

## COURSE SYLLABUS

- TEXTS: Brown, Lester R. 2006. Plan B 2.0: Rescuing a Planet Under Stress and a Civilization in Trouble. W.W. Norton. ISBN: 0-393-32831-7
- Colburn, Theo, Dianne Dumanoski, and John P. Myers. 1997. Our Stolen Future. Penguin Books. ISBN: 0-452-27414-1
- Diamond, Jared. 2005. Collapse: How Societies Choose to Fail or Succeed. Viking Penguin. ISBN: 0-670-033375-5
- Leopold, Aldo. 1949. A Sand County Almanac. Oxford University Press. Reprinted 1966. ISBN: 0-345-34505-3
- Wilson, Edward O. and Dan L. Perlman. 2000. Conserving Earth's Biodiversity<sup>1</sup>. CD-ROM for Mac or Windows. Island Press. ISBN: 1-55963-779-9

*In the end, our society will be defined not only by what we create,  
but by what we refuse to destroy.*

John Sawhill  
President, The Nature Conservancy (1990-2000)

*Socialism collapsed because it did not allow the market to tell the economic truth.  
Capitalism may collapse because it does not allow the market to tell the ecological truth.*

Oystein Dahle  
Former Vice President of Exxon for Norway and the North Sea

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<sup>1</sup> This software package will be provided by the instructor.

## COURSE OBJECTIVES:

In this course we will explore the relationship between humans and nature. In the short period since their evolutionary origin humans have become the single, dominant species on earth. Because of our technology and our population we are now changing global ecosystems in a manner that would have been unimaginable 100 years ago. Humans are destroying or modifying ecosystems and consuming resources at an unprecedented rate. We will examine the current trends associated with this environmental change. We will look at how past societies responded to environmental problems and how their decisions led to failures or successes. Using principles of ecology we will try to understand what environmental change may mean for us and for other species with which we share the biosphere. Special attention will be given to the loss of biological diversity and the forces which cause it.

A central theme of the course will be the interconnection between human activities in one part of the biosphere and the effects these activities have elsewhere. We will examine how industrialized countries, especially the United States, have disproportionate effects on the global ecosystem. In short, we will try to understand how our life-style influences our environment. We will examine the contribution of human population growth to environmental change. Unbridled population growth and the development which goes with it are tied to most of the environmental trends which are changing global ecosystems. For this reason continued growth of the human population represents a threat not only to the stability of global ecosystems but also to the well-being of humankind.

Another theme running through the course is that human well-being depends on essential services of nature (ecosystem functions). In conservation ecology there has been a shift in focus from preserving species and ecosystems for their own sake to managing ecosystems for the sustainability of ecosystem functions which support humankind. Sustainable development of natural resources is required for our way of life, yet today we are living on our "ecological capital" rather than the "interest" which it generates. Many ecologists now feel that the human impact on global ecosystems has begun to deteriorate the capacity of those ecosystems to provide essential services of nature.

Sustainable resource use and preservation of species is no longer limited by management techniques, rather man's social institutions are key. For this reason we will look at environmental issues through several lenses: economics, culture, and politics. For example, in economics the market prices of most resources do not reflect their total value and utility, and so they are not used efficiently. We will look at ways to incorporate valuation for services of nature into our economic system. Development and conservation are sustainable only in the context of culture, and we will examine how some forms of development may be culturally appropriate while others are not.

GRADING:

Grades are based on three hour exams, quizzes and homework, and a final exam. Hour exams will cover lecture materials. Quizzes will generally be on outside reading assignments (e.g. a scientific paper from the literature, a Web assignment, library readings in a reserve reference book, etc.). However, quizzes may also include material from lecture.

	<u>Point Value</u>	<u>Percentage of Final Grade</u>
Three hour exams (200 points each)	600	60%
Quizzes and/or homework assignments <sup>2</sup> (probably 3-4, each worth about 30-50 points)	150	15%
Final exam	<u>250</u>	<u>25%</u>
	1000	100%

For those who wish to do so, there is an option for a limited amount of extra credit. See page 14.

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<sup>2</sup> I don't really know how many quizzes and homework assignments there will be, but figure on three or four. In any case, their contribution to the total grade will be no more than 15%.

## LECTURE TOPICS

### **Introduction**

Scope and purpose of the course

What is your standard of living? What is your ecological footprint?

Comparing your ecological footprint to other peoples in the world

### **Historical perspectives**

Man's relation to nature and how it has changed

How are we connected to the land? The story of Bob Hart.

What can we learn from the past?

What societies in the past collapsed, and how did environmental degradation contribute to their demise?

Why did some societies collapse while others did not?

How have past societies responded to environmental problems?

Origins of the modern conservation movement

### **Environmental trends and the concept of the commons**

What do the data show about environmental trends?

Emerging water shortages

Eroding soils, shrinking cropland, food production, and air quality

Biological diversity and tropical forests

Global climate change

Human population growth

Was Malthus right?

The problem of lag time in environmental issues

Does world population growth justify the alarms sounded by environmental Cassandras?

What are the connections between environmental degradation and violent conflict?

The concept of the commons

Garrett Hardin and the tragedy of the commons

The essence of environmentalism

### **Societies which collapsed**

Easter Island and deforestation

Pitcairn and Henderson Islands - interdependency

The Anasazi: population growth and climate change

Maya: environmental damage, population growth, hostile neighbors and climate change

Mesopotamia: Sumerian City States

The Greenland Norse

### **Societies that succeeded**

Tikopia, Highland New Guinea

Tokugawa Japan

**Why do some societies make disastrous decisions**

Haiti and the Dominican Republic

The world as a polder

**The science of ecology**

How ecologists look at the world

General principles

Ecosystem functions; energy flow, biogeochemical cycles

Relationships among species

Generalizations about ecosystems

Succession and community development.

How ecosystems respond to disturbance

Ripple effects and ecological interdependencies

Biogeography

**Biodiversity**

How many species are there on earth, and how fast are they being lost?

An inordinate fondness for beetles

Important misconceptions about the loss of biodiversity

Man as a planetary, serial killer

What the earth does for us, and what we do to the earth. Services of nature.

Biodiversity “hotspots” - geographic regions of exceptional species diversity

Causes behind the loss of biological diversity

Why are small populations at risk?

Amphibian decline: What are the frogs telling us?

Are we entering the “Homogenocene?”

Why are we detached? Most of us, scientists included, refuse even to mourn.

**Environmental ethics**

What is an ethic? How do ethics develop?

Do humans have a responsibility to nature? To future generations?

Leopold’s *land ethic*

Eastern and western views of the relationship between humans and nature

Population control: a central issue in environmental ethics

How many people do we want? How do we arrive at that number?

“Lifeboat ethics”

Hardin’s dilemma in helping poor nations

**Ecological economics**

The market: How is value determined?

Total utilitarian values of most natural resources and services of nature are not reflected in the market place, and they are not used efficiently.

Externalities

Common property

Nonsubstitutability of the services of nature

Cost-benefit analysis

Natural resources as capital

**Ecological economics** (continued)

Toward sustainability

How do we account for natural resources and services of nature in the economic system?

Tax shifting from income to environmentally destructive activities

An attitude shift: From “*economizing ecology*” to “*ecologizing the economy*”

**Policies and strategies for conservation**

Why both market forces and government action are required to manage resources of the commons

Can the drive for profit which has done so much environmental damage be harnessed to save important ecosystems?

Incentives and disincentives

Removing outdated and perverse incentives, tradeable permits

Environmental legislation

Targeting loans and international aid for development, debt-for-nature swaps, ecotourism

Raising the productivity of water and land

Cutting carbon emissions

Response to social challenges

International aid for population control

Lecture Target Dates

Mon.	28 Aug.	Introduction
Wed.	30 Aug.	Our standard of living and our ecological footprint
Fri.	1 Sept.	Historical perspectives
Mon.	4 Sept.	Historical perspectives
Wed.	6 Sept.	Historical perspectives
Fri.	8 Sept.	Environmental trends: oil, water, soil, and croplands
Mon.	11 Sept.	Environmental trends: air quality, biodiversity, tropical forests
Wed.	13 Sept.	Environmental trends: global climate change
Fri.	15 Sept.	Environmental trends: global climate change
Mon.	18 Sept.	Population growth
Wed.	20 Sept.	Population growth
Fri.	22 Sept.	The concept of the commons
Mon.	25 Sept.	<b>First Hour Exam (8)</b>
Wed.	27 Sept.	Hardin's Tragedy of the commons
Fri.	29 Sept.	Societies which collapsed: Easter Island, Pitcairn, Henderson, Anasazi
Mon.	2 Oct.	Societal collapse: the Maya, Sumer, Greenland Norse
Wed.	4 Oct.	Societies that succeeded: Tikopia, Highland New Guinea, Tokugawa Japan
Fri.	6 Oct.	Rwanda's genocide: proximal and ultimate causes, Haiti, and Dominican Republic (Mid Term)
Sat.	7 Oct. - Tue. 10 Oct.	Fall Break
Wed.	11 Oct.	Why some societies make disastrous decisions. The world as a polder.
Fri.	13 Oct.	Ecology
Mon.	16 Oct.	Ecology
Wed.	18 Oct.	Ecology
Fri.	20 Oct.	Ecology
Mon.	23 Oct.	<b>Second Hour Exam (8)</b>
Wed.	25 Oct.	Ecology
Fri.	27 Oct.	Biodiversity
Mon.	30 Oct.	Biodiversity

Wed.	1 Nov.	Biodiversity
Fri.	3 Nov.	Biodiversity
Mon.	6 Nov.	Biodiversity
Wed.	8 Nov.	Biodiversity
Fri.	10 Nov.	Environmental ethics
Mon.	13 Nov.	Environmental ethics
Wed.	15 Nov.	Environmental ethics
Fri.	17 Nov.	Environmental ethics
Mon.	20 Nov.	Environmental economics
Wed.	22 Nov. - Sun. 26 Nov.	Thanksgiving vacation
Mon.	27 Nov.	Environmental economics
Wed.	29 Nov.	<b>Third Hour Exam (7)</b>
Fri.	1 Dec.	Environmental economics
Mon.	4 Dec.	Policies and strategies
Wed.	6 Dec.	Policies and strategies
Fri.	8 Dec.	Culture
Wed.	14 Dec. - Tue. 20 Dec	Final Exams



TIME LINE FOR READING ASSIGNMENTS <sup>3</sup>

<u>Lecture Topic</u>	<u>Reading Assignment</u>	<u>Due Date for Completion</u>	
Introduction			
Leopold, Preface and Foreword	xiii – xix	Tue.	29 Aug.
Part I: A Sand County Almanac pp.	3-100	Tue.	29 Aug.
Part II: Quality of Landscape	pp. 101-176	Fri.	1 Sept.
Part III: A Taste for Country	pp. 177-236	Fri.	1 Sept.
Part IV: The Upshot	pp. 237-295	Mon.	4 Sept.
Homework exercises on ecological footprint		Wed.	6 Sept.
Historical Perspectives <sup>4</sup>			
Diamond, Prologue: A Tale of Two Farms		Wed.	6 Sept.
Chapter 1: Under Montana's Big Sky		Wed.	6 Sept.
Papers by: Ponting, C. 1990. <i>Environment</i> 32:	4-33	Fri.	8 Sept.
Diamond, J. 1995. <i>Discover</i> . Aug. pp. 63-69		Fri.	8 Sept.
Diamond, J. 1997. <i>Discover</i> . Nov. pp. 69-78		Fri.	8 Sept.
Environmental Trends			
Brown, Preface & Chapters 1-3, pp. 3-58		Mon.	11 Sept.
Chapters 4-6 pp. 59-120		Wed.	13 Sept.
Papers by: Hardin, G. 1968.			
	<i>Science</i> 162: 1243-1248	Fri.	22 Sept.
Homer-Dixon et al. 1993.			
	<i>Sci. Amer.</i> 286: 38	Fri.	22 Sept.
Societies which collapsed			
Diamond, Chapters 2,3 and 4		Fri.	29 Sept.
Diamond, Chapters 5, 6-8		Mon.	2 Oct.
Societies that succeeded			
Diamond, Chapter 9		Wed.	4 Oct.

<sup>3</sup> The scientific papers in the reading assignments are listed by lecture topic on page 12. Copies of these will be supplied in class, so you need not ferret them out in the library.

<sup>4</sup> Note that for this topic I have included two articles by Diamond in *Discover* magazine (see page 12). These will be distributed in class. Both are shorter, earlier versions of the material in Chapters 2 and 3 of his book *Collapse*.

TIME LINE FOR READING ASSIGNMENTS  
(continued)

<u>Lecture Topic</u>	<u>Reading Assignment</u>	<u>Due Date for Completion</u>	
Modern societies	Diamond, Chapters 10, 11, and 12	Fri.	6 Oct.
Societal decisions	Diamond, Chapter 14	Wed.	11 Oct.
The world as a polder	Diamond, Chapter 16	Wed.	11 Oct.
The science of ecology	ESA booklets: <i>Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems</i> <i>Biodiversity and Ecosystem Functioning: Maintaining Natural Life Support Processes</i>	Mon.	16 Oct.
	Papers by: Vitousek, P.M. et al. 1986. <i>BioScience</i> 36: 368-373	Fri.	20 Oct.
	Laurance, W.F. et al. 1997. <i>Science</i> 278: 1117-1118	Fri.	20 Oct.
	Paper by: Wuethrich, B. 2000. <i>Science</i> . 289: 35-36	Wed.	25 Oct.
	Colburn et al, Prologue, Preface, & pp. 1-121 <sup>5</sup>	Mon.	6 Nov
	Colburn et al, pp. 122-266	Mon.	20 Nov
Biodiversity	Papers by: Gentry, A. 1988. <i>Proc. Natl. Acad. Sci.</i> 85: 156-57	Fri.	27 Oct.
	Erwin, T.L. 1991. <i>Conservation Biology</i> 5: 330-333	Fri.	27 Oct.
	Erwin, T.L. 1988. In: E.O. Wilson, <i>Biodiversity</i> . Nat. Acad. Press. pp. 13-18	Mon.	30 Oct.
	Myers, N. et al. 2000. <i>Nature</i> . 403: 403: 853-858	Mon.	30 Oct.

<sup>5</sup> I would suggest that you start Colburn's book after the second hour exam. Her message is important, although as you will see when you read the book rather unsettling. Try to finish the book before Thanksgiving recess, in any event before the third hour exam (29 November) since it will be included on the third exam.

TIME LINE FOR READING ASSIGNMENTS  
(concluded)

<u>Lecture Topic</u>	<u>Reading Assignment</u>	<u>Due Date for Completion</u>	
Biodiversity	Wilson & Perlman CD-ROM: homework exercises on Populations and biodiversity (assigned in class) <sup>6</sup>	Wed.	15 Nov.
Environmental Ethics	Paper: Hardin, G. 1974. <i>BioScience</i> . 24: 561-568	Wed.	15 Nov.
Ecological Economics	Brown, Chapter 10. Stabilizing Climate. pp. 182-203 Diamond, Chapter 12, Chapter 15	Mon.	27 Nov. Fri.
1 Dec.	Papers by: Bhagwati, J. 1993. <i>Sci. Amer.</i> Nov. 42-49 Daly, H.E. 1993. <i>Sci. Amer.</i> Nov. 50-57 Pimentel, D. et al. 1992. <i>BioScience</i> . 42: 750-760	Fri. Fri. Fri.	1 Dec. 1 Dec. 1 Dec.

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<sup>6</sup> It is a good idea to work in groups of two or three students to get started with the CD-ROM. Once you become familiar with how to use the program, you will find that it is a good source of materials for other topics we will be covering in class. The CD contains interactive exercises, short lectures, slide shows, video clips, and numerous Web links to supplemental materials. The Web links take you to an impressive array of environmentally relevant information (e.g. United Nations and U.S. Government data bases, professional organizations, census statistics, world geographic info., etc.).

## JOURNAL ARTICLES BY TOPIC

Even though you may not be a science major, I think it is important for you to read a few scientific papers. This will give you a sense for how scientists think, how they write, and how they communicate with each other. So, from time to time I will give you journal articles (scientific papers) which relate to lecture topics. A few of these are classic articles in ecology or conservation biology. Others are related to historical, economic, or cultural topics in the course. They will be distributed in class several days before they are to be discussed.

### Historical perspectives

Ponting, Clive. 1990. Historical perspectives on sustainable development. *Environment* 32: 4-33

### Environmental trends and the commons

Diamond, Jared. 1995. Easter's End. *Discover*. August. pp. 63-69

Diamond, Jared. 1997. Paradises Lost. *Discover*. November. pp. 69-78

Hardin, G. 1968. The tragedy of the commons. *Science* 162: 1243-1248

Homer-Dixon, T.F., J.H. Boutwell, and G.W. Rathjens. 1993. Environmental change and violent conflict. *Scientific American*. 268: 38-45

Odum, W.E. 1982. Environmental degradation and the tyranny of small decisions. *BioScience*. 32: 728-729

Vitousek, P.M., P.R. Ehrlich, A.H. Ehrlich and P.A. Matson. 1986. Human appropriation of the products of photosynthesis. *BioScience* 36: 368-373

### The science of ecology

Laurance, W.F. et al. 1997. Biomass collapse in Amazonian forest fragments. *Science*. 278: 1117-1118

Wuethrich, B. 2000. Combined insults spell trouble for rainforests. *Science*. 289: 35-36

### Biodiversity

Erwin, T.L. 1991. How many species are there?: Revisited. *Conservation Biology*. 5: 330-333

JOURNAL ARTICLES  
(continued)

Biodiversity (continued)

Erwin, T.L. 1988. The tropical forest canopy: The heart of biotic diversity. In: E.O. Wilson. *Biodiversity*. National Academy Press. pp. 13-18 ISBN: 0-309-03739-5

Gentry, A. 1988. Tree species richness of upper Amazonian forests. *Proc. Natl. Acad. Sci. US*. 85: 156-157.

Myers, Norman et al. 2000. Biodiversity hotspots for conservation priorities. *Nature*. 403: 853-858

Environmental ethics

Hardin, G. 1974. Living on a Lifeboat. *BioScience*. 24: 561-568

Ecological economics

Bhagwati, J. 1993. The case for free trade. *Scientific American* Nov. 42-49

Daly, H.E. 1993. The perils of free trade. *Scientific American* Nov. 50-57

Pimentel, D. et al. 1992. Environmental and economic costs of pesticide use. *BioScience*. 42: 750-760

### EXTRA CREDIT READINGS AND VIDEOS

For those who wish to do so, there are outside readings on reserve and extra credit videos which may be viewed in Reeves Library. The outside readings come from John McPhee's book:

McPhee, John. 1971. Encounters with the Archdruid. Farrar, Straus and Giroux

There are three chapters in the book: *A Mountain, An Island, and A River*. The narratives of the chapters are set in three wildernesses between David Brower, a militant conservationist (the "archdruid")<sup>7</sup> and three of his antagonists who seek to develop land or extract resources. The book brings into sharp focus the philosophical divide between men of integrity who hold different views about their environment. McPhee captures the essence of each man's arguments revealing the complex and difficult nature of many environmental decisions. Each chapter is worth 20 points; you may read two of them for extra credit. If you elect to do this, you must advise the instructor in advance. To receive credit you need to turn in a one-page abstract (more if you simply can't control yourself) summarizing the central ideas of the chapter(s) you read.

The video titles on the following page are on reserve in Reeves Library. Each is worth 10 points. You may select up to three of them. They can be viewed in the library. To receive credit you need to advise the instructor of your intent and turn in a one-page abstract summarizing the central ideas of the film. Your summary should be turned in within one week of viewing the film.

The maximum extra credit is 40 points (reading two chapters in McPhee's book). All reading and video summaries must be turned in to the instructor on or before **Wednesday 6 December**. Extra credit summaries are not accepted during final exam week. Videos are listed on page 15. The ones marked with an asterisk may be on reserve for Biology 119 as well as for this course, so look both places if you are interested in them.

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<sup>7</sup> Charles Frazer, a resort developer, regards all conservationists as druids, "religious figures who sacrifice people and worship trees."

## RESERVE VIDEOS

### Historical perspectives

Wilderness - An American Ideal\*

### Environmental trends

Race to Save the Planet 5: Remnants of Eden

What's Up with the Weather (NOVA)

### The science of ecology

Amazon, Land of the Flooded Forest\*

Manu: Peru's Hidden Rainforest\*

The Queen of Trees\*

### Biodiversity

Alien Invaders: Exotic Species in the Food Web of the Great Lakes

Rain Forest (National Geographic)

Rain Forest: Heroes of the High Frontier (National Geographic)

Nomads of the Rain Forest (NOVA)

Spirits of the Rainforest (Discovery channel video)\*

### Environmental ethics

Aldo Leopold's Wilderness\*

From the Heart of the World: The Elder Brother's Warning