General Course Content:

Sustainability will explore the philosophical, ecological, economic, and computational basis for saving the world. For us, the term “saving the world” means to provide the science that can enable people to continue to exist on earth indefinitely while leading healthful and rewarding lives. The science of sustainability is probably the most difficult, technically demanding, and ultimately rewarding synthetic discipline in the world today. It is humanity’s collective bulwark against famine, disease, poverty, war, mass extinction, and global climate change. Despite the solemnity, this course is not all that formidable, but you must work very hard. The most interesting problem is the need for us to marry biology with philosophy, economics, anthropology, geography, and earth science in order to become knowledgeable, wise, and effective as clinical ecologists.

Students will learn to link human uses with ecological processes through the concept of ecosystem services. They will work together to define the boundaries of workable solutions by creating computer models that capture the dynamics of linked human-natural systems.

Both sustainability, and our course rely on three practices: theory, observation, and experiment. The theory is anthropological, ecological, and economic. We will focus on anthropological and ecological theory (basically, human and all other ecologies) mostly, though we will learn about ecological economics, and a background in classical economics can be helpful. Our observations will be of natural history and human nature. Of course, the idea is to remember all that you observe- or that others have observed. This amounts to knowing your system- perhaps a whale sanctuary or a coral reef, a city or farm- or a special community of people- and to know your organisms, whether trees, or birds, or corals, or bacteria or a particular culture or political leader. The class is based upon case studies, each of which represents a huge experiment in human-natural system coupling. When you choose a case study project team, you will begin direct participation in very specific giant experiment in the real world. These experiments are located in the watersheds and coastal communities of Massachusetts, Belize, East Africa, and south Florida. As you can see, simply by attending Boston University, eating, breathing, moving about and flushing the toilet, you are already a guinea pig in at least one of these experiments.

Required Texts and Software

Norton- Sustainability.
Ehrlich and Ehrlich- The Dominant Animal.
Norse and Crowder- Marine Conservation Biology

Total cost: ca. $100.

Software: ISEE Systems, STELLA- $60 6-month site license (there is option for $129 permanent license, recommended if you think you’ll want to keep doing this kind of work).
Supporting Texts  
Daily: Nature’s Services  
Leslie and MacLeod- Marine EBM book  
Primack and Corlett- Tropical Rain Forests: An ecological and biogeographical comparison.

Grading:  
Class participation  25%  
Take-home mid-term  25%  
Term project  50%


January 14 – An Introduction to Sustainability
Readings:  
Norton: Preface through Chapter 1- The EPA Experiment  
N&C: Forward and Chapter 1- Contrast and Synthesis: Terrestrial and Marine Conservation Principles  
Research:

January 19- Watershed-based Whole-System Dynamics: Ridge-to-Reef
Readings:  
Norton: Chapter 2- What “Sustainability” Means  
Ehrlich²: Chapter 1- Evolutionary Principles and Conservation Biology  
Modeling: Intro to modeling  
Research:

January 21- The Meaning of Modeling
Readings:  
Norton: Chapter 3- Aldo Leopold and Adaptive Management  
N&C: Chapter 2- A Once and Future Ocean; Chapter 24- The Sea Ethic  
Modeling: Population models 1  
Research:

January 26- Ethics and Goal-setting for Sustainability
Readings:  
Ehrlich²: Chapter 2- Geographical Variation and Place-Based Conservation  
N&C: Page 31 through Chapter 3 and Chapter 19- Marine Population Biology  
Modeling: Population models 2  
Research:

January 28- Simple and Complex Dynamics In Population Models
Readings:  
Norton: Chapter 4- Loosening Your Frame of Mind
Unit II: The Ridge-to-Reef Paradigm in Four Case Studies

February 2- Distinguished Guest: Valerie Pasquarella speaks on MIDAS, a Spatially Explicit Decision Support Tool for Coastal Belize

Readings:
- Ehrlich: Chapter 5- Cultural and Biological Evolution of Humans in Ecological Landscapes
- N&C: Chapter 4- Allee Effects

February 4- Distinguished: Valerie Pasquarella leads a STELLA modeling lab

Readings:
- Norton: Chapter 5- Environmental Values and Ethics
- N&C: Chapter 5- Extinction Risk in Marine Species

February 9- Massachusetts Oceans Act and Mass Bay Modeling Study

Readings:
- Norton: Chapter 6- Values, Ethics, and Valuation

February 11- South Florida

Readings:
- Ehrlich: Chapter 6- Perception, Cognition, and the Human-Ecosystem Nexus
- N&C: Chapter 6- Human Behavior in an Ecosystem Context

February 18 (16 is Monday schedule) Lake Victoria

Readings:
- Norton: Chapter 7- Sustainability as a Social Science
- Ehrlich: Chapter 7- Human Demographics and Environmental Footprints
- N&C: Chapter 7- Eutrophication Impacts on Coastal Marine Ecosystems
Unit III: Isolating Constraints, Trade-Offs, and Real Solutions

February 23- The Human Factor

Readings:
Norton: Chapter 8- Matching the Time Scales of Social and Biological Processes
N&C: Chapter 8- Bioinvasions

February 25- Matching Up Biological and Social Processes

Readings:
Ehrlich²: Chapter 8- Contrast and Interplay of Cultural and Biological Evolution

March 2- Linking Natural and Social Science in Whole-System Sustainability Models

Readings:
Norton: Chapter 9- Redefining Sustainability and Setting Concrete Goals
Ehrlich²: Chapter 9- Thermodynamics and Constraints on the Flow of Matter and Energy in Ecosystems

March 4- Identifying and Confronting Trade-Offs in Ecosystem Services

Readings:
Norton: Chapter 10- Decision Theory and Practice
Ehrlich²: Chapter 10- Ecosystem Services and How the Human Enterprise Overshot Earth’s Limits
N&C: Chapter 10- Multiple Stressors

March 16- Ecosystem Service Profiles and Trade-Offs in Class Project Case Studies

Readings:
Norton: Chapter 11- Merging Biophysical and Social Science to Get Stuff Done
Ehrlich²: Chapter 11- Processes of Consumption and Environmental Degradation
N&C: Page 347 through Chapter 20- Human Dimensions in Fisheries

Unit IV: Subsystem Dynamics

(March 9 and 11 are Spring Vacation)
March 18- Defining and Enriching Model Subsystems

Readings:
Norton: Chapter 12- Cutting the Bull and Pulling the Cart
Ehrlich: Chapter 12- Ecosystem Impacts and the End of Open Access

Modeling:
Research:

March 23- Spatial Regimes as Subsystems in an Adaptive Management Experiment

Readings:
N&C: Page 261 – Chapter 16- Place-Based Management and MPAs

Modeling:
Research:

March 25- Real-World Spatial Experiments on Land and Sea

Readings:
Ehrlich: Chapters 13 and 14 (speed-read)- Atmosphere and Energy
N&C: Chapter 17- Marine Reserves and Food Security

Modeling:
Research:

March 30- Balancing Global and Local Drivers in Adaptive Management Models

Readings:
Ehrlich: Chapter 15 (read carefully)- Conservation of Natural Capital
N&C: Chapter 18- Open Ocean Area Management

Modeling:
Research:

Unit V: Reuniting The Landscape

April 1- Landscape, Processes, Services, Agents, and Trade-Offs in the Mass Bay Ecosystem

Readings:
Ehrlich: Chapters 16 and Epilogue- Governance, Global Trade, and Communications
N&C: Chapter 25- Closing the Ocean Commons

Modeling:
Research:

April 6- Landscape, Processes, Services, Agents, and Trade-Offs in the Lake Victoria Ecosystem

Readings:
N&C: Chapter 21- Legal Aspects of Marine Conservation
Modeling:
Research:

April 8- Landscape, Processes, Services, Agents, and Trade-Offs in the Belize Ecosystem

Readings:
N&C: Chapter 22- Dealing With Uncertainty
Modeling:
Research:

April 13- Landscape, Processes, Services, Agents, and Trade-Offs in the South Florida Ecosystem

Readings:
N&C: Chapter 23- Coral Reefs as a Case Study in Restoration
Modeling:
Research:

**Unit VI: Project Troubleshooting and Presentations**

April 15
Project work and troubleshooting

April 20
Project work and troubleshooting

April 22
Project work and troubleshooting

April 27
Project Presentations

April 29
Project Presentations