**Sustainability Courses**

**The Woods College of Advancing Studies at Boston College**

Course Offerings with Descriptions

**Sustainability Science** - Through technology and our growing population, humans are altering the planet at rates much faster than Earth can adjust to the changes. The health of the planet and of its human population are inevitably intertwined. In this course, we will explore areas where the human species is causing long-term alteration to the Earth's physical-chemical systems by consuming and polluting our planet's natural resources. We will look at the problems we face in managing limited resources in a technological age and rapidly growing world, the natural processes with which we interact, the wastes we generate, and the pros and cons of various potential solutions to these problems. We will survey issues in geology that are critical to the future of humanity, as well as the limits on what we must do now towards sustainability. Though we will discuss these topics in a manner suited for the non-science major, our focus will be on science. Our aim is to expose students to a broad range of environmental topics that are the subject of public debate.  In doing so, students will be informed citizens and savvy consumers of environmental news. A strong emphasis will be placed on developing critical, data-based reasoning skills that will help students personally to evaluate issues that students encounter daily in the press, and to separate fact from the spin to which environmental issues are often subjected.

**Corporate Sustainability** - In this course, students will learn about how companies balance stewardship and economics.  We will investigate a hierarchy of actions companies take as they become more sustainable, and how to involve all members of the corporation.  We will look at how sustainability officers evaluate and prepare sustainability reports, and how the banking and other communities view sustainable business practices.  Students will learn how to develop and use sustainable marketing technologies and how to capitalize on these techniques to maximize ecologically friendly processes. We will use case studies from local and international companies.

**Sustainable Agriculture** - Of all we humans do on - and to - Earth, agriculture has the single biggest impact.  We will focus on students’ eating habits which also contributes to this impact. The first part of this course will cover the principles of economics as they pertain to agriculture; agricultural styles and practices; soil resources and problems; and the ways we pollute the Earth’s air, soil, and water as we obtain food.  The second part of the course will be a discussion of these topics in the form of pro/con debates including: subsistence vs. industrial agriculture; pesticides, herbicides, and fertilizers; integrated pest management; tropical deforestation for agriculture (case study: coffee); organic farming vs. local food; milk and meat husbandry and consumption; fast food; food additives (colors, thickeners, preservatives, stabilizers, etc.); emerging infectious diseases; genetically modified organisms; hunting; packaging; transportation and food miles.

**Building Green Buildings** – Seventy-five percent of electricity generated in the United States is used in the built environment, and nearly half of all greenhouse gases come from buildings.  In this course, we will look at how to increase sustainability by green building, including the theory, history, state of the industry, and best practices. We will investigate building assessment systems including LEED, FORTIFIED, and NetZero. At the completion of this course, students will have a basic working knowledge of: green and natural building design; sustainable building assessment; landscaping and encouraging walking, biking, and public transport; building efficient thermal envelopes; an overview of efficient mechanical and electrical systems; water conservation systems including re-use; waste management and green material selection; indoor environmental quality including indoor air pollution, lighting, and views; green construction operations; building commissioning; and economic analysis of green buildings.  We will take two optional field trips: one to Boston Police B-2 station in Roxbury, a LEED-Gold; and the Boston Nature Center in Mattapan, which is LEED-Platinum certified.

**Energy in the 21st Century -** Oil, gas, and coal are polluting, non-renewable resources and society must reduce their dependence on these fossil fuels.  Alternative energies such as wind, solar, and tidal power are non-polluting and renewable and are therefore highly desirable.  Some people are confused why not much progress appears to have been made towards phasing out fossil fuels and transitioning to alternative energy.  This course takes a non-traditional approach in that it includes the benefits of fossil fuels, and delves into the stumbling blocks to implementing the following alternative energy technologies:  hydropower, wave power, biomass, solar, geothermal, wind, hydrogen and nuclear energies. Science, technology, policy, and societal concerns will be discussed in a seminar style and students are responsible for researching and presenting each type of energy.  We will also discuss the “smart” use of energy, as well as the storage, transportation, housing, and consumption of energy. We will conclude by discussing and creating potential policies for the expedited phasing in of alternative technologies, including regional, strategic, health, safety, and environmental concerns.  Attendees will leave the course with a deep understanding of the technological and policy-based obstacles to alternative energy as well as the pressing nature of this transition.

**Water Resources -** This course is intended for mid-level students with an interest in water-related science, policy, management, and resources. The course integrates a wide variety of water resources topics including: water history, surface and groundwater hydrology, water law, water use and development, economics, environmental issues, water management, policy, and more. This course will help prepare you for a career in sustainability, earth sciences, biology, geology, watershed science, natural resources management, environmental studies, wildlife management, soils, biology, fisheries & wildlife, and law.  We will have two optional field trips through which students will gain valuable insight and experience in a variety of water-related environments.

**Wetlands Science and Policy -** This course is intended for students with an interest in geological, hydrologic, biological, and social sciences with a specific focus on wetland environments and resources.  In the course, students gain an interdisciplinary overview of biological, and cultural aspects of wetlands. We cover definitions, classification systems, origins, and natural processes of wetland environments. We discuss wetlands across the globe, including boreal, temperate, and tropical climates. We investigate hydrology, soils, and vegetation and their relationship to ecosystem processes, societal values, and management.  We examine human use, modification, exploitation, jurisdictional delineation, and management options, along with legal and political aspects of wetlands. This broad course also encompasses forestry, coastal management, energy, climate change, agriculture, history, and ecosystem succession. This course is intended as a rational approach to wetland conservation balanced with responsible development. People need to be able to live and draw water from somewhere but wetlands serve many vital functions and oftentimes are highly valuable ecosystems that should be protected.

**Marine Resources -** This course will give students a better understanding of the resources we obtain from the ocean and the pollutants we put into the ocean.  Topics include energy from the marine environment including tidal, wind, and wave power, oil and natural gas; food resources of the sea including fish, lobsters, shellfish, shrimp, and seaweed; analysis of world marine food production; marine food technology, conservation, and agriculture; coastal zone recreational resources including fishing, boating, and SCUBA; beaches, hurricanes, and shore erosion; marine pollution; plastic pollution; and the law of the sea.

**Environmental Economics** – In this course, students will learn about the central theory of externalities. Market failure will provide the basis for applying microeconomic concepts to the study of environmental improvement.  Cost benefit analyses and other analytical tools will be discussed and students will use them to solve environmental problems using models. We will define and describe strategies used in the development and implementation of environmental policy, both in the United States and abroad.  A review of past and present condition of the local and global environment with regards to air, water and waste management will be part of the curriculum. Environmental management issues such as air and water quality, and solid and hazardous waste will be looked at through the lens of both industrializing and developed nations, and we will spend some time discussing economic solutions to these problems (example: cap and trade).

**Natural Disasters -** Natural disasters currently cost the United States about 50 billion dollars per year. Fortunately, we currently have the knowledge to significantly reduce these costs. Unfortunately, political and cultural trends cause some disasters to occur again and again. This course is designed to provide an overview of what we know about the causes, locations and effects of some of the most important natural disasters such as earthquakes, floods, and hurricanes. We also will look at how loss of life and property damage can be minimized by implementing geologic knowledge. The course will also briefly examine less common, but possibly more devastating catastrophes such as large volcanic eruptions, meteorite impacts, and rapid climate change.

**Evolution of Life and Historical Geology -** We will delve into a fascinating exploration of the co-evolution of life and Earth surface environments through time.  Students will learn about mass extinctions - rare and short term events that collectively shaped the biological world we experience today. Can we reconstruct mass extinctions as evolutionary events, using the fossil record, aided by phylogenies based on comparative biology?  Can we, in turn, use information in sedimentary rocks to understand the environmental perturbations that killed so many organisms? Using physiology, can we understand causal relationships between environmental events and patterns of selective extinction (and survival) recorded by fossils?  Can knowledge of this past provide useful perspective on current threats to biodiversity?

**Applied Hydrogeology–** This course covers the origin, distribution, and flow of groundwater in permeable sediments and bedrock; hydrologic and geologic characteristics of aquifers; regional flow systems emphasizing rock structure, stratigraphy, and other aspects of the geological environment; principles of hydrogeologic mapping and analysis; introduction to well testing, field methods, and well hydraulics; introduction to modeling; and introduction to groundwater geochemistry and contamination of aquifers. Hydrogeology is an interdisciplinary study involving the fields of geology, mathematics, chemistry, engineering, and computer science. In this course we will focus on the physical flow of groundwater through porous media. There will also be an introductory treatment of chemical interactions of groundwater with geological materials, mathematical modeling of groundwater; and groundwater management and policy.

**Urban Ecology: Environmental History of Boston** – Boston is one of America’s oldest cities.  It was settled in 1630, and since then, has experienced profound transformations by both humans and nature.  Early on, Boston was an important early trade hub. As its population and economy grew, developers extended the city's shoreline into the surrounding tidal mudflats to create more useable land. Further expansion of the city was achieved through the annexation of surrounding communities and the burgeoning population and economy spread to outlying areas. The interconnection of city and suburb opened the floodgates to increased commerce, services and workforces, while also leaving a wake of roads, rails, bridges, buildings, deforestation, and pollution.  This course will cover a variety of topics, including: the glacial formation of the region; physical characteristics and composition of the land and harbor; dredging, sea walling, flattening, and landfill operations in the reshaping of the Shawmut Peninsula; the longstanding controversy over the link between landfills and shoaling in shipping channels; population movements between the city and suburbs and their environmental implications; interdependence of the city and its suburbs; preservation and reclamation of the Charles River; suburban deforestation and later reforestation as byproducts of changing land use; the planned outlay of parks and parkways; and historic climate changes and the human and biological adaptations to them. *(note: this course description was taken largely from the course’s textbook, “Remaking Boston” by A. Penna)*