinricher, et al. "Great Problems Seminars: A New First-Year Foundation at WPI." *ASEE Regional Meeting, West Point*. March 2008, 3.

global issues at hand and a more effective development of the communication, teamwork and analytical skills central to the GPS learning goals. Throughout the second term, students investigate a problem of their choosing (within the context of the GPS in which they are enrolled). The course culminates in a poster presentation day in which students present their findings to other students, faculty and staff. This capstone project experience is the defining characteristic of the GPS - students are working together in small teams to research, understand, and evaluate a real-world problem and to communicate conclusions in a professional manner.

The intellectually challenging and stimulating learning environment created in a GPS classroom pushes first-year students to attain their maximal academic potential. In a report describing a study conducted by the UMass Donahue Institute, survey results indicate that the GPS achieved its goals during its first year in operation. Compared to Non-GPS students, GPS students said that their first year experience included all of the following to a greater extent:

- Using information ethically;
- Using library research tools;
- Working in teams;
- Functioning effectively in teams;
- Developing a greater understanding of global issues;
- Understanding contemporary issues;
- Solving complex real-world problems;
- Presenting and defending opinions by making judgments about information, validity of ideas, or quality of work based on set of criteria.[5]

From this data, it is evident that the GPS is a valuable addition to the first-year experience at WPI. This interdisciplinary, project-based approach to learning has the potential to not only prepare WPI freshmen for their upcoming project experiences, but better prepare them for the open-ended problems they will ultimately face upon graduating from the University.

[5] "A Report of Summative Findings from the Evaluation of the Great Problems Seminars of 2007-2008 at Worcester Polytechnic Institute." *UMass Donahue Institute, Research & Evaluation Group*, August 2008.

Importance of Interdisciplinary Education

An interdisciplinary approach to education has increasingly been finding its way onto college and university campuses, especially within the context of the first-year experience. Before discussing the benefits of interdisciplinary education, it is necessary to define "interdisciplinary" and distinguish it from related terms (e.g. multidisciplinary and cross-disciplinary). The dictionary defines "interdisciplinary" as "combining or involving two or more academic disciplines or fields of study."[6] A key distinction between "interdisciplinary" and "multidisciplinary" is that the former refers to an *integrative* relationship and the latter is *additive*. Analyzing one discipline from the perspective of another is the essence of taking a "cross-disciplinary" approach. Author James Davis, director for the Center of Academic Quality at the University of Denver, notes that the key characteristic of interdisciplinary courses is "'integration' – scholars working together to pool their interests, insights, and methods, usually with the hope of gaining and presenting new understandings that could not be derived from working alone."[7] Out of this integration emerges a new conceptual framework that can be applied to any number of situations or problems.

In examining the meaning of 'interdisciplinary', it is necessary to also determine the nature of a "discipline," how education based on distinct disciplines arose, and why disciplines eventually became the defining framework in academia. The dictionary defines "discipline" as "a branch of knowledge or teaching."[8] Essentially, a discipline "constitutes a distinctive way of thinking about the world."[9]

In an effort to further define the nature of an academic discipline, scholars have recorded 10 specific characteristics of a discipline. The following description of academic disciplines with respect to these 10 characteristics is excerpted from James Davis' book, *Interdisciplinary Courses and Team Teaching*:

[6] "Interdisciplinary." 1 Oct. 2008. <http://dictionary.reference.com/browse/interdisciplinary>.
[7] James R. Davis. "Interdisciplinary Courses and Team Teaching." (Phoenix, AZ: Oryx Press, 1995), 6.
[8] "Discipline." *The Free Dictionary.* 4 Oct. 2008. < http://www.thefreedictionary.com/discipline>.
[9] Howard Gardener. "Five Minds for the Future." (Boston: Harvard Business School, 2006), 27.

- *A discipline is a community of persons*. It is a "corps of human beings with a common intellectual commitment…a community of individuals whose ultimate task is the gaining of meaning."
- *A discipline is an expression of human imagination*. It is an activity of the imagination involving the creation of "novel mental images in a variety of forms: ideas, sentences, concepts, sequences, harmonics, rhythms, figures, among others."
- *A discipline is a domain*. It is a bounded realm in the "larger territory known as the intellectual life…on which the members of the disciplines focus their attention."
- *A discipline is a tradition*. It has a history with "intellectual heroes" and is "built on the discourse of its forebears."
- *A discipline is a syntactical structure*. It has not only a content, but a way of gathering and evaluating data and the evidence to support its assertions.
- *A discipline is a conceptual structure*. It employs a system of fundamental ideas, principles, and propositions and organizes them into meaningful categories.
- *A discipline is a specialized language or other system of symbols*. It uses "an intellectual shorthand" of technical terms (jargon) and symbols, and it invents new terminology as needed.
- *A discipline is a heritage of literature and a communication network*. The members of a discipline produce a heritage of "writings, paintings, compositions, musical scores, artifacts, recorded interviews and other symbolic expressions" which become available in "libraries, galleries, lecture halls, theaters, museums, and studios." Scholars stay in touch through books, professional meetings, scholarly journals, and a network of informal communications.
- *A discipline is a valuative and affective stance*. It involves prior assumptions about reality and human nature and includes intellectual passions and commitments.
- *A discipline is an instructive community*. It provides the underlying principles that structure a subject for instruction. [10]

With these criteria, distinct academic disciplines may be distinguished from each other (though overlap can certainly exist). Despite some inherent limitations, disciplines have been an

[10] James R. Davis. "Interdisciplinary Courses and Team Teaching." (Phoenix, AZ: Oryx Press, 1995), 25.

effective way of organizing known information and directing the search for new knowledge. In the words of Philip Phenix, Professor Emeritus of Philosophy and Education at Columbia University:

> The most impressive claim the disciplines have upon education is that they are the outcome of learning that has actually been successful. A discipline is a field of inquiry in which learning has been achieved in an unusually productive way. Most human efforts at understanding fail. A very few succeed, and these fruitful ways of thought are conserved and developed in the disciplines. Every discipline is simply a pattern of investigation that has proved to be a fertile field for the growth of understanding.[11]

The discovery and transmission of knowledge has traditionally been shaped by a disciplinary mindset. Separating academic subjects into their respective disciplines can be traced back to ancient Greece and Rome, and followed throughout history to the present day.[12] The disciplines were used to organize known bodies of knowledge at any given point in history. The number of disciplines and sub-disciplines increased in tandem with humanity's growing body of knowledge. The maintenance of these specific areas of study was further ingrained into the fabric of academia with the disciplinary associations and the departmental system within established colleges and universities.[13] Once this disciplinary structure was established, it was propagated to future generations – scholars who learned a specific discipline through their educational experience and who eventually entered academia would teach their particular area of expertise.

It is evident that discipline-based courses have a long history and a justifiable rationale to support their educational value. However, disciplinary specialization has specific drawbacks that should be considered in a discussion of effective educational approaches. Today, academics are said to "know more and more about less and less"; essentially, it can be argued that "what began as a reasonable effort to delineate domains of study and methods of investigation has ended in the infinite regress of specialization."[14] This specialization often overrides the bigger picture and likewise, tends to downplay broader issues that extend outside the realm of a narrow disciplinary focus.

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[11] Philip Phenix, *Realms of Meaning* (New York: McGraw-Hill, 1964), 36.
[12] James R. Davis, *Interdisciplinary Courses and Team Teaching* (Phoenix, AZ: Oryx Press, 1995), 27.
[13] Ibid, 29.
[14] Ibid, 35.

As disciplines become more specialized, they tend to become more isolated from one another. The jargon becomes only understandable to experts in the field and it becomes difficult to promote collaboration between the disciplines. In addition, each discipline promotes a specific way of looking at the world and specific methods for analyzing information. It is easy for experts within a discipline to view the world solely from that one perspective, often ignoring other methods of approach that could potentially shed light on a particular problem of interest. Such limited perspectives on an issue, though useful in pushing the boundaries of knowledge within a specialized field of study, can potentially be detrimental in the attempt to understand the overall complexity of many important problems.

Interdisciplinary courses, on the other hand, can provide a valuable, multi-faceted perspective that cannot be found through the study of a specialized academic discipline. While the primary goal of disciplinary specialization is the transfer of specific, content-driven information, that of interdisciplinary education is to help students locate, retrieve, understand, and use information.[15] Although there is a content component to interdisciplinary courses, the focus remains largely on the development of astute critical thinking abilities, the use of multiple perspectives in problem-solving, and the ability to draw connections between related issues – skills that transcend all disciplines and remain applicable in the pursuit of solutions to any problem. In brief, the potential advantages of interdisciplinary education are as follows:

- It is reflective of life, which is not segmented into discrete disciplines;
- It allows for the use of multiple approaches and applications of skills for problem solving;
- It can provide a broader context for new information;
- It allows for a broad use of diverse experiences and knowledge bases;
- It encourages creativity and creative thinking;
- It allows for greater flexibility;
- It can provide expanded opportunities for the application of theory;
- It provides a good introduction and foundation for various disciplines;
- It allows for the use of diverse perspectives;

[15] James R. Davis, *Interdisciplinary Courses and Team Teaching* (Phoenix, AZ: Oryx Press, 1995), 38.

- In can enhance the ability to synthesize and integrate information. [16]

Traditionally, most college and university courses are defined within a single discipline. One significant drawback to such a format for higher learning is that real-world problems rarely present themselves in this fashion, pertaining solely to a single field of academic study. The Great Problems Seminars take a holistic approach and portray such real-world issues in an interdisciplinary manner that accurately reflects their inherent complexity. Such complexity calls on many academic disciplines for adequate consideration and effective solutions, and a complete picture cannot be portrayed without approaching the problem from the many academic angles. Collaboration from experts in many fields must occur before solutions to global problems can be reached, and it is this truth that the GPS strives to convey to its students through highlighting the importance of considering multiple perspectives.

Making those connections between disciplines in the pursuit of solving some of the world's toughest problems is another strength of interdisciplinary education. A report by the Association of American Colleges describes a need in higher education for "constructing relationships among various modes of knowledge and curricular experiences" and for "relating academic learning to a wider world, to public issues and personal experience."[17] With its interdisciplinary, project-based approach, the GPS program seeks to do just that.

Importance of Project-Based Learning

Project-based learning is an educational approach that "engages students in learning knowledge and skills through an extended inquiry process structured around complex, authentic questions."[18] Student-centered learning is a hallmark of this type of project experience. In contrast to other approaches to learning that involve assigning problems after instruction and asking students to apply newly obtained knowledge, project-based learning emphasizes the importance of presenting students with a problem which then, in turn, serves to initiate, motivate and direct the learning process. Essentially, this approach:

[16] Diane Rover, "Interdisciplinary Teaching and Learning: the What, Why and How." *Journal of Engineering Education and Learning.* 1 Oct. 2008. <http://findarticles.com/p/articles/mi_qa3886/is_200210/ai_n9121908.>
[17] James R. Davis, *Interdisciplinary Courses and Team Teaching* (Phoenix, AZ: Oryx Press, 1995), 42.
[18] "Handbook: Introduction to Project-Based Learning." *Buck Institute for Education.* 6 Oct. 2008. < http://www.bie.org/index.php/site/PBL/pbl_handbook_introduction/#standards>.

- Recognizes students' inherent drive to learn, their capability to do important work, and their need to be taken seriously by putting them at the center of the learning process.
- Highlights provocative issues or questions that lead students to in-depth exploration of authentic and important topics.
- Requires the use of essential tools and skills, including technology, for learning, self-management, and project management.
- Involves the presentation of information generated through investigation, research, and reasoning.
- Encourages collaboration in some form, either through small groups, student-led presentations, or whole-class evaluations of project results.[19]

Studies have shown that project-based learning can result in higher-level cognitive development.[20] By tackling multifaceted, open-ended problems, students must draw connections between academic disciplines and weigh many factors before reaching solutions. Part of this process requires that students learn how to gather and organize information as well as determine what information is necessary to reach a solution and what information is irrelevant. While achieving specific content-based goals is an important component to project-based learning, the specific analytical, critical thinking, communication, teamwork, and problem-solving skills that are developed during the process are especially valuable. These skills remain with the student after the completion of the course and are applicable ubiquitously. This type of self-directed learning can shape a student's ability to practice life-long learning.

The benefits of this type of learning experience are many. Effectively, project-based learning:

- Overcomes the dichotomy between knowledge and thinking, helping students to both "know" and "do."
- Supports students in learning and practicing skills in problem solving, communication, and self-management.
- Encourages the development of habits of mind associated with lifelong learning, civic responsibility, and personal or career success.

[19] Ibid.
[20] Ibid.

- Integrates curriculum areas, thematic instruction, and community issues.
- Assesses performance on content and skills using criteria similar to those in the work world, thus encouraging accountability, goal setting, and improved performance.
- Creates positive communication and collaborative relationships among diverse groups of students.
- Meets the needs of learners with varying skill levels and learning styles.[21]

Perhaps most importantly, project-based learning shows students the *relevance* of what they are learning. The problems they are faced with are very large, complex and real. Charged with the task of analyzing the situation, students must collectively apply past knowledge and skills learned in the classroom to reach feasible solutions. Each group member will bring a unique perspective and knowledge base to the discussion, illuminating the importance of working collaboratively to achieve a common goal. Once a solution has been devised, the student must then present his conclusions with the appropriate amount of data and text in a clear, concise, and complete manner; such skills transcend the bounds of the project at hand and are certainly capable of aiding the student with their future educational and career endeavors.

Through its term-long project requirement in B-term and mini projects assigned throughout the course, the GPS embraces the project-based learning approach. In doing so, it meets its key goals of engaging students; encouraging critical thinking, information literacy, and evidence-based writing; and developing personal responsibility, organization, effective teamwork, and time management skills. The 2008 GPS program derives its project topics from a diverse array of global issues pertaining to health, food, energy, and sustainable development. A large area of interest that has not yet been addressed through a GPS is the global environment and how humans are affecting it. These issues are broad in scope and would be fruitful and relevant topics for project work in the first year experience.

The 21st Century: The Century of the Environment

Human beings and the natural world are on a collision course. Human activities inflict harsh and often irreversible damage on the environment and on critical resources. If not checked,

[21] "Handbook: Introduction to Project-Based Learning." *Buck Institute for Education.* 6 Oct. 2008. < http://www.bie.org/index.php/site/PBL/pbl_handbook_introduction/#standards>.

many of our current practices put at serious risk the future that we wish for human society and the plant and animal kingdoms, and may so alter the living world that it will be unable to sustain life in the manner that we know. Fundamental changes are urgent if we are to avoid the collision our present course will bring about.[22]

So begins the 1992 *World Scientists' Warning to Humanity*, signed by 1700 of the world's leading scientists, including the majority of Nobel Laureates in the sciences at the time. In the document, they explicitly allude to one of the most pressing challenges facing humanity in the 21st century: environmental degradation. In fact, the 21st century has already been dubbed "The Century of the Environment", a clear testimony to the types of the great problems which will define and shape the next 100 years.[23] We have reached a critical point in human history; our collective actions can now, like never before, permanently alter the earth's global environment. With an unprecedented growth in the human population and the countless new technologies that have emerged over the years, human action has essentially evolved into a force of nature, capable of causing extreme change within the global arena.

The impacts transcend the aesthetic, entering and affecting the realm of human health and perhaps more critically, jeopardizing the ability of the planet to sustain life. Humans have turned nearly half of the Earth's habitable lands into urban and agricultural areas, significantly altered atmospheric chemistry, and accelerated the rates of species extinction.[24] Massive losses of habitats and biodiversity, soil erosion, global climate change, pollution of the air, water, and soil with industrial and agricultural toxins – these are all great problems facing humanity in the 21st century. The integrity of the biosphere is inevitably and inextricably linked to human health, economic health, social justice, and national security.[25] The concept of sustainability – meeting the needs of the present without compromising the ability of future generations to meet their needs – has become, more than ever before, a driving force for change in the 21st century.

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[22] Union of Concerned Scientists, "World Scientists' Warning to Humanity," http://www.chicagomanualofstyle.org/tools_citationguide.html

[23] Jane Lubchenco, "Entering the Century of the Environment: A New Social Contract for Science," *Science*, January 23, 1998, www.sciencemag.org.

[24] Vitousek, PM, HA Mooney, J Lubcenco and JM Melillo. 1997. "Human domination of Earth's ecosystems." *Science* 277: 494-499.

[25] Jane Lubchenco, "Entering the Century of the Environment: A New Social Contract for Science," *Science*, January 23, 1998, www.sciencemag.org.

In the words of Jane Lubchenco, as expressed during her Presidential Address at the Annual Meeting of the American Association of the Advancement of Science: "Humans have unwittingly embarked upon a grand experiment with our planet. The outcome of this experiment is unknown, but has profound implications for all of life on Earth."[26] It is estimated that humanity's demands on the biosphere have surpassed its regenerative capacity since the 1980s and are overshooting this capacity by approximately 25%.[27] This demand on the biosphere is commonly known as Earth's "Ecological Footprint," measured in terms of the area of biologically productive land and water required to supply the resources we use and to assimilate our waste. This trend is not sustainable and will ultimately lead to a collapse of the critical ecological systems that support life on earth if humankind continues down this path unabated. Figure 1 below, extracted from the World Wildlife Fund's *Living Planet Report*, depicts humanity's estimated ecological footprint since the 1960s, and offers three projections of the current trend into the future based on how quickly we are able to reduce our impact, if we do so at all.

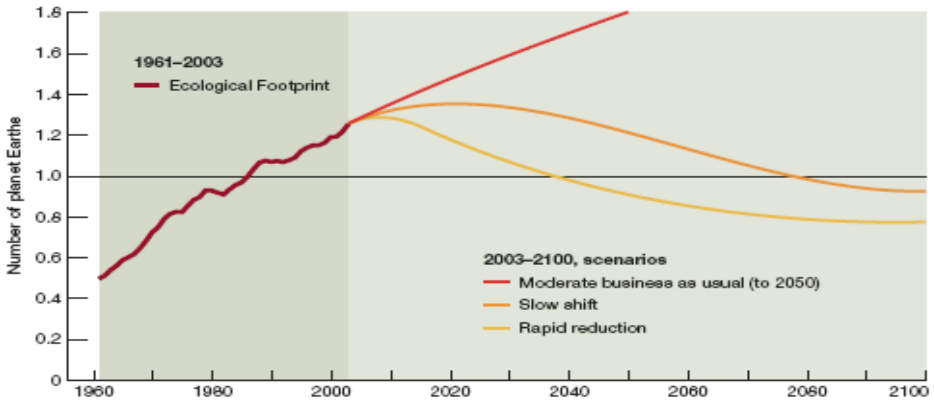

Figure 1. Three Ecological Footprint Scenarios, 1961-2100[28]

This graph emphasizes the World Scientists' Warning by highlighting the fact that change is necessary to ensure a sustainable future. The major question at hand is what should that change be and how should it be implemented? The answers are neither obvious nor trivial, as they are inevitably tangled in a number of social, economic and ethical considerations, but it is these

[26] Jane Lubchenco, "Entering the Century of the Environment: A New Social Contract for Science," *Science*, January 23, 1998, www.sciencemag.org.
[27] Mathis Wackernagel and William Rees, *Our Ecological Footprint* (Gabriola Island: New Society Publishers, 1996), 149.
[28] Chris Hails, ed., "Living Planet Report 2006," *World Wildlife Fund*, <www.panda.org>.

types of questions that can serve as a thought-provoking foundation on which to build another Great Problems Seminar.

A GPS WITH AN ENVIRONMENTAL FOCUS

Rationale

Environmental issues are central to all aspects of our lives; the quality of our lives directly depends on the quality of the environment, and the quality of the environment in turn depends on our lifestyles. From climate change to species loss, air pollution to water contamination, and everything in between, environmental problems are diverse in scope and many in number. As such, they affect the world on both a local and global scale. An educated citizenry should be well-versed in the rhetoric of the environment and should understand the impact humanity can have on environmental systems (through our technology, by what we produce and consume, etc). Making informed decisions in a democratic society demands it. A sound grounding in issues of environmental concern can serve as a cornerstone for responsible decision making in the 21st century.

The Great Problems Seminars at WPI are "all about important problems."[29] Issues of environmental concern present some of the most urgent problems facing the global community today. A GPS with an environmental focus, therefore, would undoubtedly provide engaging and relevant material for a thought-provoking first year seminar experience with unlimited opportunities for project topics. Such a course is of further value, especially at a technological institution like WPI. Aspiring scientists and engineers (the majority of the student body at WPI) should possess a solid foundation in environmental issues, as their future work could involve the development of processes or technologies that may harm or help the environment to varying degrees. As an institution of higher education, WPI is well-positioned to produce graduates who possess the information, skills, and environmental stewardship to help our complex, global society move toward a more sustainable way of life.

Furthermore, the creation of an environmentally-focused GPS falls in line with the University's green initiatives. In the description of the WPI President's Task Force on Sustainability, taken from the WPI Sustainability website, it states the following as its goals:

[29] "Launch Your Project Experience in the First Year." 12 Nov. 2007. <http://www.wpi.edu/Academics/Undergraduate/FirstYear/launch.html>.

> …to provide leadership and coordination for WPI's campus-wide efforts in energy and resource conservation and reduction in the harmful environmental impacts of our operations, all directed toward enhancing the long-term sustainability of WPI's activities and the environment of which we are a part. We are an educational institution; thus, these goals are interwoven with our academic goals in teaching about the practice of sustainable design and the impacts of behavioral changes, as well in conducting research in the reduction of environmental impacts and in methods of enhancing sustainability.[30]

These university goals, therefore, can be partially fulfilled by the installation of an environmental GPS. The project-based focus of the GPS would certainly contribute to WPI's goal to "actively seek to foster a community that produces innovative ideas and practical solutions to the complex problems associated with each part of the sustainability puzzle."[31] Additionally, this GPS will complement WPI's existing departments and courses that have an environmental focus, even perhaps serving as a feeder system for those programs. It is not beyond the realm of possibility that such a course could inspire first year students to adopt an environmentally-related career path, if they have not yet committed to such a goal before enrolling.

Following the pattern of the other GPS course names (an imperative verb + "the World"), a GPS centered on the study of environmental problems could appropriately be coined "Save the World" or "Sustain the World." For the purposes of this report, the course will henceforth be referred to as "Save the World."

Guiding Question

The guiding question for a particular curriculum is "the fundamental query that directs the search for understanding. Everything in the curriculum is studied for the purpose of answering it."[32] The guiding question for the *Feed the World* GPS, for example, is "Why do we eat what we eat?" An appropriate guiding question for *Save the World* is "Does the world need to be saved?" An equally important corollary question, "If so, how?", should also be considered. Behind these deceptively simple questions is a driving force to study the complexities of environmental problems, their relative severity, the science behind them, and their potential solutions. In doing so, it is also necessary to place value on that which we are trying to save (discussing the

[30] "WPI Sustainability." 2008. <http://www.wpi.edu/About/Sustainability/taskforce.html>.
[31] Ibid.
[32] Robert Traver. "What is a Good Guiding Question?" (*Educational Leadership*. March 1998.), 72.

importance of ecological services) and to investigate the nature of human behavior (how human actions impact the environment and the psychology of convincing people to adopt more sustainable behaviors). Discussion of these matters requires a consideration of the economic, social, political, and ethical dimensions inherent in issues of environmental concern (See Figure 2 below).

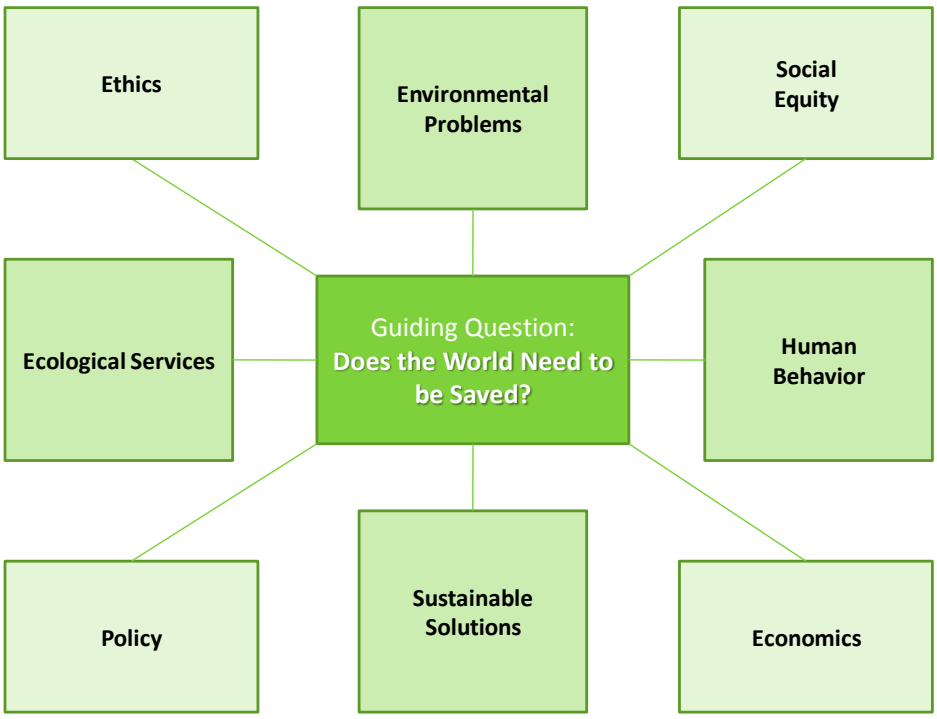

Figure 2. A concept map depicting the guiding question for the *Save the World* GPS.

The ultimate goal of Save the World, however, transcends simply finding a yes or no answer to the guiding question. It is the *process* of answering the guiding questions that is of central importance to this course, as it should lead to environmental literacy – the crux of this Great Problems Seminar.

Environmental Literacy: An Overview

In January of 2003, the National Science Foundation's Advisory Committee for Environmental Research and Education reported that "in the coming decades, the public will more frequently be called upon to understand complex environmental issues, assess risk, evaluate proposed environmental plans and understand how individual decisions affect the environment at local and

global scales."[33] In brief, the public will be called on to become more environmentally-literate citizens.

Environmental literacy, as defined by the Environmental Literacy Council, "requires a fundamental understanding of the systems of the natural world, the relationships and interactions between the living and the non-living environment, and the ability to deal sensibly with problems that involve scientific evidence, uncertainty, and economic, aesthetic and ethical considerations."[34] Environmental literacy is an urgent and inherently interdisciplinary goal. It equally draws on the sciences (natural and social) and the humanities, demanding the integration of multiple disciplines. For example, at WPI, the study of environmental problems spans multiple departments: Biology, Chemistry and Biochemistry, Chemical Engineering, Civil and Environmental Engineering, Environmental Studies, Humanities and Arts, and Social Science and Policy Studies.

In a traditional sense, the term "literacy" refers to one's ability to use language through the written and spoken word. Environmental literacy is, in many respects, about understanding the language of the environment – its "grammar, literature, and rhetoric. It involves understanding the underlying scientific and technological principles, societal and institutional value systems, and the spiritual, aesthetic, ethical and emotional responses that the environment invokes in all of us."[35] Those who are environmentally literate are able to take the appropriate action to maintain, restore or improve the health of environmental systems.

Environmentally literate students should understand the state of the global environment (humanity's "ecological footprint") and the causes of global environmental change. They should also be familiar with the life-support processes that ecosystems provide ("ecosystem services") and the role of policy and market forces ("ecological economics") as they affect the state of the

[33] Coyle, Kevin. "Environmental Literacy in America." *The National Environmental Education and Training Foundation.* Washington, D.C. Sept. 2005.
[34] "Environmental Literacy." *The Environmental Literacy Council.* 2002. <http://www.enviroliteracy.org/>.
[35] "Environmental Decision Making, Science and Technology." *Carnegie Mellon University.* 2003. <http://telstar.ote.cmu.edu/environ/m1/s1/index.shtml>.

environment. They should know that their choices affect the environment, how those choices help or harm the environment, and what they need to do (as an individual or part of a larger group) to keep the environment healthy so that they, and future generations, can live well.

Students should also have a solid understanding of the concept of sustainability. Sustainability, as defined by the 1989 World Commission on Environment and Development (the Brundtland Commission), is "meeting the needs of the present without compromising the ability of future generations to meet their own needs." It can be found at the intersection of economy, environment, and social equity (the "three pillars" of sustainability), as depicted in Figure 3 below.

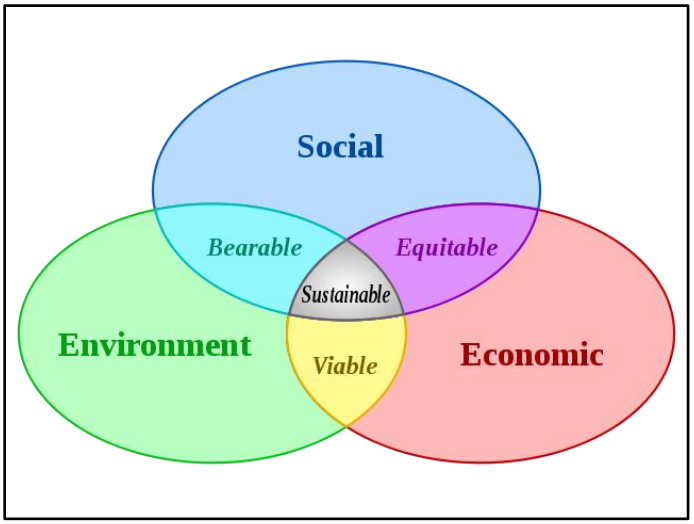

Figure 3. A visual representation of the relationship between the economic, environmental and social dimensions of sustainability.[36]

Understanding the relationship between these three areas – environmental, social, and economic aspects – can help individuals make informed decisions and take responsible action. After all, the ultimate goal of environmental literacy goes beyond the mere acquisition of knowledge and skills. It is the *application* of that acquired knowledge and of those acquired skills that is essential – the ability to decide and act in a way that is conducive to solving today's environmental problems, thus working towards achieving a more sustainable way of life.

[36] "Sustainability." 12 April 2009. <http://en.wikipedia.org/wiki/File:Sustainable_development.svg>.

Environmental literacy can be divided into five major components. The Campaign for Environmental Literacy depicts these components in a hierarchical structure, as shown below in Figure 4.

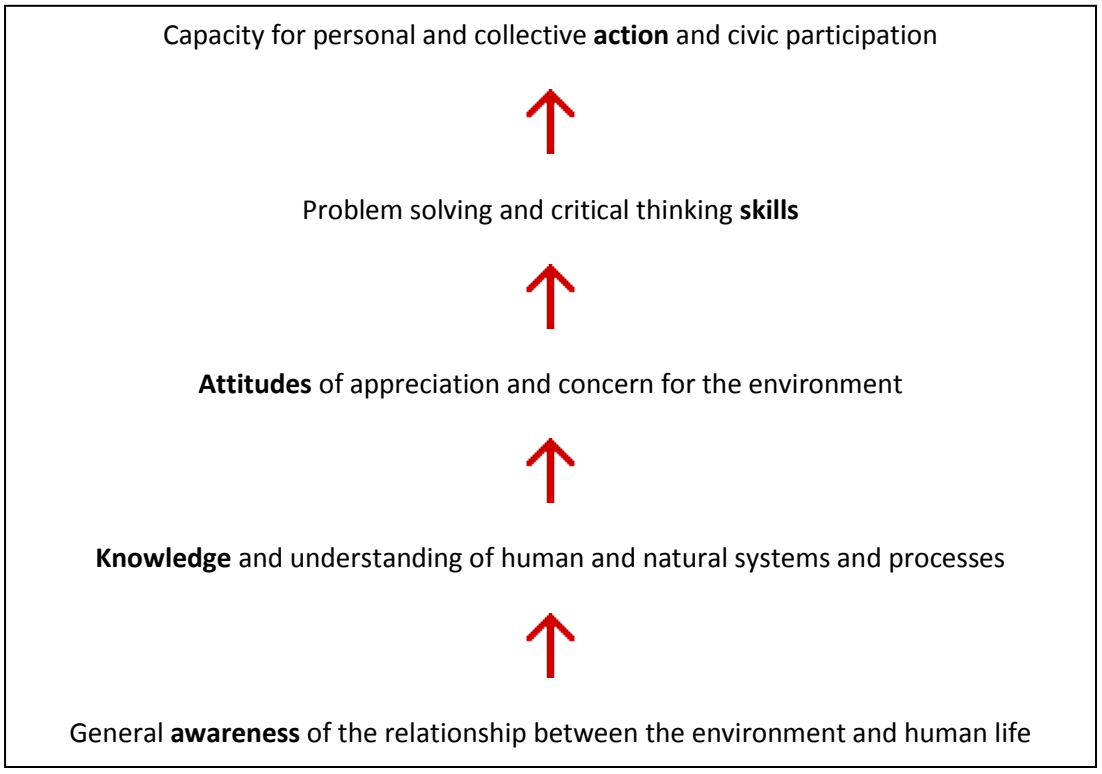

Figure 4. The Environmental Literacy Ladder.[37]

The progression towards environmental literacy shown here begins with a general awareness of human-environment interactions. This is followed by the acquisition of ecological knowledge, after which comes attitudes of appreciation for the natural world. Next is the development of the necessary analytical skills needed to finally be able to take appropriate action for the betterment of the environment. Each rung of the ladder presents an important step in the climb toward environmental literacy and all should be incorporated into a course centered on molding students into environmentally-literate citizens.

[37] "What is Environmental Literacy?" *Campaign for Environmental Literacy*. 2007. <http://www.fundee.org/facts/envlit/whatisenvlit.htm>.

It important to note that the order in which and rate at which students reach each rung will likely vary depending on the structure of the course and on a student's individual background, values, and motivation.

The Components of Environmental Literacy

Awareness: Developing an Environmental Consciousness

The typical foundation for environmental literacy begins with the development of an environmental consciousness; such a consciousness stems from a general awareness of humanity's relationship with the earth, its dependence on the earth's ecological services, and the collective impact humanity has had on the earth. The idea that ecological welfare dictates human welfare may seem intuitive; however, it is a truth that is often overlooked in the name of economic expansion and short-term gains.

Quite often, the natural world is viewed as simply something "out there," sitting outside the window pane, a force to be reckoned with at some point or another. Perhaps nothing is taken for granted more than the earth we live on, depend on, and need for our very survival. Few stop to think about the countless ecological services from which we all benefit on a day -to-day basis, without which the very life we know and cherish could never be sustained: air and water purification; mitigation of droughts and floods; decomposition and detoxification of wastes; regeneration of soil nutrients; buildup of soil structure; pollination; moderation of wind and temperature extremes; provision of a wide variety of agricultural, medicinal, and industrial products; evolution and maintenance of the biotic gene pool and the biodiversity that performs the aforementioned tasks; and unparalleled aesthetic, spiritual, and intellectual uplift, just to name a few.[38] Learning to value such a wealth of services is the first step to safeguarding them. In the process, brought to light will be a seemingly obvious truth that human society is very much intertwined with the natural world, relying upon its well-being more than any other factor. Coming to terms with such a simple, frequently overlooked idea as this has the potential to unlock the door to a more sustainable future. It is on this principle that students can begin to comprehend the significance of the environmental problems they will encounter during the GPS.

[38] Donella Meadows, et al. *Limits to Growth: The 30-Year Update* (White River Junction: Chelsea Green Publishing, 2004), 83-84.

Before focusing on specific environmental issues, it is important to first consider humanity's impact on the biosphere in a broad sense. This task can be achieved by using the "ecological footprint" concept, as described below:

> [It is] a tool for measuring and analyzing human natural resources consumption and waste output within the context of nature's renewable and regenerative capacity (or biocapacity). It represents a quantitative assessment of the biologically productive area (the amount of nature) required to produce the resources (food, energy, and materials) and to absorb the wastes of an individual, city, region, or country.[39]

Such a tool will also provide insight on whether or not humankind is in "overshoot"; in other words, it can lead to the conclusion of whether or not human society is using up the earth's capital faster than it can be regenerated. In light of this investigation, students can face the American culture of consumerism and deliberate on the fate of waste and in so doing, consider the subsequent consequences for the planet as a whole. (See Appendix B for three individual assignments that will help students realize the nature of the waste problem: "Where is 'Away'?", "A Trashy Assignment, Part 1" and "A Trashy Assignment, Part 2"). To put Americans' consumerism and waste generation into perspective, students can think about how many earths would be necessary to support their way of life if everyone in the world lived with the lifestyle that they do (visit <www.footprintnetwork.org/gfn_sub.php?content=calculator> and similar websites to estimate such a figure). Comparing the ecological footprints of different nations will inevitably pull in questions of social equity as well. (See Appendix B for an individual assignment entitled "Sizing up Your Ecological Footprint" that asks students to determine their personal ecological footprint and see Appendix C for a group project entitled "Sizing up WPI's Ecological Footprint" that asks students to determine the collective ecological footprint of various communities on campus).

Key questions relevant to this component of environmental literacy that could be investigated by students in *Save the World* include:

- Does the world need to be saved? From what? For whom? Is time running out?
- What is "nature"? What is the "environment"? Is there a difference?
- Does the environment have intrinsic value?

[39] Sharon Beder, *Environmental Principles and Polices: An Interdisciplinary Introduction* (Sterling: University of New South Wales, 2006), 25.

- What is humanity's relationship with nature? (Both past and present.)
- What should humanity's relationship with nature be like?
- How do we view and interact with nature today? Is that different than in the past? How so?
- How should we view and interact with nature?
- What are ecological/ecosystem services, what do they contribute to life on earth, and how does human society depend on them?
- What does the term "ecological footprint" mean and what is its significance? How does it help us understand humanity's overall impact on the biosphere?
- Can everyone in the world live like the average American? (think in terms of per capita consumption and waste).

Further awareness is generated through learning about specific issues of environmental concern.

Knowledge: Understanding Environmental Issues

Fundamental knowledge of the types of environmental issues facing the globe today and their consequences for both the physical planet and human society is a key facet of environmental literacy. From the GPS, students should gain a familiarity with the magnitudes, rates, and trends associated with any or all of the following topics: population growth, biodiversity loss, deforestation, desertification, climate change, ozone depletion, air and water pollution, toxic and radioactive contamination, resource and energy use. The specific topics of interest can be divided into seven main subject areas:

- Population Growth
- Energy
- Air Pollution
- Global Warming
- Land Degradation
- Biodiversity
- Water

Due to the interrelatedness of the abovementioned issues, content will overlap in some respects among them. They are arranged in such a way that will allow a smooth transition from topic to topic. Not all topics are expected to need equal amount of time of class coverage, though they each represent distinct issues that students should be aware of and understand.
This knowledge can be imparted to students through a variety of means. Lectures, guest speakers, course readings, videos, and student presentations of group projects are all plausible modes of communicating the necessary knowledge. Periodic quizzes and/or exams throughout the course can help ensure that the students are acquiring the fundamental knowledge they need to reach a state of environmental literacy. In this course, students should be presented with a solid overview of the major global environmental challenges facing humanity before the beginning of B-term. Hopefully, a number of topics will have peaked their interest and they will be able to formulate a focused project proposal for their term-long, capstone project.

Attitudes: Appreciating the Environment

Stephen J. Gould argued that human beings are unlikely to protect what they do not love, and that we cannot love what we do not know.[40] Students need to first learn how to appreciate the environment before they can find meaning and motivation to solve environmental problems. This could take one of many forms, depending on the individual, ranging from the biocentric to the anthropocentric. Environmental appreciation could stem from an inherent love for nature that is derived out of personal experience and reflection on nature's perceived intrinsic value. Or, it could arise from the realization that in order to maintain a habitable home for humans, the earth must be cared for. In both cases, there exists a level of appreciation for the planet's natural systems.

This appreciation can be further strengthened through experience at other rungs of the environmental literacy ladder.

Skills: Analyzing Environmental Problems

Equipped with a general understanding of the natural world and society's place in it, students will be introduced to the appropriate framework with which to analyze and evaluate environmental issues. If awareness and appreciation for the earth and its life-support systems

[40] Stephen J.Gould, *Eight Little Piggies.* (New York: W.W. Norton & Co, 1993), 40.

serve as the foundation for environmental literacy, then the fundamental core principles and approaches needed to appropriately address the issues provide the frame. The conceptual framework developed in this GPS will illuminate the scientific, ethical, and social dimensions related to issues of environmental concern, placing them in the appropriate context. Such considerations will serve as a basis for the problem-solving and decision-making skills (analysis, synthesis, and evaluation skills) needed to deal with a diverse agenda of environmental challenges, cultivating an ability to seek out the relevant knowledge for a given problem or situation.

The students will come to realize that environmental problems are highly interdisciplinary in nature and call on many academic disciplines, including biology, chemistry, economics, engineering, history, philosophy, policy and psychology. The complexity of environmental issues is such that they cannot be wholly understood through the principles brought forth by any one discipline, but instead demands consideration from across the academic spectrum. The natural sciences, humanities, and social sciences must be united not just to offer a more complete picture of such multifaceted problems, but to collectively lead to the most viable and just solutions. Evaluating a situation from multiple points of view, ranging from assorted academic perspectives to varying ethical positions, is a key goal of this course. Such a practice will enable the students to see the "big picture," and ultimately help in the problem-solving process. Students will learn that solutions will only be found at the interface of a number of perspectives; not considering all the factors involved may yield a short-sighted, and incomplete, solution.

Further complicating the nature of global environmental issues is their interrelatedness. Due to the intricacy of the natural world, no environmental problem can ever be completely isolated from the others. In an effort to fully understand the dynamics of complex environmental problems, a systems approach should be applied. Understanding natural systems (and their related issues) at a systemic level involves not just knowledge of each isolated component, but rather a solid comprehension of the relationships that connect each to the others. Due to this interconnectedness, trade-offs almost always have to be made when dealing with human-induced environmental problems. As such, students will learn how to conduct an appropriate cost-benefit analysis to evaluate proposed solutions.

The projected consequences of many environmental issues are highly debated in terms of their severity and even likeliness to occur. Students will have to learn how to assess risk and act accordingly. A fundamental attitude related to this issue and often used in the context of environmental problems is the "precautionary principle." The precautionary principle states that in the absence of ample scientific proof of predicted consequences, preventive action should always be taken if the potential consequences are sufficiently dire. With respect to the environment, the precautionary principle implies that to avoid the possibility of serious or irreversible harm to natural systems (and in most cases, to human society as well), appropriate action should be taken even if the scientific evidence of such harm occurring is incomplete or inconclusive.

Environmental problems often have an ethical dimension, which the students will come to learn early on in the course. Debating and evaluating varying ethical perspectives should be integrated into the discussion of any environmental issue. For example, when considering humanity's overall impact on the biosphere, the issue of whether or not we have any sort of responsibility toward future generations is of central concern. If one concludes that posterity is of little consequence to those alive today, perhaps damaging the environment for the sake of maintaining today's lifestyles is acceptable as long as the negative consequences do not emerge within the lifetimes of those causing the problem. On the other hand, if one concludes that it is our moral duty to preserve the earth's precious life-supporting systems for those yet to be born into this world, fundamental changes in practice and policy should be urgently implemented to halt current trends of environmental degradation. Two ethical perspectives; two very different outcomes.

Principles of social equity are also inevitably intertwined with discussions of environmental problems and their solutions. Economically underprivileged communities tend to feel the effects of environmental degradation much more so than their wealthier counterparts. Discussing why this is the case and what can be done about it is an important topic for consideration. Furthermore, when contemplating solutions to environmental issues, one must do so in a way that is socially equitable. The polluter pays principle states that industry should internalize the cost of environmental damage caused from the production of a given product. While such an

idea seems logical and appropriate on the surface, one must remember that this cost will be passed on to the consumers in the form of a higher price for that product. Raising the cost of products (like gas for your car) to reflect the environmental damage they impart (polluting the atmosphere and accelerating global warming) would certainly help reduce their negative effects (because people would drive less), but the lower classes would suffer much more than the middle and upper classes as a result. The concept of environmental justice is one that students should be introduced to prior to delving into specific environmental problems, large or small.

Students will come to understand problems of scale – the notion that what is safe locally or in the short-term may be catastrophic globally or in the long-term. In most every aspect of human society, decisions are frequently made with only the short-term benefits in mind without much consideration for the detrimental long-term consequences that may result. Such thinking is the source of much of humanity's assault on natural systems; as such, learning to think about the long-term and global implications of their individual actions is an important skill students should acquire from this course. Acknowledgement of another simple truth - natural resources are not an infinite commodity - is highlighted in the 1992 *World Scientists' Warning to Humanity*: "The earth is finite. Its ability to absorb wastes and destructive effluent is finite. Its ability to provide food and energy is finite. Its ability to provide for growing numbers of people is finite. And we are fast approaching many of the earth's limits."[41] It this the combination of short-term focus and disregard for the earth's natural limits on which many current practices and policies are based, causing the environmental degradation that is continuing into the future. A discussion of the earth's limits can transition into an introduction to the concept of sustainability – for something to be sustainable, it theoretically is capable of continuing indefinitely into the future and thus every sustainable solution needs to take into account the finite nature of the earth's resources.

In addition, data analysis is a key skill to be taught during this course. The study of environmental issues inevitably includes a great deal of charts, tables, and figures to illustrate present and future conditions. Students will need to learn not only how to read and interpret

[41] Union of Concerned Scientists, "World Scientists' Warning to Humanity," <http://www.chicagomanualofstyle.org/tools_citationguide.html>.

these modes of data representation, but also evaluate the credibility and limitations of the information they portray. Extrapolating data to predict the future course of events is also an important aspect of data analysis. Not only is it important for students to draw conclusions from a diverse array of data, they will need to learn how to use such data in their own research endeavors (most notably, the term project they will complete in B-term).

Overall, this framework that needs to be developed during this GPS is complemented with a skill set that will prove to be applicable to not only addressing environmental issues, but also to the students' future academic and professional lives. They include the following:

- Communications Skills
    - Written
    - Oral
    - Visual
- Teamwork
    - Working effectively in groups.
    - Managing time effectively to achieve a common goal by a set deadline.
- Data Analysis
    - Reading and interpreting data in different forms (tables, figures, etc.) and drawing appropriate conclusions from them.
    - Extrapolating data and trends to understand plausible implications for the future.
- Critical Thinking
    - Analyzing a problem from many points of view.
    - Dealing with uncertainty.
- Research
    - Using the library effectively.
    - Acquiring information from a variety of sources.
    - Assessing the credibility of sources.

These skills and frameworks provide the necessary tools and context that students can use to effectively develop and communicate solutions to environmental problems.

Action: Developing Solutions to Environmental Problems

David Orr notes that "the study of environmental problems is an exercise in despair unless it is regarded as only a preface to the study, design, and implementation of solutions."[42] Following in line with this premise, the proposed GPS is not merely about describing problems, but about finding solutions. It is about learning how to effectively tackle issues of pressing environmental concern in a socially-responsible and well-informed manner. The course is not meant to overwhelm, but to empower. Students need to understand that feasible solutions to these daunting problems do exist – they just need to be solidified and implemented. Needless to say, that is easier said than done. Having developed an understanding of natural systems, a framework with which to evaluate global environmental problems, and a knowledge base of what those environmental problems entail, students will be ready to investigate solutions. This portion of the course can easily and effectively incorporate role-play (emphasizing decision-making) and debates (emphasizing diverse perspectives), both of which can boost student engagement in the classroom setting.

Like other Great Problem Seminars, *Save the World* will be project-based. The first term should offer several key group projects that allow the students to tackle real-world environmental problems and report on their conclusions. Please refer to Appendix C for a listing of possible group projects.

With the hallmark of the GPS program, the 7-week long research project, students can investigate in depth an environmental problem that most interests them. Everything they have learned will come together into this one project. It should draw on background knowledge and gained skills (research, collaboration in teams, writing, oral presentation, etc). From this course, students should gain the ability to recognize and frame a specific environmental concern, then seek the relevant knowledge, skills, and tools to address the issue. Understanding the interplay of science, technology, human and institutional behavior, and decision making is necessary for a complete approach to any environmental concern.

[42] David Orr. *Ecological Literacy: Education and the Transition to a Postmodern World* (Albany: State University, 1992), 94.

The subject area of this GPS also allows for ample opportunity for community service projects as well, should the instructors choose to pursue such a path. Participating in the community clean-ups, volunteering at the EcoTarium (a nature museum in Worcester, MA), or collecting recycled items around campus are all possible community service ideas.

Focusing on the future is a central theme that will run throughout the course. Students will qualitatively and quantitatively draw conclusions about the future of this planet should society continue with current practices. They will extrapolate global trends into the future and predict the consequences that will ultimately arise (see Appendix B for a writing assignment, "In the Year 2525..", that directly addresses this idea) . Hopefully such analysis will, for each student, spark a desire for not only finding solutions, but for taking action as well.

Students will learn to question whether technology is enough to ameliorate the environmental crisis, or whether a paradigm shift of culture, values and general outlook on humankind's relationship with nature is necessary to occur first. How much are these problems technological, and how much are they social in nature? It is important to keep in mind that our political, cultural, and economic attitudes were formulated over thousands of years during which time natural resources were viewed as eternally plentiful and the human impact on the natural environment was viewed as negligible. It is only in recent years that an environmental consciousness has begun to creep into the forefront of global attention and inspire action on many levels.

Students will need to consider solutions on a number of different scales – on the individual level, the community level, the state level, the national level, and the international level. They will come to understand that what is feasible at one level may not be appropriate at another level, depending on the circumstances, the issue at hand, and the people involved. A substantial focus should be on what students can do as individuals; by the end of the course, they should have a solid understanding of how they can help the environment through their personal decisions and also understand what they can do to facilitate positive change within their local community. In most cases, solutions to environmental problems often require everyone's cooperation to be effective. Since that is the case, students must enter into the realm of psychology and consider

the best ways to convince people to change their current habits and adopt environmentally-friendly behaviors (see Appendix C for a group project entitled "Think Globally, Act Locally" that challenges students to do just that).

In the process of learning about past and present solutions and thinking about future solutions, students will need to grapple with the complexity of the situations at hand and consider the factors that make the issues so difficult to deal with:

- *Conflicting interests and values.* People come from a myriad of diverse backgrounds, which result in many worldviews. Such differences render reaching a consensus quite difficult.
- *Tradeoffs need to be made.* For every gain there is some cost. Whether or not that cost is worth the gain is always up for debate.
- *Difference in priorities*. The well-being of the environment may not always be (and often is not) at the top of everyone's priority list. For example, members of underprivileged communities may see environmental laws making it more difficult for them to find jobs and obtain a better income. Their first priority is making a decent living for themselves and their families.
- *Too much focus on the short-term.* It is human nature to focus on short-term benefits over long-term consequences. Progress toward sustainability is hampered by the tendency of governments and political and business leaders to take a short-term, rather than a much needed long-term, view of the relationship between people and the planet.
- *Costs in environmental matters are often very difficult to measure*. What is the price of clean air to breathe? Clean water to drink? How much are you willing to sacrifice for it?
- *Hard to put the blame on a specific person or organization*. In many respects, we all contribute to the environmental problems we see today. As such, knowing the price each of us should pay to reverse the damage is difficult to discern.
- *Collective action is necessary.* Everyone needs to change their ways in some respects to achieve a sustainable future for all. Cooperation across all fronts, regardless of culture, class, etc., needs to happen.

- *Out of sight, out of mind.* A growing number of dead zones in ocean waters is not something you can see. Neither is the loss of biodiversity in the Amazon. As such, critical environmental causes tend to be overlooked and/or ignored by most people.
- *People tend not to see past their own lives and livelihoods.* Everyone leads busy lives and has a plethora of personal issues to deal with. What is important to most people is what is happening here and now, not what could happen 50 years from now.
- *Change is too slow*. With many environmental issues, changes occur at such a slow rate relative to a human lifespan that they often seem negligible – that is, until a crisis is upon us and it may already be too late to act.
- *Different approaches.* For the majority of environmental issues, people can agree that there is indeed a problem at hand that needs to be addressed. However, there exist many differences in opinion regarding how to best handle the issues and as such, it can be difficult to reach a common solution that everyone will accept.

The students can, and should, draw on the key concepts and principles established by this point in the course to further develop their research topics and think critically about appropriate solutions. Some questions students can consider as they reach the environmental literacy ladder rung of taking action include:

- If we keep going like we are going, business-as-usual, what is the earth going to look like in 50 years? 100 years? 200 years? 500 years?
- Are current policies leading to a sustainable future or to collapse?
- How do you get people to collectively adopt more sustainable behaviors?
- Can the environmental problems which have emerged as a result of the dominant Western world view be adequately addressed within that world view, or is a paradigm shift required?
- Is technology enough, or is a cultural paradigm shift required to obtain a sustainable future?
- To what degree is technology the cause and cure of global environmental problems?
- Is the future described in William McDonough's "Cradle to Cradle" feasible?
- What can we do about environmental problems on an individual level? Community level? State level? National level? Global level?

- What factors make environmental problems so hard to deal with?
- What is biomimicry and could it unlock the door to a more sustainable future?
- What does it mean to “go green”?
- To what extent are environmental problems technological in nature? To what extent are they social problems? How does the answer translate into appropriate solutions?

THE APPROACH

There are specific modes of approach that can facilitate the achievement of environmental literacy, the most important of which center around student engagement and project work.

Engaging students with pertinent, thought-provoking problems is a key goal of all the Great Problems Seminars. If the students are genuinely interested in the course material, they will progress easily up the Environmental Literacy Ladder because the drive to do so will be internally-motivated. It is the instructor's responsibility to foster a classroom environment in which this is possible. The way in which course material is presented has a significant impact on the level of student engagement - if the instructor is enthusiastic about the course material and present it as such, it is much more likely that the students will be interested in the topics as well. An effective way in which to engage students is to relate the course information to their lives – essentially, to demonstrate the relevance of what they are learning in the classroom to their daily lives, both now and in the future. With respect to each course topic, the instructor should always think: Why should the students *care* about this? If the instructor can communicate the answer to that question to the students, they will succeed in engaging them in the course material. Out of this approach can come "attitudes of appreciation and concern for the environment."

Along similar lines, contextualizing the course material is an effective method of approach for engaging students. The instructor should avoid generalizing about the world's environmental problems as much as possible and instead, build the course around specific examples that the students can learn about and explore. These specific examples can take the form of the analysis of current events and case studies.

In addition, the number and variety of classroom activities also contributes to the overall level of student engagement. Interactive classroom activities that encourage student participation (e.g. class discussion, small group activities, etc.) promote student engagement. Furthermore, a diverse repertoire of classroom activities can also heighten the students' overall understanding of the course material and reach students more effectively, due to the inherent differences in the way they learn best. Activities such as in-class debates and role play exercises can also be a

valuable asset to the classroom experience. Not only will they demand active participation from the students, they will inevitably expose students to many points of view. Learning to approach environmental problems from many perspectives is both a necessary and important precursor to understanding them and investigating their potential solutions. Environmental issues are rarely cut and dry; they invoke a spectrum of opinions and perspectives that must be taken into consideration before any action is taken. With respect to the Environmental Literacy Ladder, this approach can enhance their "knowledge and understanding of human and natural systems and processes" and their "problem solving and critical thinking skills."

A course on the environment can (and should) include a significant data analysis component. Understanding tables, figures, and graphs, and extrapolating trends into the future are important skills for an environmentally literate citizen. The challenge that the instructor of this course faces is making the numbers and the data *real* for the students so that they can fully comprehend not only the nature of the quantities that they are dealing with, but also the meaning and implications behind the numbers. Why should the students actually *care* about these numbers? How do they impact the students' lives? What can be done to help them grasp the true significance of a population growth rate of 77 million people per year, an increase in atmospheric carbon dioxide to 385 parts per million, or a United States ecological footprint of 9.7 hectares per person? How can these numbers be portrayed in order to foster concern for the natural world and inspire action to protect it? If the students can grasp the significance of the data they are presented with, they can better acquire a "general awareness of the relationship between the environment and human life" by better understanding the impact humans have on the natural world as it manifests itself through the data.

It is also important for the instructor not to overwhelm the students with an onslaught of data and environmental problems. Instead, the instructor should be focused on empowering the students and motivating them to act as environmental stewards. This can be achieved by focusing on how the students, both as individuals and members of a community, can take steps to protect the environment and mediate some of the current environmental problems. Students will have the opportunity to act on environmental problems through the project work infused in the curriculum, whether it be the smaller group projects scattered throughout the course or the larger,

term-long project students will tackle during the second half of the course. They will also have the opportunity to collect and analyze their own data relevant to environmental problems. In this manner, the instructor can spark students' "capacity for personal and collective action and civic participation."

Keeping the project work at the heart of the curriculum, as the driving force of the entire course, is what distinguishes this class from any other environmental studies class. Any instructor can choose to incorporate engaging project work into a standard course, though such work will most likely be viewed as ancillary; the standard syllabus directing the progression of the course will continue to be driven by textbook readings, homework problems, and exams. In the spirit of the GPS program, *Save the World* will put the project work first. Organizing a course around a series of projects is a unique approach that will challenge students to think about the *application* of their knowledge to complex, real-world problems.

COURSE MATERIALS & ASSESSMENT

Course materials for *Save the World* will help reinforce the subject matter discussed in class and serve to further develop the students' critical thinking, written, and oral presentation skills. They should also relate to the environmental literacy ladder by doing at least one (or more) of the following: inspiring general awareness of the relationship between the environment and human life, contributing to students' knowledge and understanding of human and natural systems and processes, fostering attitudes of appreciation and concern for the environment, honing problem solving and critical thinking skills, and/or contributing to the students' capacity for personal and collective action and civic participation.

The three types of course materials outlined in this report are individual assignments, group projects, and case studies.

Individual Assignments

Individual assignments (see Appendix B on page 59) will especially help develop students' writing skills. The "EcoBlog" assignment, for example, will encourage students to think critically and write about any number of potential topics relevant to the course material. Each student can set up a free online blog which they can personalize with a creative title, style, and color scheme. This will give the students a sense of ownership of their work. This blog can be a course-long endeavor, with the professors assigning particular questions for students to consider as they arise in class. Figure 5 on page 37 provides a sample handout for this assignment.

EcoBlog

Over the course of this seminar, we will be investigating a number of topics of ecological concern, including the relationship society has with the environment, the evolution of pressing environmental issues, and factors to consider when thinking critically about these problems, just to name a few. You will come face to face with many complex, thought-provoking questions along the way. Through this assignment, you will reflect on some of these questions and develop your opinions on a number of issues, as well as investigate your personal connection with the environment and how you impact it.

Throughout the term, questions will be posted on myWPI under the "EcoBlog" section. They will be related to the topics we are covering in class at the time. The amount you write will be up to you, though note that you will be graded on the thoughtfulness of your responses and your ability to fully address the question at hand. Although this is type of writing is informal in nature, it is expected that you use proper grammar, spelling, and punctuation.

Here's what you need to do:

1.) Go to https://www.blogger.com/start to set up your blog.
2.) Come up with a title ("EcoBlog" is acceptable, but I encourage you to be creative and think of your own title!).
3.) Email the blog URL to me at _____.wpi.edu.

I will post the links to each of your blogs on myWPI under the "EcoBlog" section. I encourage you to read each other's writing and leave thoughtful comments and questions!

Remember to date and give a title to each entry of the blog. Feel free to be creative with this assignment! Pictures are certainly welcome to supplement your entries.

Figure 5. The "EcoBlog" Assignment Sheet

The questions the professors may assign for this blog can take many forms. For example, they can lead to reflective, opinionated, creative or descriptive responses. Below are examples of each kind of question.

Reflective

1.) What is an "environmentalist"? Do you consider yourself to be one? Why or why not?
2.) Read the poem "If the earth were a few feet in diameter" by Joe Miller (see Appendix F on for the poem – page 89). Do you think this poem has a valid point? Explain.
3.) Name three ways you can minimize your personal carbon footprint. Will it be difficult for you to commit to these things over the long-term? Explain.

Opinionated

1.) What do you think are the five most important issues facing the environment today? Why?
2.) Do you think every "overpopulated" country should adopt a one-child policy?
3.) Do we have a moral obligation to protect the earth for future generations?

Creative

1.) Choose a global environmental issue. Then look at relevant data and extrapolate it into the future. Based on this data, and whether or not you think action will be taken to deal with this issue, describe the severity of this issue (if you think it still exists) 50 years into the future.
2.) Consider yourself now an advisor to the U.S. government. What policy changes would you make, if any, regarding greenhouse gas emission regulations?
3.) Go outside and sit in nature for 15 minutes in an area with minimal student traffic. Write a poem about the experience.

Descriptive

1.) Describe a local environmental problem in Worcester and what is being done about it (if anything).
2.) Describe one way in which WPI can feasibly become more "environmentally-friendly." Devise an action-plan to implement this idea.
3.) Find today's newspaper. Identify an article written about an environmental issue. Give a summary of the issue and describe your thoughts on it.

With this assignment, students should be able to see how their ideas are shaped by the course. The instructors could choose to assign some of the same questions as they did toward the beginning of the course at the end of the course to see if students' opinions have been influenced by the course (e.g. "What do you think are the top five most pressing environmental issues?"). The online nature of this assignment and ability to archive posts will also allow students to refer back to their writing and see their progress as a writer and thinker. The nature of these blogs will not only allow students to read each others' entries, it will also allow them to comment on them. Overall, there is an incredible amount of flexibility with this assignment; professors can have pre-made questions ready to post, or if an interesting debate or issue arises in class, the professors can easily assign a related question for the students to consider further. This flexibility in the types of questions that can be asked also allows for the incorporation of questions that touch on each rung of the environmental literacy ladder. Furthermore, the informal nature of this writing will also allow students to more easily put their thoughts on paper, as they will be uninhibited by the daunting task of writing a longer, more structured academic essay for this particular assignment.

One aspect of the assignment not included in the assignment sheet is how often the entries will be graded, and how long the students will have to write a given entry after the question is posted (this will be left up to the instructors). A possible system to adopt would be to randomly select entries to grade at the end of the term to minimize the work load of evaluating all of the entries, while still encouraging the students to write every entry to the best of their ability.

Group Projects

The smaller group projects assigned throughout the term will help students learn more about team dynamics, which is key in WPI's project-based curriculum (and good preparation for life after graduation). Refer to Appendix C on page 69 for sample group project assignments. These group projects can be a great tool for encouraging students to think about solutions to environmental problems; essentially, to reach the highest rung of the environmental literacy ladder – capacity for personal and collective action and civic participation to create a positive impact on the quality of the environment.

For example, the “Think Globally, Act Locally” project will encourage students to research ways in which individuals can change their daily habits that could, in turn, help preserve the integrity of the environment. Knowing about these possible solutions is not enough; convincing the masses to adopt them is what counts. The crux of the project, therefore, is the development of an effective ad campaign to encourage others to change their current behavior and adopt a more environmentally-friendly behavior (e.g. carpooling, composting, recycling, etc.). See Figure 6 on page 41for a sample handout for this assignment.

Think Globally, Act Locally

Achieving a more sustainable future begins with individuals acting at the local level. Many small efforts from individuals can add up in a very big way. One challenge environmentalists face is convincing others to adopt more environmentally-friendly behaviors. This assignment will get you thinking about how to motivate people to take action or modify their current behaviors.

Your task is to develop an effective campaign to promote a sustainable behavior (carpooling, composting, recycling, etc.)

You may want to consider the following information, excerpted from the book *Fostering Sustainable Behavior*, by Doug McKenzie-Mohr and William Smith:

- Campaigns that rely solely on providing information often have little or no effect upon behavior.
- All persuasion begins with capturing attention. Without attention, persuasion is impossible.
- Threatening or fear arousing message need to be combined with clear suggestions regarding what people can do to reduce the threat.
- Messages which emphasize losses that occur as a result of inaction are consistently more persuasive than are messages that emphasize savings as a result of taking action.
- Threatening messages are a necessary part of directing people's attention to crises. However, they are likely to be counter-productive if they are not coupled with messages that are empowering.

When working on this project, you should think about the following:

- Who is your audience?
- What message are you trying to get across?
- What tone should you use?
- Should you have a slogan?
- What benefits can someone incur from adopting this behavior?
- How do you make your message credible?
- Is information enough?

What the end-product will look like is up to you. (Possible ideas include an infomercial, a brochure, a letter to be sent to members of a community, a website, etc.) You will be graded on this end-product and on a 5 minute presentation you will give to the class.

Reference:

McKenzie-Mohr, Doug and William Smith. Fostering Sustainable Behavior. Gabriola Island: New Society Publishers, 1999.

Figure 6. The "Think Globally, Act Locally" Assignment Sheet

The instructors may choose to request that the students actually implement the ad-campaign on the WPI campus or in the local Worcester community and to assess whether it actually made a difference.

Case Studies

The analysis of case studies in this course will give the students exposure to real-world, complex problems, provide information on the kinds of environmental crises nations are facing around the world, and offer the opportunity to see a multi-faceted issue from multiple perspectives. These case studies will not only include the appropriate background, problem, and questions to consider (see Appendix D on page 74 for examples), but instructors should also provide relevant background reading (articles, excerpts from texts, etc.) that discuss the situation from various points of view.

One example of a case study for *Save the World* is "China: Polluting its Way to Prosperity?" This case study investigates the complicated relationship between a need for economic growth and the resultant air pollution that inevitably follows. To what extent should China continue to sacrifice the health of its citizens in the name of economic growth and financial gain? How does one go about approaching such a complex issue? What are the important questions to consider? What are the existing perspectives on this issue, and which do you think contains the most merit? What is the U.S.'s role, if any, in this situation? These types of questions will help develop the students' critical thinking skills while simultaneously giving them exposure to the environmental problems facing the world today. As a result, case studies can be a powerful educational tool for use in this type of course. See Figure 7 on pages 43 and 44 for a sample assignment sheet for this particular case study.

China: Polluting its Way to Prosperity?

Coal is indeed China's double-edged sword – the new economy's black gold and the fragile environment's dark cloud.[1]

Background

The Chinese government is struggling to find an appropriate balance between the need for economic growth on the one hand and the need for a reasonable level of air quality of the other. Having economic growth and clean air to breathe are both desirable outcomes, though for China, achieving the two at the same time is a seemingly difficult task. As such, priorities need to be set, and tough decisions need to be made.

China boasts the fastest economic growth rate in the world – approximately 10% per year (compared to the 2 - 3% growth rate typical of First World countries). As a result, no country has succeeded in alleviating poverty at such a rapid rate as modern China. For raising hundreds of millions of people out of poverty in 20 years, the World Bank has proclaimed China as a "poverty reduction model" for the rest of the world. This is good news for the one-fifth of the world's population that call China home. However, the profitable industries that are responsible for creating jobs, raising the average standard of living for millions of Chinese, an pulling countless out of poverty are fueled primarily by coal, and thus, generate greenhouse gas emissions.

Air pollution in China poses a threat to both the natural environment and human health. According to the World Health Organization's report on air quality in cities worldwide, seven of the 10 most polluted cities are located in China. China's factories emit pollutants such as carbon dioxide, sulfur dioxide, and particulate matter into the air. China used 2.1 billion tons of coal in 2004 – more than what the U.S., the European Union, and Japan used combined. The current level of air pollution in China is six times greater than the level deemed safe to breathe by the World Health Organization. Incidents of cancer and respiratory illness are rising among the Chinese in tandem with its booming economy, and a World Bank study indicates that air pollution is causing 350,000 – 400,000 premature deaths per year.

Although the Chinese government has taken steps to improve air quality, they are hesitant to impose stringent environmental regulations. They do not want to compromise the increased standard of living for their citizens. After all, why shouldn't China continue to take broad strides toward First World living standards? Didn't the U.S. struggle through its own industrial revolution to eventually emerge as the prosperous nation it is today?

It is important to note that China's air pollution does not end at the county's borders; on the contrary, its effects are felt worldwide. Far from the industrial factories and coal-powered energy plants from which it came, filthy air is carried by the wind around the globe, making its way into the lungs of many

[1] Keith Bradsher and David Barboza. "Pollution from Chinese Coal Casts a Global Shadow." *The New York Times*. 11 June 2006. <http://www.nytimes.com/2006/06/11/business/worldbusiness/11chinacoal.html>.

and is responsible for acid rain in other countries. Clearly, China's air pollution has transcended the realm of local problems and has emerged as a global issue.

Questions for Consideration

1.) To what extent do you agree with the following statement: "Sacrificing air quality for the sake of economic growth, and thus increase in per capita income, is justified." Please explain your position with specific examples pertaining to China's situation.
2.) If you were an advisor to the Chinese government, what policy changes, if any, would you recommend regarding air quality control and why?
3.) What role, if any, should the U.S. play (the government and/or U.S. citizens) in trying to reduce the level of air pollution in China? Does the U.S. have an obligation to intervene in this situation? Is it appropriate for the U.S. to intervene in this situation? Please explain.
4.) How is China's progress measured? Consider whether environmental costs are taken into account, and decide whether or not they should be factored into such a discussion. In what ways could changing the current definition of "progress" impact China's future policies with respect to air pollution?

Related Topics by Discipline

Engineering

- State-of-the-art technologies used to remediate or limit air pollution and whether or not China does (or should) use them.
- Investigation of alternative energy options for China (as opposed to coal).

Social Science

- Tradeoff between economic growth and environmental protection.
- Examination of China's current policies with respect to air quality regulation and whether or not they are sufficient.

Natural Sciences

- Health effects of air pollutants and how they contribute to disease.
- How air pollution is spread around the globe.
- Acid rain: causes and effects.

Humanities

- The history of countries that experienced an industrial revolution and where they are today.
- Defining "quality of life" – how do health effects factor in (e.g. those caused by poor air quality)? Should only economic gain be considered? Is only economic gain considered?

Figure 7. The "China: Polluting its Way to Prosperity?" Sample Case Study (continued from page 43)

The “Questions to Consider” can be topics of class discussion or the instructor may choose to assign one or more of them as writing assignments. The “Related Topics by Discipline” section provides more issues for consideration, reflecting the interdisciplinary nature of the problem at hand.

FUTURE CONSIDERATIONS

The purpose of this report is to lay the foundation for a new GPS with an environmental focus and to provide starting materials and resources for the faculty who may choose to teach this course. However, outside of the scope of this report, there are many questions to consider for further discussion relevant to the Great Problems Seminars in general, this specific GPS on environmental issues, and the expansion of environmental education at WPI. Below are recommendations of related topics that could be investigated further.

Great Problems Seminars

- Should a first-year project experience be a graduation requirement for all WPI undergraduates?
- What kind of academic credit should the students receive?
- Are there other ways to fulfill a first-year project experience other than the GPS model?
- To what extent is the degree of overlap between GPS courses acceptable?
- How can there be more cooperation and collaboration between GPS courses and GPS faculty?
- Would it be feasible and/or desirable for students from different GPS courses to work together on the final term-long project on a topic common to both seminars?

GPS with an Environmental Focus

- How can this GPS be structured so that it is sufficiently distinct from WPI's existing environmental studies courses?
- Due to the breadth and diversity of environmental issues, would it be beneficial to have several separate GPS courses focused on different types of environmental problems?

Environmental Education at WPI

- Should a course on environmental issues be a general education requirement for all WPI undergraduates?
- Should WPI have an "environmental literacy" general education requirement, as several other colleges do?[43]

[43] For more information on this topic, read "Environmental Literacy and Sustainability as Core Requirements: Success Stores and Models," by Debra Rowe (in Teaching Sustainability at Universities; 2002).

CONCLUSION

WPI's dual focus on environmentally sustainable practices and introducing project work into the first year experience support the creation of an environmentally-related Great Problems Seminar. WPI possesses the resources and faculty expertise to make this GPS a reality. Such a GPS has the potential to jump start future WPI graduates' involvement with environmental endeavors. With engaging course topics and a growing interest in environmentally-friendly practices among communities world-wide, *Save the World* will be a valuable addition to the GPS program.

The highly interdisciplinary nature of the subject matter provides for a great deal of flexibility on the spin the course can have. Emphasis on particular disciplinary approaches to the environmental issues discussed in *Save the World* will vary from year to year depending on the expertise the professors are bringing to the course. Though the disciplinary approaches can easily vary from year to year, the core of the course will remain the same – the instructors will need to challenge the students to think critically about how we, as individuals and as a society, can make better decisions in the face of uncertainty to preserve the integrity of the global environment with the ultimate goal of ensuring the quality of life for all living things both now and in the future.

The guiding question for this GPS – *does the world need to be saved* – will direct the course's content. Answering this question and its corollary question – *if so, how* – demands the study of the nature and scale of environmental problems, an investigation of their potential solutions, and consideration of the economic, social, political, and ethical factors inextricably linked to them. Through the process of answering these questions, students will become environmentally-literate. They will, ideally, reach every rung of the Environmental Literacy Ladder, and in doing so, will acquire a general awareness of the relationship between the environment and human life, a core knowledge and understanding of human and natural systems and processes, attitudes of appreciation and concern for the environment, problem solving and critical thinking skills, and perhaps most importantly, an ability for personal and collective action and civic participation.

The project-based approach that this course will take is what separates this class from traditional courses. An emphasis on real-world problems leads to this central focus on project work –

projects that will focus on the critical analysis of these problems and of their potential solutions. As such, the project work will be the driving force behind the class, unlike traditional courses that focus predominantly on textbook-based, disciplinary content goals. This approach will help engage the students in the study of environmental issues and empower them to help solve some of these problems, both during the course and after it is completed.

Future *Save the World* instructors can use this report as a foundation upon which to build this course, drawing on the fundamental ideas of environmental literacy as outlined in this document and using the sample course materials as a starting point for the development of writing assignments, projects, and case studies.

"Saving the World" in the environmental sense arguably begins and ends with education. As David Orr asserted:

> The [environmental] crisis we face is first and foremost a crisis of mind, perception, and values – hence, a challenge to those institutions presuming to shape minds, perceptions, and values. It is an educational challenge…The generation now being educated will have to do what we, the present generation, have been unable or unwilling to do: stabilize a world population that is growing at the rate of a quarter of a million each day; stabilize and then reduce the emission of greenhouse gases, which threaten to change the climate – perhaps disastrously; protect biological diversity, no declining at an estimated rate of one hundred species per day; reverse the destruction of rainforests (both tropical and temperate), now being lost at the rate of one hundred and sixteen square miles or more each day; and conserve soils, now being eroded at the rate of sixty-five million tons per day. Those who follow us must learn how to use energy and materials with great efficiency. They must learn how to utilize solar energy in all its forms. They must rebuild the economy in order to eliminate waste and pollution. They must learn how to manage renewable resources for the long term. They must begin the great work of repairing, as much as possible, the damage done to the earth in the past two hundred years of industrialization. No generation has ever faced a more daunting agenda.[44]

The path to a sustainable future, as Orr clearly illustrates, will not be an easy one to navigate. The road ahead is long; the future, uncertain. As the Chinese philosopher Confucius said, "A journey of one thousand miles begins with a single step." This GPS will equip WPI first year

[44] James L. Elder. *A Field Guide to Environmental Literacy: Making Strategic Investments in Environmental Education*. (Rock Spring: Environmental Education Coalition, 2003), 6.

students with the knowledge and skills to traverse such a path and hopefully inspire them to start walking.

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APPENDICES

Appendix A: Course Catalog Description
This appendix provides a description of *Save the World* as it could appear in the WPI course catalog or on the web.

Appendix B: Individual Assignments
This appendix provides the sample assignment sheets for possible *Save the World* individual assignments ("EcoBlog," "Where is 'Away'?", "Sizing Up our Ecological Footprint," "A Trashy Assignment, Part 1," "A Trashy Assignment, Part 2," "Environmental Autobiography," "Nature and the Humanities," and "In the Year 2525…").

Appendix C: Group Projects
This appendix provides the sample assignment sheets for possible *Save the World* group projects ("Think Globally, Act Locally," "Sizing Up WPI's Ecological Footprint," "Moving Toward a Greener WPI," and "Environmental Disasters").

Appendix D: Case Studies
This appendix provides the sample handouts for two possible *Save the World* case studies ("China: Polluting its Way to Prosperity?" and "Food vs. Forest: A Brazilian Dilemma").

Appendix E: Possible Course Books
This appendix provides a listing of four possible books to use as required texts for *Save the World*. Each book has a different disciplinary focus (engineering, social science, natural sciences, and humanities).

Appendix F: Further Reading & Inspiration
This appendix provides three readings: the 1992 *World Scientists' Warning to Humanity*, *The Earth Charter*, and a poem entitled "If the Earth were only a few feet in diameter…".

Appendix A: Course Catalog Description

Save the World is a two-term course focused on the nature and scale of environmental problems and their potential solutions, both at the local and global levels. This course will utilize an interdisciplinary approach, as environmental problems are best understood through the perspectives of many academic disciplines. Environmental issues will be investigated through a variety of means, including lectures, guest speakers, assigned readings, videos, in-class debates, class discussion, case studies, writing assignments, and group projects. The course will culminate in a term-long research project conducted in teams of 3 to 4 students in which you will analyze an environmental problem of interest and design a feasible approach to address it. Like other Great Problems Seminar courses, this course will emphasize the development of teamwork, research, writing, and presentation skills.

Appendix B: Individual Assignments

EcoBlog

Over the course of this seminar, we will be investigating a number of topics of ecological concern, including the relationship society has with the environment, the evolution of pressing environmental issues, and factors to consider when thinking critically about these problems, just to name a few. You will come face to face with many complex, thought-provoking questions along the way. Through this assignment, you will reflect on some of these questions and develop your opinions on a number of issues, as well as investigate your personal connection with the environment and how you impact it.

Throughout the term, questions will be posted on myWPI under the "EcoBlog" section. They will be related to the topics we are covering in class at the time. The amount you write will be up to you, though note that you will be graded on the thoughtfulness of your responses and your ability to fully address the question at hand. Although this is type of writing is informal in nature, it is expected that you use proper grammar, spelling, and punctuation.

Here's what you need to do:

1.) Go to https://www.blogger.com/start to set up your blog.
2.) Come up with a title ("EcoBlog" is acceptable, but I encourage you to be creative and think of your own title!).
3.) Email the blog URL to me at _____.wpi.edu.

I will post the links to each of your blogs on myWPI under the "EcoBlog" section. I encourage you to read each other's writing and leave thoughtful comments and questions!

Remember to date and give a title to each entry of the blog. Feel free to be creative with this assignment! Pictures are certainly welcome to supplement your entries.

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For the Professors

This blog will be a good way to get the students thinking about any number of issues that may come up in class. The questions/assignments can take many forms. For example, they can lead to reflective, opinionated, creative, or descriptive responses.

Reflective

1.) What is an "environmentalist"? Do you consider yourself to be one? Why or why not?
2.) Read the poem "If the earth were a few feet in diameter" by Joe Miller. Do you think this poem has a valid point? Explain.
3.) Name three ways you can minimize your personal carbon footprint. Will it be difficult for you to commit to these things over the long-term? Explain.

Opinionated

1.) What do you think are the five most important issues facing the environment today? Why?
2.) Do you think every "overpopulated" country should adopt a one-child policy?
3.) Do we have a moral obligation to protect the earth for future generations?

Creative

1.) Choose a global environmental issue. Then look at relevant data and extrapolate it into the future. Based on this data, and whether or not you think action will be taken to deal with this issue, describe the severity of this issue 50 years into the future.
2.) Go outside and sit for 15 minutes in area with minimal student traffic. Write a poem about the experience. (Think about the senses – What did you see? What did you hear? Etc.)
3.) Pretend you are an advisor to the U.S. government. What policy changes would you make, if any, regarding greenhouse gas emissions regulations?

Descriptive

1.) Describe a local environmental problem in Worcester and what is being done about it (if anything).
2.) Describe one way in which WPI can feasibly become more "environmentally-friendly." Devise an action-plan to implement this idea.
3.) Find today's newspaper. Identify an article written about an environmental issue. Give a summary of the issue and describe your thoughts on it.

If interesting questions come up during class discussion, it may be a good idea to post a blog assignment related to that. It may also be a good idea to encourage students to read each others' blogs and comment on them.

Something that was not included in the assignment sheet (but should be) is how often the entries will be graded, and how long the students will have to write a given entry after the question is posted. Perhaps a good system will be to randomly select entries to grade at the end of the term to minimize the work load of evaluating all of the entries, but yet still encouraging the students to write every entry to the best of their ability.

Where is "Away"?

"Throw it away" is a common phrase in the English language. Do you ever stop to think about where "away" is? This assignment is going to challenge you to figure that out for yourself.

Your task is to investigate the following: when you throw an item away at home or recycle an item at home, where does it eventually end up? Choose two items (one non-recycled and one recycled item) and research that question. You may have to make some phone calls.

Your final report should include answers to the following questions:

1.) What non-recycled item did you choose? Describe the path it took to get to its final destination. Create a schematic depicting that path. Was this path ideal from an environmental point of view? Can you suggest a more environmentally-friendly path for this object?
2.) What recycled item did you choose? Describe the path it took to get to its final destination. Create a schematic depicting that path. Was this path ideal from an environmental point of view? Can you suggest a more environmentally-friendly path for this object?

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Sizing Up Your Ecological Footprint

In an effort to quantify the impact an individual, community, or country has on the environment, the concept of an "ecological footprint" was developed. The term was first coined in 1992 by Mathis Wackernegal, PhD, author of "*Our Ecological Footprint: Reducing Human Impact on the Earth.*"

Your ecological footprint is a measure of how much land area is required to support your consumption and assimilate your waste. Based on current methods of ecological footprint calculations, humanity is currently in overshoot, or in other words, using up the earth's resources faster than they can be regenerated. By some estimates, if everyone lived like the average American, we would need approximately 5-7 earths to support that kind of lifestyle. Despite the exact number of earths needed, the conclusion from these types of calculations remains the same – overall, we are not living sustainably. ("Sustainability" is defined as meeting the needs of the present without compromising the ability of future generations to meet their own needs.[1] Or as one WPI professor said, "Party so that future generations can party too.")

There are a number of "ecological footprint calculators" online. You will be using two of them to determine your personal ecological footprint.

The two websites you will be using are the following:

1.) http://www.footprintnetwork.org/en/index.php/GFN/page/personal_footprint
    - You'll have a choice between entering "basic information" and entering "detailed information." Enter as much detailed information as you can.
2.) http://www.myfootprint.org/
    - When you go through this site, be sure to click on the orange text to get more information on a particular topic.

Answer the online questions as best as you can. Write down the answers you put for each question because you will need to know that information to answer one of the questions.

You will hand in a paper with answers to the following questions:

1.) Report your ecological footprint from both websites in terms of the area of land and in terms of the number of earths that would be required to sustain your type of lifestyle if everyone on earth lived the way you do. How does your footprint compare to that of the average American?
2.) How close were the two ecological footprint estimates to each other? Which calculator do you think is more accurate, and why?
3.) Based on your lifestyle, chances are that not everyone in the world could feasibly live like you do. What kinds of social equity issues does this bring up?

[1] As defined during by the Brundtland Commission in 1987.

4.) Name three ways you can realistically reduce your ecological footprint. Be specific. Will making these changes to your habits be difficult for you? Is this something you think you can sustain for the rest of your life? Run through both calculators again only making those three changes and report how much your footprint is reduced by making those changes to your lifestyle.

5.) These calculators are not going to be perfectly accurate because they cannot possibly take into account everything and you probably needed to estimate the answers to several of the questions. However, what are the benefits of carrying out an exercise like this one anyway? Is there anything that can still be learned or gained from it? Explain.

A Trashy Assignment, Part 1

Imagine trying to live a life in which you personally dealt with every piece of waste you generated, instead of tossing it in a garbage can to become someone else's problem. In an effort to do just that for a year, "Sustainable Dave" has embraced such a challenge. Read the December 31, 2007 entry of his blog, "365 Days of Trash": http://365daysoftrash.blogspot.com/2007/12/365-days-of-trash.html.

Though you will not have to keep all the trash you generate in your dorm room for this assignment, you will need to keep a written log of it, just like Dave does. For the next week, take note of what you throw away, and keep track of the items under the headings "garbage" and "recycle," depending on if you disposed of the item in a trash can or in a recycling bin. Do not make any changes to your normal behavior for this assignment. I suggest keeping a little notepad and pen on you wherever you go so you can jot down whatever trash you generate at the time, instead of trying to remember what you threw out later on.

A Trashy Assignment, Part 2

This week, continue to record the amount of waste you generate, except make every effort to reduce it by at least 50% (compared to the previous week). At the end of the week, write a report comparing your behaviors during both weeks of this assignment, addressing the following questions:

1.) By how much (in the form of a percent) were you able to reduce your waste?
2.) In what ways did you adjust your behaviors to reduce the amount of trash you generated during Week 2? What sacrifices did you have to make, if any, to meet the goal of a 50% reduction?
3.) What did you find difficult about this assignment?
4.) Most people don't stop to think about how much waste they generate on a day-to-day basis. How much of a role does awareness play in inspiring more sustainable behaviors? Does this apply to other issues of environmental concern? Explain.

Be sure to attach to your report your record of what you threw away for the past two weeks.

Environmental Autobiography

We are all shaped by our environment – where we grew up and the people who are around us. This assignment focuses on the effect the natural world had on creating the person you are today.

An environmental autobiography is an autobiography with an emphasis on the natural environment. You are to describe, in first person, the effects of early experiences of landscape and environment on your identity today and how those experiences relate to your currently held feelings and values toward the environment. How has a particular (outdoor) place shaped who you are today – your biases, your career ambitions, your likes and dislikes…? What kinds of emotions (positive or negative) does this place trigger for you? How has it shaped your present relationship with the natural world and thoughts toward it? In your essay, be sure to describe the place thoroughly – the sights, smells, sounds, etc., and clearly articulate how this place has influenced you. Is there a particular event that occurred in this place? Multiple events? A particular person or people you associate this place with? Did you learn something significant there?

Take some time to reflect back on your past experiences in nature and have fun with this assignment. Your essay should be 3-5 pages long.

Nature and the Humanities

The natural world has long fascinated humans. This fascination has been reflected in all genres of the humanities – from art to literature to poetry to music.

You have two options for this assignment. Choose ONE of the following options:

1.) Choose three different genres of the humanities, find a specific example of each, and discuss in a 3-5 page essay how nature is portrayed in it. In what light is nature portrayed? What does it say about the relationship between humanity and nature? What emotions are conveyed? What is the prevailing message? How does the specific humanities genre aid in generating these emotions and communicating this message? These are all questions you should consider. Discuss which genre has the largest effect on you – emotionally and intellectually – and why.

2.) Choose three different genres of the humanities and find a specific example of each that share the same overall theme that in some way, has to do with the natural environment. Examples of such themes include "humankind should be dominant over nature" or "the natural world is often taken for granted" or "children appreciate nature more than adults do." Compare and contrast in a 3-5 page paper how the same theme is communicated through the three different genres. What specific techniques are used? In your opinion, is any one genre more effective in terms of relaying the message more than the other two? Be sure to explain your reasoning clearly and concisely.

Please attach the text or an image of each specific example to the end of your report, in the order in which you discuss them.

In the Year 2525…

What will the world look like in 2525? Write a 3-5 page paper developing this vision. Extrapolate the global trends we have been studying in class to address this question and reference them in your paper when possible. Is this a world you would like to live in? This can be a creative piece or an academic essay; the genre is up to you – you could choose to write it as an extended poem, a science fiction story, a letter, etc. Be sure to use sensory details to make the piece come alive.

Through this exercise, you should become more aware of how today's decisions affect tomorrow's world and how changes in our way of life in this day and age can shape the future of the environment that our descendents will ultimately inhabit. Do we have a moral obligation to future generations to ensure the existence an environmentally-sound world?

Appendix C: Group Projects

Think Globally, Act Locally

Achieving a more sustainable future begins with individuals acting at the local level. Many small efforts from individuals can add up in a very big way. One challenge environmentalists face is convincing others to adopt more environmentally-friendly behaviors. This assignment will get you thinking about how to motivate people to take action or modify their current behaviors.

Your task is to develop an effective campaign to promote a sustainable behavior (carpooling, composting, recycling, etc.)

You may want to consider the following information, excerpted from the book *Fostering Sustainable Behavior*, by Doug McKenzie-Mohr and William Smith:

- Campaigns that rely solely on providing information often have little or no effect upon behavior.
- All persuasion begins with capturing attention. Without attention, persuasion is impossible.
- Threatening or fear arousing message need to be combined with clear suggestions regarding what people can do to reduce the threat.
- Messages which emphasize losses that occur as a result of inaction are consistently more persuasive than are messages that emphasize savings as a result of taking action.
- Threatening messages are a necessary part of directing people's attention to crises. However, they are likely to be counter-productive if they are not coupled with messages that are empowering.

When working on this project, you should think about the following:

- Who is your audience?
- What message are you trying to get across?
- What tone should you use?
- Should you have a slogan?
- What benefits can someone incur from adopting this behavior?
- How do you make your message credible?
- Is information enough?

What the end-product will look like is up to you. (Possible ideas include an infomercial, a brochure, a letter to be sent to members of a community, a website, etc.) You will be graded on this end-product and on a 5 minute presentation you will give to the class.

Reference:

McKenzie-Mohr, Doug and William Smith. Fostering Sustainable Behavior. Gabriola Island: New Society Publishers, 1999.

Sizing up WPI's Ecological Footprint

Now that you've quantified your personal ecological footprint, you will now investigate the ecological footprint of either a freshman residence hall or a group of WPI faculty. Each group will be assigned to a different "population."

Here are the populations you will choose from:

- Natural Sciences faculty
- Engineering faculty
- Social Sciences faculty
- Humanities faculty
- Morgan Hall
- Daniels Hall
- Riley Hall
- Stoddard A
- Stoddard B
- Stoddard C
- Institute Hall

You will be using the footprint calculator found at http://www.myfootprint.org. You will need to interview members of your population to collect this data. Try to select your sample as randomly as possible. Aim for at least 10% of your population, and a minimum 15 people. You should create a Word document with the footprint calculator questions and list of possible choices for answers, and an Excel spreadsheet where you will keep all of the data. You will need to report the following:

1.) The total number of people in your population.
2.) The number of people you surveyed.
3.) The percentage of the population that you surveyed.
4.) The responses to each question for each person.
5.) The ecological footprint (in hectares) for each person.
6.) The number of earths required to sustain each person's lifestyle.
7.) The averages and totals of the responses to each question.
8.) The ecological footprint (in hectares) for the average person in your population.
9.) The number of earths needed to sustain the lifestyle of the average person in your population.
10.) The estimated total footprint (in hectares) of your population.

For the written portion of this assignment, I would like you discuss in 2-3 pages the lifestyle of the average person in your population. How does the average person in your population compare to the average American in terms of their ecological footprints?

For the Professors: Follow-Up Assignments

Compare the average footprint per person of all of the faculty vs. all of the freshmen.

Have the groups analyze each other's data – each group can be assigned two different populations that differed significantly in their average ecological footprints per person and they can analyze the data spreadsheets to discover why that is the case. Then they can write up an analysis of why one population has a bigger footprint than the other, describing the majors areas in which the lifestyles of one population differ significantly from another (this will probably work best between one faculty population and one freshman population).

Bonus assignment: Have a group write a *Towers* article summarizing their findings.

Sample Excel Spreadsheet Setup for this Assignment:

	Question 1	Question 2	Question 3	Footprint (hectares)	# of earths
Person 1					
Person 2					
Person 3					
Average					
Total					
Total for the population					

# of people in population	# of people surveyed	% of population surveyed

Moving Toward a Greener WPI

Congratulations! WPI has just hired you and your team as environmental consultants. You will be assigned to a particular building on campus and will be responsible for analyzing the environmental impacts of the activities in that building and determining ways to make that building more environmentally-friendly in a cost-effective manner.

It will be expected that you compile your analysis and recommendations in a memo addressed to the President's Task Force on Sustainability. In your report, be sure to detail a plan of action to implement your recommendations and also include a cost-benefit analysis that quantifies the potential economic and environmental benefits that would result.

To receive extra credit on this assignment, your team should discuss your recommendations with the person(s) responsible for implementing such changes and work towards actually putting those recommendations into practice.

Environmental Disasters

One need not look far to find examples of human-induced environmental disasters that have caused devastation around the globe. In your group, you will investigate one of these disasters and educate the class on the context, causes, environmental impacts, the aftermath, and implications of such an event.

Below is a partial listing of environmental disasters that you could choose from:

- Love Canal
- Dust Bowl (1930s)
- Meuse Valley Fog in Belgium (1930)
- Donora Disaster (1948)
- London "pea-souper" (1952)
- Mercury Poisoning in Japan (1956)
- The Torrey Canyon Oil Spill (1967)
- Cuyahoga River in Cleveland, Ohio (1969)
- Santa Barbara Oil Spill (1969)
- The Amoco Cadiz Oil Spill (1978)
- Three-Mile Island (1979)
- Times Beach in Missouri (1983)
- Chernobyl (1986)
- Exxon Valdez Oil Spill in Prince William Sound, Alaska (1989)

For this assignment, you are a news reporter. Research, analyze, and talk about issue, also touching on the ethics surrounding it. Could it have been prevented? What should have been done differently? What can be learned from this event?

You will be handing in a newspaper article (3-5 pages). A picture or two is welcome to supplement your article, just as if it were to be published in a real newspaper. You may also include quotes from people involved with the incident (real or made-up) to illustrate more clearly the human effects of the disaster.

You will also present your findings to the class with a 5 minute PowerPoint presentation.

Appendix D: Case Studies

China: Polluting its Way to Prosperity?

Coal is indeed China's double-edged sword – the new economy's black gold and the fragile environment's dark cloud.[1]

Background

The Chinese government is struggling to find an appropriate balance between the need for economic growth on the one hand and the need for a reasonable level of air quality of the other. Having economic growth and clean air to breathe are both desirable outcomes, though for China, achieving the two at the same time is a seemingly difficult task. As such, priorities need to be set, and tough decisions need to be made.

China boasts the fastest economic growth rate in the world – approximately 10% per year (compared to the 2 - 3% growth rate typical of First World countries). As a result, no country has succeeded in alleviating poverty at such a rapid rate as modern China. For raising hundreds of millions of people out of poverty in 20 years, the World Bank has proclaimed China as a "poverty reduction model" for the rest of the world. This is good news for the one-fifth of the world's population that call China home. However, the profitable industries that are responsible for creating jobs, raising the average standard of living for millions of Chinese, an pulling countless out of poverty are fueled primarily by coal, and thus, generate greenhouse gas emissions.

Air pollution in China poses a threat to both the natural environment and human health. According to the World Health Organization's report on air quality in cities worldwide, seven of the 10 most polluted cities are located in China. China's factories emit pollutants such as carbon dioxide, sulfur dioxide, and particulate matter into the air. China used 2.1 billion tons of coal in 2004 – more than what the U.S., the European Union, and Japan used combined. The current level of air pollution in China is six times greater than the level deemed safe to breathe by the World Health Organization. Incidents of cancer and respiratory illness are rising among the Chinese in tandem with its booming economy, and a World Bank study indicates that air pollution is causing 350,000 – 400,000 premature deaths per year.

Although the Chinese government has taken steps to improve air quality, they are hesitant to impose stringent environmental regulations. They do not want to compromise the increased standard of living for their citizens. After all, why shouldn't China continue to take broad strides toward First World living standards? Didn't the U.S. struggle through its own industrial revolution to eventually emerge as the prosperous nation it is today?

It is important to note that China's air pollution does not end at the county's borders; on the contrary, its effects are felt worldwide. Far from the industrial factories and coal-powered energy plants from which it came, filthy air is carried by the wind around the globe, making its way into the lungs of many

[1] Keith Bradsher and David Barboza. "Pollution from Chinese Coal Casts a Global Shadow." *The New York Times*. 11 June 2006. <http://www.nytimes.com/2006/06/11/business/worldbusiness/11chinacoal.html>.

and is responsible for acid rain in other countries. Clearly, China's air pollution has transcended the realm of local problems and has emerged as a global issue.

Questions for Consideration

1.) To what extent do you agree with the following statement: "Sacrificing air quality for the sake of economic growth, and thus increase in per capita income, is justified." Please explain your position with specific examples pertaining to China's situation.
2.) If you were an advisor to the Chinese government, what policy changes, if any, would you recommend regarding air quality control and why?
3.) What role, if any, should the U.S. play (the government and/or U.S. citizens) in trying to reduce the level of air pollution in China? Does the U.S. have an obligation to intervene in this situation? Is it appropriate for the U.S. to intervene in this situation? Please explain.
4.) How is China's progress measured? Consider whether environmental costs are taken into account, and decide whether or not they should be factored into such a discussion. In what ways could changing the current definition of "progress" impact China's future policies with respect to air pollution?

Related Topics by Discipline

Engineering

- State-of-the-art technologies used to remediate or limit air pollution and whether or not China does (or should) use them.
- Investigation of alternative energy options for China (as opposed to coal).

Social Science

- Tradeoff between economic growth and environmental protection.
- Examination of China's current policies with respect to air quality regulation and whether or not they are sufficient.

Natural Sciences

- Health effects of air pollutants and how they contribute to disease.
- How air pollution is spread around the globe.
- Acid rain: causes and effects.

Humanities

- The history of countries that experienced an industrial revolution and where they are today.
- Defining "quality of life" – how do health effects factor in (e.g. those caused by poor air quality)? Should only economic gain be considered? Is only economic gain considered?

Food vs. Forest: A Brazilian Dilemma

"A billion people around the world are going hungry. Ask them if they want Brazil to stop expanding its farms."[1]

Background

Deforestation has been on the rise in the Amazon in recent years. More and more land has been cleared for cattle ranching and agricultural purposes. Projections of current rates of deforestation predict that if this rate continues, 40% of the forest will be gone by 2050.

The total area of the Amazon rainforest covers an area equivalent to two thirds of the United States (over 6 million km^2 or 2.3 million sq. miles) and this forest is ecologically important in many ways. Its ecological services transcend the local realm and extend into the global arena. The Amazon Rainforest is one of the richest areas of biodiversity, with respect to both animal and plant life. To illustrate this, note that over 200 species of trees can be found on one hectare of the Amazon and one tree has been shown to have 72 different ant species living in it. The worlds' rainforests are a global resource - not only are they directly important to the air we all breathe, they also harbor a huge, largely untapped reservoir of species diversity which could be of profound importance to science and future medical and pharma research. Much of the plant and animal life remains to be discovered, and cures of today's most deadly diseases could be residing somewhere within such a wealth of biodiversity.

Furthermore, the Amazon Rainforest is the world's largest carbon sink. Trees play an important role in keeping carbon dioxide out of the atmosphere, and thus, help slow global warming. Destroying the Amazon Rainforest in its entirety would be tantamount to warming the earth by a couple degrees Celsius, a change that could have devastating consequences for our planet.

On the other hand, turning Brazil's rainforest into farmland not only has implications for reducing hunger in Brazil, but for reducing hunger worldwide. Brazil is the top exporter for a number of foods, including soy, sugar, orange juice, coffee, beef, and poultry, and its exportation of corn and rice are growing.

The dilemma is clear – how much of the Brazilian rainforest should be destroyed? How much is too much?

At the heart of this issue is determining how to weigh short-term benefits against possible long-term consequences. People are hungry now, but the integrity of these ecosystems is in jeopardy.

[1] Joshua Schneyer. "Brazil's Answer to Global Hunger." *BusinessWeek*. 2 Jun. 2008, 72.

Questions for Consideration

1.) Part of what makes many environmental issues so complex is that to reach a solution, tradeoffs must be made. The Brazilian dilemma is no exception. What are the pros and cons of continuing to cut down the Amazon rainforest unhindered? What are pros and cons of ceasing the destruction of the rainforest altogether? Is there a middle ground that can be reached? Please explain.
2.) What role, if any, should the U.S. play (the government and/or U.S. citizens) in trying to slow or stop deforestation in the Amazon? Does the U.S. have an obligation to intervene in this situation? Is it appropriate for the U.S. to intervene in this situation? Please explain.
3.) Should you, as a student in the U.S. care about the deforestation in the Amazon? Why or why not?
4.) What laws are in place in Brazil to regulate the destruction of the rainforest? What laws would you recommend?

Topics by Discipline

Engineering

- Technologies that can be developed to help increase the yield of crops on each plot of land cleared for agriculture.

Social Science

- Constructing a cost-benefit analysis of the issue.
- Determining whether financial incentives should be used to encourage people to refrain from cutting down forest.

Natural Sciences

- How the rainforest helps mitigate climate change.
- How cutting down the rainforest impacts surrounding ecosystems.

Humanities

- The ethical dimensions of the dilemma.
- The history of the Amazon rainforest and its pattern of destruction through the years.

Appendix E: Possible Course Books

ENGINEERING

Cradle to Cradle, by William McDonough & Michael Braungart (2002)

Cradle to Cradle is a small book with a revolutionary vision, challenging tradition and calling on society to embrace a new way of thinking about sustainability. It centers on the concept of design – the established cradle-to-grave approach and the novel cradle-to-cradle approach, explaining why the former is inevitably sending society down a path of environmental demise and how the latter holds the key to an environmentally-sound future. For the authors, society and this planet are in dire need of another industrial revolution, one of true sustainability. The authors see a world of abundance, not limits, and encourage the rest of the world the share the same vision. The text raises a number of thought-provoking ideas and may change students' outlook on how society can (and potentially should) operate.

SOCIAL SCIENCE

Red Sky at Morning: America and the Crisis of the Global Environment, by James Speth (2005)

James Speth is a renowned expert on environmental issues and policy – he founded and was president of the World Resources Institute, co-founded the Natural Resources Defense Council, served as advisor on environmental issues for Presidents Carter and Clinton, and was chief executive officer of the United Nations Development Programme. In his book, he explains how the world has responded to the major environmental problems and perhaps more importantly, discusses why and how these efforts have (more often than not) failed in the attempt. He also highlights the importance of recognizing not simply the symptoms of environmental destruction, but the drivers behind them. He concludes by addressing how society can successfully attack the root causes of environmental degradation and proceeds to describe the fundamental transitions needed to achieve a more equitable and sustainable future. This is a very accessible and informative read. Highly recommended.

NATURAL SCIENCES

The Little Green Handbook: Seven Trends Shaping the Future of our Planet, by Ron Nielsen (2006)

In this book, Nielson takes the reader through an analysis of what he believes are the seven most critical global trends facing the world: 1) the population explosion, 2) diminishing land resources, 3) diminishing water resources, 4) the destruction of the atmosphere, 5) the approaching energy crisis, 6) social decline, and 7) conflicts and increasing killing power. Not only does this book contain pertinent scientific information on a wide range of environmental issues, it also contains a lot of data, both embedded in the text and in an appendix. As data analysis is an important component of the class, this book will be especially useful.

HUMANITIES

Environmental Ethics: Readings in Theory and Application, 5th ed., by Louis P. Pojman and Paul Pojman (2008)

This comprehensive text provides an introduction to environmental ethics. It is a collection of writings from some of the most influential and most widely-cited essays on the environment. The book is split into two parts: Theory and Practice. In Part 1: Theory, the sections covered include the following: Perspectives; Animal Rights; Philosophical Theories of Nature, Biocentric Ethics, Ecocentric Ethics, and Deep Ecology; Preservation of Species Nature and Natural Objects; Non-Western Voices; and Obligations to Future Generations. In Part 2: Practice, the sections covered include the following: Population and Consumption, Food Ethics, Pollution: General Considerations, Pesticides, Climate Change, Economics and the Environment, Environmental Justice, and From Dysfunctional to Sustainable Society. Each section contains an introduction written by Pojman. Furthermore, each individual essay is introduced with a brief background on the text and the author, and at the end of each essay are thought-provoking study questions.

Appendix F: Further Reading & Inspiration

WORLD SCIENTISTS' WARNING TO HUMANITY

Human beings and the natural world are on a collision course. Human activities inflict harsh and often irreversible damage on the environment and on critical resources. If not checked, many of our current practices put at serious risk the future that we wish for human society and the plant and animal kingdoms, and may so alter the living world that it will be unable to sustain life in the manner that we know. Fundamental changes are urgent if we are to avoid the collision our present course will bring about.

THE ENVIRONMENT IS SUFFERING CRITICAL STRESS

The Atmosphere

Stratospheric ozone depletion threatens us with enhanced ultra-violet radiation at the earth's surface, which can be damaging or lethal to many life forms. Air pollution near ground level, and acid precipitation, are already causing widespread injury to humans, forests and crops.

Water Resources

Heedless exploitation of depletable ground water supplies endangers food production and other essential human systems. Heavy demands on the world's surface waters have resulted in serious shortages in some 80 countries, containing 40% of the world's population. Pollution of rivers, lakes and ground water further limits the supply.

Oceans

Destructive pressure on the oceans is severe, particularly in the coastal regions which produce most of the world's food fish. The total marine catch is now at or above the estimated maximum sustainable yield. Some fisheries have already shown signs of collapse. Rivers carrying heavy burdens of eroded soil into the seas also carry industrial, municipal, agricultural, and livestock waste—some of it toxic

Soil

Loss of soil productivity, which is causing extensive land abandonment, is a widespread byproduct of current practices in agriculture and animal husbandry. Since 1945, 11% of the earth's vegetated surface has been degraded—an area larger than India and China combined—and per capita food production in many parts of the world is decreasing.

Forests

Tropical rain forests, as well as tropical and temperate dry forests, are being destroyed rapidly. At present rates, some critical forest types will be gone in a few years and most of the tropical rain forest will be gone before the end of the next century. With them will go large numbers of plant and animal species.

Living Species

The irreversible loss of species, which by 2100 may reach one third of all species now living, is especially serious. We are losing the potential they hold for providing medicinal and other benefits, and the contribution that genetic diversity of life forms gives to the robustness of the world's biological systems and to the astonishing beauty of the earth itself.

Much of this damage is irreversible on a scale of centuries or permanent. Other processes appear to pose additional threats. Increasing levels of gases in the atmosphere from human activities, including carbon dioxide released from fossil fuel burning and from deforestation, may alter climate on a global scale. Predictions of global warming are still uncertain—with projected effects ranging from tolerable to very severe—but the potential risks are very great.

Our massive tampering with the world's interdependent web of life—coupled with the environmental damage inflicted by deforestation, species loss, and climate change—could trigger widespread adverse effects, including unpredictable collapses of critical biological systems whose interactions and dynamics we only imperfectly understand.

Uncertainty over the extent of these effects cannot excuse complacency or delay in facing the threat.

POPULATION

The earth is finite. Its ability to absorb wastes and destructive effluent is finite. Its ability to provide food and energy is finite. Its ability to provide for growing numbers of people is finite. And we are fast approaching many of the earth's limits. Current economic practices which damage the environment, in both developed and underdeveloped nations, cannot be continued without the risk that vital global systems will be damaged beyond repair.

Pressures resulting from unrestrained population growth put demands on the natural world that can overwhelm any efforts to achieve a sustainable future. If we are to halt the destruction of our environment, we must accept limits to that growth. A World Bank estimate indicates that world population will not stabilize at less than 12.4 billion, while the United Nations concludes that the eventual total could reach 14 billion, a near tripling of today's 5.4 billion. But, even at this moment, one person in five lives in absolute poverty without enough to eat, and one in ten suffers serious malnutrition.

No more than one or a few decades remain before the chance to avert the threats we now confront will be lost and the prospects for humanity immeasurably diminished.

WARNING

We the undersigned, senior members of the world's scientific community, hereby warn all humanity of what lies ahead. A great change in our stewardship of the earth and the life on it, is required, if vast human misery is to be avoided and our global home on this planet is not to be irretrievably mutilated.

WHAT WE MUST DO

Five inextricably linked areas must be addressed simultaneously:

1. We must bring environmentally damaging activities under control to restore and protect the integrity of the earth's systems we depend on.

We must, for example, move away from fossil fuels to more benign, inexhaustible energy sources to cut greenhouse gas emissions and the pollution of our air and water. Priority must be given to the development of energy sources matched to third world needs—small scale and relatively easy to implement.

We must halt deforestation, injury to and loss of agricultural land, and the loss of terrestrial and marine plant and animal species.

2. We must manage resources crucial to human welfare more effectively.

We must give high priority to efficient use of energy, water, and other materials, including expansion of conservation and recycling.

3. We must stabilize population. This will be possible only if all nations recognize that it requires improved social and economic conditions, and the adoption of effective, voluntary family planning.

4. We must reduce and eventually eliminate poverty.

5. We must ensure sexual equality, and guarantee women control over their own reproductive decisions.

The developed nations are the largest polluters in the world today. They must greatly reduce their overconsumption, if we are to reduce pressures on resources and the global environment. The developed nations have the obligation to provide aid and support to developing nations, because only the developed nations have the financial resources and the technical skills for these tasks.

Acting on this recognition is not altruism, but enlightened self-interest: whether industrialized or not, we all have but one lifeboat. No nation can escape from injury when global biological systems are damaged. No nation can escape from conflicts over increasingly scarce resources. In addition, environmental and economic instabilities will cause mass migrations with incalculable consequences for developed and undeveloped nations alike.

Developing nations must realize that environmental damage is one of the gravest threats they face, and that attempts to blunt it will be overwhelmed if their populations go unchecked. The greatest peril is to become trapped in spirals of environmental decline, poverty, and unrest, leading to social, economic and environmental collapse.

Success in this global endeavor will require a great reduction in violence and war. Resources now devoted to the preparation and conduct of war—amounting to over $1 trillion annually—will be badly needed in the new tasks and should be diverted to the new challenges.

A new ethic is required—a new attitude towards discharging our responsibility for caring for ourselves and for the earth. We must recognize the earth's limited capacity to provide for us. We must recognize its fragility. We must no longer allow it to be ravaged. This ethic must motivate a great movement, convince reluctant leaders and reluctant governments and reluctant peoples themselves to effect the needed changes.

The scientists issuing this warning hope that our message will reach and affect people everywhere.

We need the help of many.

We require the help of the world community of scientists—natural, social, economic, political;

We require the help of the world's business and industrial leaders;

We require the help of the worlds religious leaders; and

We require the help of the world's peoples.

We call on all to join us in this task.

PROMINENT INDIVIDUALS
AMONG MORE THAN 1,500 SIGNATORIES

_Anatole Abragam, Physicist; Fmr. Member, Pontifical Academy of Sciences; France
_Carlos Aguirre President, Academy of Sciences, Bolivia
_Walter Alvarez Geologist, National Academy of Sciences, USA
_Viqar Uddin Ammad, Chemist, Pakistani & Third World Academies, Pakistan
_Claude Allegre, Geophysicist, Crafoord Prize, France
_Michael Alpers Epidemiologist, Inst. of Med. Research, Papua New Guinea
_Anne Anastasi, Psychologist, National Medal of Science, USA
_Philip Anderson, Nobel laureate, Physics; USA
_Christian Anfinsen, Nobel laureate, Chemistry; USA

Thailand
_Zhao Zhong-xian, Physicist, Chinese & Third World Academies, China
_Zhou Guang-zhao, Physicist; President, Chinese Academy of Sciences;, China
_Solly ZuckerInan, Zoologist, Royal Society, Great Britain

Over 1,500 members of national, regional, and international science academies have signed the Warning. Sixtynine nations from all parts of Earth are represented, including each of the twelve most populous nations and the nineteen largest economic powers. The full list includes a majority of the Nobel laureates in the sciences. Awards and institutional affiliations are listed for the purpose of identification only. The Nobel Prize in medicine is for physiology or medicine.

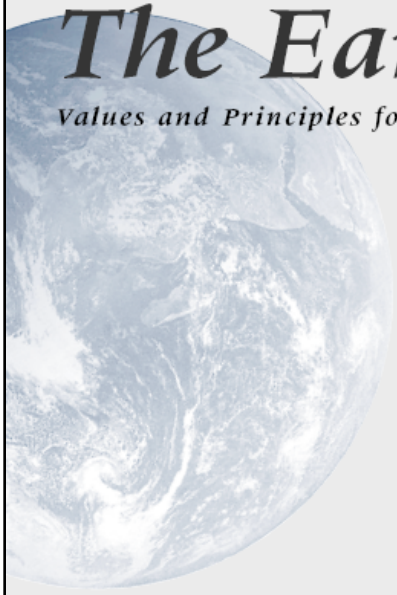
A **WORLD SCIENTISTS' WARNING BRIEFING BOOK** is available from the Union of Concerned Scientists. It provides the citations to support their WARNING.

Union of Concerned Scientists, 96 Church Street, Cambridge, Mass 02238-9105, USA
Phone: 617-547-5552; FAX: 617-864-9405
http://www.ucsusa.org/ ucs@igc.apc.org

[Warning issued on November 18, 1992, transcribed by Jay Hanson—apologies for any typos]

The Earth Charter

Values and Principles for a Sustainable Future



The Earth Charter is a declaration of fundamental principles for building a just, sustainable, and peaceful global society in the 21st century. It seeks to inspire in all peoples a new sense of global interdependence and shared responsibility for the well-being of the human family and the larger living world. It is an expression of hope and a call to help create a global partnership at a critical juncture in history.

The Earth Charter's inclusive ethical vision recognizes that environmental protection, human rights, equitable human development, and peace are interdependent and indivisible. It provides a new framework for thinking about and addressing these issues. The result is a fresh, broad conception of what constitutes a sustainable community and sustainable development.

Why is the Earth Charter important?

At a time when major changes in how we think and live are urgently needed, the Earth Charter challenges us to examine our values and to choose a better way. It calls on us to search for common ground in the midst of our diversity and to embrace a new ethical vision that is shared by growing numbers of people in many nations and cultures throughout the world.

What is the history of the Earth Charter?

In 1987 the United Nations World Commission on Environment and Development issued a call for creation of a new charter that would set forth fundamental principles for sustainable development. The drafting of an Earth Charter was part of the unfinished business of the 1992 Rio Earth Summit. In 1994 Maurice Strong, the secretary general of the Earth Summit and chairman of the Earth Council, and Mikhail Gorbachev, president of Green Cross International, launched a new Earth Charter initiative with support from the Dutch government. An Earth Charter Commission was formed in 1997 to oversee the project and an Earth Charter Secretariat was established at the Earth Council in Costa Rica.

By what process was the Earth Charter created?

The Earth Charter is the product of a decade long, worldwide, crosscultural conversation about common goals and shared values. The drafting of the Earth Charter has involved the most open and participatory consultation process ever conducted in connection with an international document. Thousands of individuals and hundreds of organizations from all regions of the world, different cultures, and diverse sectors of society have participated. The Charter has been shaped by both experts and representatives of grassroots communities. It is a people's treaty that sets forth an important expression of the hopes and aspirations of the emerging global civil society.

Who wrote the Earth Charter?

Early in 1997, the Earth Charter Commission formed an international drafting committee. The drafting committee helped to conduct the international consultation process, and the evolution and development of the document reflects the progress of the worldwide dialogue on the Earth Charter. Beginning with the Benchmark Draft issued by the Commission following the Rio+5 Forum in Rio de Janeiro, drafts of the Earth Charter were circulated internationally as part of the consultation process. Meeting at the UNESCO Headquarters in Paris in March, 2000, the Commission approved a final version of the Earth Charter.

What are the sources of Earth Charter values?

Together with the Earth Charter consultation process, the most important influences shaping the ideas and values in the Earth Charter are contemporary science, international law, the teachings of indigenous peoples, the wisdom of the world's great religions and philosophical traditions, the declarations and reports of the seven UN summit conferences held during the 1990s, the global ethics movement, numerous non-governmental declarations and people's treaties issued over the past thirty years, and best practices for building sustainable communities.

What is the mission of the international Earth Charter Initiative?

A new phase in the Initiative began with the official launching of the Earth Charter at the Peace Palace in The Hague on June 29, 2000. The mission of the Initiative is to establish a sound ethical foundation for the emerging global society and to help build a sustainable world based on respect for nature, universal human rights, economic justice, and a culture of peace.

What are the goals of the Earth Charter Initiative?

1. To promote the dissemination, endorsement, and implementation of the Earth Charter by civil society, business, and government.
2. To encourage and support the educational use of the Earth Charter in schools, universities, faith communities, and many other settings.
3. To seek endorsement of the Earth Charter by the United Nations.

The Earth Charter

PREAMBLE

We stand at a critical moment in Earth's history, a time when humanity must choose its future. As the world becomes increasingly interdependent and fragile, the future at once holds great peril and great promise. To move forward we must recognize that in the midst of a magnificent diversity of cultures and life forms we are one human family and one Earth community with a common destiny. We must join together to bring forth a sustainable global society founded on respect for nature, universal human rights, economic justice, and a culture of peace. Towards this end, it is imperative that we, the peoples of Earth, declare our responsibility to one another, to the greater community of life, and to future generations.

EARTH, OUR HOME

Humanity is part of a vast evolving universe. Earth, our home, is alive with a unique community of life. The forces of nature make existence a demanding and uncertain adventure, but Earth has provided the conditions essential to life's evolution. The resilience of the community of life and the well-being of humanity depend upon preserving a healthy biosphere with all its ecological systems, a rich variety of plants and animals, fertile soils, pure waters, and clean air. The global environment with its finite resources is a common concern of all peoples. The protection of Earth's vitality, diversity, and beauty is a sacred trust.

THE GLOBAL SITUATION

The dominant patterns of production and consumption are causing environmental devastation, the depletion of resources, and a massive extinction of species. Communities are being undermined. The benefits of development are not shared equitably and the gap between rich and poor is widening. Injustice, poverty, ignorance, and violent conflict are widespread and the cause of great suffering. An unprecedented rise in human population has overburdened ecological and social systems. The foundations of global security are threatened. These trends are perilous—but not inevitable.

THE CHALLENGES AHEAD

The choice is ours: form a global partnership to care for Earth and one another or risk the destruction of ourselves and the diversity of life. Fundamental changes are needed in our values, institutions, and ways of living. We must realize that when basic needs have been met, human development is primarily about being more, not having more. We have the knowledge and technology to provide for all and to reduce our impacts on the environment. The emergence of a global civil society is creating new opportunities to build a democratic and humane world. Our environmental, economic, political, social, and spiritual challenges are interconnected, and together we can forge inclusive solutions.

UNIVERSAL RESPONSIBILITY

To realize these aspirations, we must decide to live with a sense of universal responsibility, identifying ourselves with the whole Earth community as well as our local communities. We are at once citizens of different nations and of one world in which the local and global are linked. Everyone shares responsibility for the present and future well-being of the human family and the larger living world. The spirit of human solidarity and kinship with all life is strengthened when we live with reverence for the mystery of being, gratitude for the gift of life, and humility regarding the human place in nature.

We urgently need a shared vision of basic values to provide an ethical foundation for the emerging world community. Therefore, together in hope we affirm the following interdependent principles for a sustainable way of life as a common standard by which the conduct of all individuals, organizations, businesses, governments, and transnational institutions is to be guided and assessed.

PRINCIPLES

I. RESPECT AND CARE FOR THE COMMUNITY OF LIFE

1. Respect Earth and life in all its diversity.

a. Recognize that all beings are interdependent and every form of life has value regardless of its worth to human beings.

b. Affirm faith in the inherent dignity of all human beings and in the intellectual, artistic, ethical, and spiritual potential of humanity.

2. Care for the community of life with understanding, compassion, and love.

a. Accept that with the right to own, manage, and use natural resources comes the duty to prevent environmental harm and to protect the rights of people.

b. Affirm that with increased freedom, knowledge, and power comes increased responsibility to promote the common good.

3. Build democratic societies that are just, participatory, sustainable, and peaceful.

a. Ensure that communities at all levels guarantee human rights and fundamental freedoms and provide everyone an opportunity to realize his or her full potential.

b. Promote social and economic justice, enabling all to achieve a secure and meaningful livelihood that is ecologically responsible.

4. Secure Earth's bounty and beauty for present and future generations.

a. Recognize that the freedom of action of each generation is qualified by the needs of future generations.

b. Transmit to future generations values, traditions, and institutions that support the long-term flourishing of Earth's human and ecological communities.

In order to fulfill these four broad commitments, it is necessary to:

II. ECOLOGICAL INTEGRITY

5. Protect and restore the integrity of Earth's ecological systems, with special concern for biological diversity and the natural processes that sustain life.

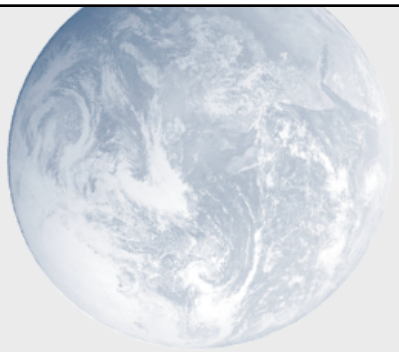
a. Adopt at all levels sustainable development plans and regulations that make environmental conservation and rehabilitation integral to all development initiatives.

b. Establish and safeguard viable nature and biosphere reserves, including wild lands and marine areas, to protect Earth's life support systems, maintain biodiversity, and preserve our natural heritage.

c. Promote the recovery of endangered species and ecosystems.

d. Control and eradicate non-native or genetically modified organisms harmful to native species and the environment, and prevent introduction of such harmful organisms.

e. Manage the use of renewable resources such as water, soil, forest products, and marine life in ways that do not exceed rates of regeneration and that protect the health of ecosystems.



f. Manage the extraction and use of non-renewable resources such as minerals and fossil fuels in ways that minimize depletion and cause no serious environmental damage.

6. Prevent harm as the best method of environmental protection and, when knowledge is limited, apply a precautionary approach.

a. Take action to avoid the possibility of serious or irreversible environmental harm even when scientific knowledge is incomplete or inconclusive.

b. Place the burden of proof on those who argue that a proposed activity will not cause significant harm, and make the responsible parties liable for environmental harm.

c. Ensure that decision making addresses the cumulative, long-term, indirect, long distance, and global consequences of human activities.

d. Prevent pollution of any part of the environment and allow no build-up of radioactive, toxic, or other hazardous substances.

e. Avoid military activities damaging to the environment.

7. Adopt patterns of production, consumption, and reproduction that safeguard Earth's regenerative capacities, human rights, and community well-being.

a. Reduce, reuse, and recycle the materials used in production and consumption systems, and ensure that residual waste can be assimilated by ecological systems.

b. Act with restraint and efficiency when using energy, and rely increasingly on renewable energy sources such as solar and wind.

c. Promote the development, adoption, and equitable transfer of environmentally sound technologies.

d. Internalize the full environmental and social costs of goods and services in the selling price, and enable consumers to identify products that meet the highest social and environmental standards.

e. Ensure universal access to health care that fosters reproductive health and responsible reproduction.

f. Adopt lifestyles that emphasize the quality of life and material sufficiency in a finite world.

8. Advance the study of ecological sustainability and promote the open exchange and wide application of the knowledge acquired.

a. Support international scientific and technical cooperation on sustainability, with special attention to the needs of developing nations.

b. Recognize and preserve the traditional knowledge and spiritual wisdom in all cultures that contribute to environmental protection and human well-being.

c. Ensure that information of vital importance to human health and environmental protection, including genetic information, remains available in the public domain.

III. SOCIAL AND ECONOMIC JUSTICE

9. Eradicate poverty as an ethical, social, and environmental imperative.

a. Guarantee the right to potable water, clean air, food security, uncontaminated soil, shelter, and safe sanitation, allocating the national and international resources required.

b. Empower every human being with the education and resources to secure a sustainable livelihood, and provide social security and safety nets for those who are unable to support themselves.

c. Recognize the ignored, protect the vulnerable, serve those who suffer, and enable them to develop their capacities and to pursue their aspirations.

10. Ensure that economic activities and institutions at all levels promote human development in an equitable and sustainable manner.

a. Promote the equitable distribution of wealth within nations and among nations.

b. Enhance the intellectual, financial, technical, and social resources of developing nations, and relieve them of onerous international debt.

c. Ensure that all trade supports sustainable resource use, environmental protection, and progressive labor standards.

d. Require multinational corporations and international financial organizations to act transparently in the public good, and hold them accountable for the consequences of their activities.

11. Affirm gender equality and equity as prerequisites to sustainable development and ensure universal access to education, health care, and economic opportunity.

a. Secure the human rights of women and girls and end all violence against them.

b. Promote the active participation of women in all aspects of economic, political, civil, social, and cultural life as full and equal partners, decision makers, leaders, and beneficiaries.

c. Strengthen families and ensure the safety and loving nurture of all family members.

12. Uphold the right of all, without discrimination, to a natural and social environment supportive of human dignity, bodily health, and spiritual well-being, with special attention to the rights of indigenous peoples and minorities.

a. Eliminate discrimination in all its forms, such as that based on race, color, sex, sexual orientation, religion, language, and national, ethnic or social origin.

b. Affirm the right of indigenous peoples to their spirituality, knowledge, lands and resources and to their related practice of sustainable livelihoods.

c. Honor and support the young people of our communities, enabling them to fulfill their essential role in creating sustainable societies.

d. Protect and restore outstanding places of cultural and spiritual significance.

IV. DEMOCRACY, NONVIOLENCE, AND PEACE

13. Strengthen democratic institutions at all levels, and provide transparency and accountability in governance, inclusive participation in decision making, and access to justice.

a. Uphold the right of everyone to receive clear and timely information on environmental matters and all development plans and activities which are likely to affect them or in which they have an interest.

b. Support local, regional and global civil society, and promote the meaningful participation of all interested individuals and organizations in decision making.

c. Protect the rights to freedom of opinion, expression, peaceful assembly, association, and dissent.

d. Institute effective and efficient access to administrative and independent judicial procedures, including remedies and redress for environmental harm and the threat of such harm.

e. Eliminate corruption in all public and private institutions.

f. Strengthen local communities, enabling them to care for their environments, and assign environmental responsibilities to the levels of government where they can be carried out most effectively.

14. Integrate into formal education and life-long learning the knowledge, values, and skills needed for a sustainable way of life.

a. Provide all, especially children and youth, with educational opportunities that empower them to contribute actively to sustainable development.

b. Promote the contribution of the arts and humanities as well as the sciences in sustainability education.

c. Enhance the role of the mass media in raising awareness of ecological and social challenges.

d. Recognize the importance of moral and spiritual education for sustainable living.

15. Treat all living beings with respect and consideration.

a. Prevent cruelty to animals kept in human societies and protect them from suffering.

b. Protect wild animals from methods of hunting, trapping, and fishing that cause extreme, prolonged, or avoidable suffering.

c. Avoid or eliminate to the full extent possible the taking or destruction of non-targeted species.

16. Promote a culture of tolerance, nonviolence, and peace.

a. Encourage and support mutual understanding, solidarity, and cooperation among all peoples and within and among nations.

b. Implement comprehensive strategies to prevent violent conflict and use collaborative problem solving to manage and resolve environmental conflicts and other disputes.

c. Demilitarize national security systems to the level of a non-provocative defense posture, and convert military resources to peaceful purposes, including ecological restoration.

d. Eliminate nuclear, biological, and toxic weapons and other weapons of mass destruction.

e. Ensure that the use of orbital and outer space supports environmental protection and peace.

f. Recognize that peace is the wholeness created by right relationships with oneself, other persons, other cultures, other life, Earth, and the larger whole of which all are a part.

The Way Forward

As never before in history, common destiny beckons us to seek a new beginning. Such renewal is the promise of these Earth Charter principles. To fulfill this promise, we must commit ourselves to adopt and promote the values and objectives of the Charter.

This requires a change of mind and heart. It requires a new sense of global interdependence and universal responsibility. We must imaginatively develop and apply the vision of a sustainable way of life locally, nationally, regionally, and globally. Our cultural diversity is a precious heritage and different cultures will find their own distinctive ways to realize the vision. We must deepen and expand the global dialogue that generated the Earth Charter, for we have much to learn from the ongoing collaborative search for truth and wisdom.

Life often involves tensions between important values. This can mean difficult choices. However, we must find ways to harmonize diversity with unity, the exercise of freedom with the common good, short-term objectives with long-term goals. Every individual, family, organization, and community has a vital role to play. The arts, sciences, religions, educational institutions, media, businesses, nongovernmental organizations, and governments are all called to offer creative leadership. The partnership of government, civil society, and business is essential for effective governance.

In order to build a sustainable global community, the nations of the world must renew their commitment to the United Nations, fulfill their obligations under existing international agreements, and support the implementation of Earth Charter principles with an international legally binding instrument on environment and development.

Let ours be a time remembered for the awakening of a new reverence for life, the firm resolve to achieve sustainability, the quickening of the struggle for justice and peace, and the joyful celebration of life.

Who has endorsed the Earth Charter?

Thousands of nongovernmental organizations and cities and towns throughout the world have endorsed the Earth Charter and are working to implement its principles. Among these groups are national and international environmental organizations, educational institutions and associations, religious groups, peace initiatives, and local government councils, including the United States Conference of Mayors and the International Council for Local Environmental Initiatives. The Earth Charter has also been endorsed by the United Nations University for Peace in Costa Rica, with which the international Secretariat is presently affiliated. See the Earth Charter website for more information on endorsements.

How can the Earth Charter be used?

A growing number of individuals, organizations, and communities are finding that there are a variety of interrelated ways to use the Earth Charter. It can be utilized as:

- an educational tool for developing understanding of the critical choices facing humanity and the urgent need for commitment to a sustainable way of life.
- an invitation to individuals, institutions, and communities for internal reflection on fundamental attitudes and ethical values governing behavior.
- a catalyst for multi-sectoral, cross-cultural, and interfaith dialogue on global ethics and the direction of globalization.
- a call to action and guide to a sustainable way of life that can inspire commitment, cooperation, and change.
- a values framework for creating sustainable development policies and plans at all levels.
- an instrument for designing professional codes of conduct that promote accountability and for assessing progress towards sustainability in businesses, communities, and nations.
- a soft law instrument that provides an ethical foundation for the ongoing development of environmental and sustainable development law.

How you can participate in the Earth Charter Initiative

- Consult the Earth Charter website (http://www.earthcharter.org). The website provides extensive information on the background of the Earth Charter and suggestions for how to use it in a variety of settings.
- Contact a local or national Earth Charter group in your area. This information can be found on the Earth Charter website.
- Start an Earth Charter study group and explore how to use the Earth Charter and apply its principles in your home, workplace, and local community.
- Provide copies of the Earth Charter and relevant background information to schools, faith communities, businesses, and local governments. To request copies of the Earth Charter brochures, call the International Secretariat at (506) 205-1600 or write to info@earthcharter.org.
- Make use of the Earth Charter in public events, conferences, and workshops.
- Endorse the Earth Charter and encourage endorsement by organizations to which you belong.
- Encourage your local and national government to use and endorse the Earth Charter.
- Urge your national government to support endorsement of the Earth Charter by the United Nations.
- Make charitable contributions in support of local Earth Charter projects and the international Earth Charter Initiative.

Who provides the funding for the Initiative?

The Earth Charter Initiative is dependent upon contributions from individuals, nongovernmental organizations, and foundations. Some governments have also provided support. Financial contributions to the international Earth Charter Initiative can be sent to The Earth Charter Fund/TPC, attention: Claire Wilson, Post Office Box 648, Middlebury, VT 05753 USA.

What does endorsement of the Earth Charter mean?

Endorsement of the Earth Charter by individuals or organizations signifies a commitment to the spirit and aims of the document. It indicates an intention to use the Earth Charter in ways that are appropriate given the situation and to cooperate with others in working for the implementation of its principles. Endorsement builds support for the Earth Charter Initiative and social change. See the website for further information on endorsement.

Earth Charter Commission

AFRICA AND THE MIDDLE EAST
Amadou Toumani Touré, Mali*
Princess Basma Bint Talal, Jordan
Wangari Maathai, Kenya
Mohamed Sahnoun, Algeria

ASIA AND THE PACIFIC
Kamla Chowdhry, India*
A.T. Ariyaratne, Sri Lanka
Wakako Hironaka, Japan
Pauline Tangiora, New Zealand/Aoteroa
Erna Witoelar, Indonesia

EUROPE
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Pierre Calame, France
Ruud Lubbers, The Netherlands
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Elizabeth May, Canada
Steven Rockefeller, United States of America
Severn Cullis-Suzuki, Canada

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Leonardo Boff, Brazil
Yolanda Kakabadse, Ecuador
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Mohamed Sahnoun, Algeria
Severn Cullis-Suzuki, Canada
Rick Clugston, United States of America*
*Chair, Finance Committee

Maximo Kalaw, Philippines
In Memoriam

For more information please contact:
Mirian Vilela, Executive Director
Earth Charter International Secretariat
c/o University for Peace
P.O. Box 319-6100 San José, Costa Rica
Phone: (506) 205-1600
Fax: (506) 249-3500
E-mail: info@earthcharter.org
Website: http://www.earthcharter.org

The well-being of the human family and greater community of life depends on our personal commitment...

Join the Earth Charter Initiative!

If the Earth were only a few feet in diameter...

by Joe Miller