

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 Biodiversity¹. 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

¹ 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 also 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 global climate change and to the loss of biological diversity. We will examine the forces which cause these phenomena.

A central theme of the course will be the interconnection between human activities in one part of the biosphere and the effects which 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 the preservation of species are 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 ² (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.

LECTURE TOPICS

Introduction

Scope and purpose of the course

² 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%.

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

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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

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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

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Lecture Target Dates

Mon.	27 Aug.	Introduction
Wed.	29 Aug.	Our standard of living and our ecological footprint
Fri.	31 Aug.	Historical perspectives
Mon.	3 Sept.	No class (Labor Day)
Wed.	5 Sept.	Historical perspectives
Fri.	7 Sept.	Historical perspectives

Mon.	10 Sept.	Environmental trends: oil, water, soil, and croplands
Wed.	12 Sept.	Environmental trends: air quality, biodiversity, tropical forests
Fri.	14 Sept.	Environmental trends: global climate change
Mon.	17 Sept.	Environmental trends: global climate change
Wed.	19 Sept.	Population growth
Fri.	21 Sept.	Population growth
Mon.	24 Sept.	First Hour Exam
Wed.	26 Sept.	The concept of the commons
Fri.	28 Sept.	Hardin's Tragedy of the commons
Mon.	1 Oct.	Societies which collapsed: Easter Island, Pitcairn, Henderson, Anasazi
Wed.	3 Oct.	Societal collapse: the Maya, Sumer, Greenland Norse
Fri.	5 Oct.	Societies that succeeded: Tikopia, Highland New Guinea, Tokugawa Japan (Mid Term)
Sat.	6 Oct. - Tue. 9 Oct.	Fall Break
Wed.	10 Oct.	Rwanda's genocide: proximal and ultimate causes, Haiti, and Dominican Republic
Fri.	12 Oct.	<i>Natural Connections</i>
Mon.	15 Oct.	Why some societies make disastrous decisions. The world as a polder.
Wed.	17 Oct.	Ecology
Fri.	19 Oct.	Ecology
Mon.	22 Oct.	Ecology
Wed.	24 Oct.	Second Hour Exam
Fri.	26 Oct.	Ecology
Mon.	29 Oct.	Ecology
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Wed.	31 Oct.	Biodiversity
Fri.	2 Nov.	Biodiversity
Mon.	5 Nov.	Biodiversity
Wed.	7 Nov.	Biodiversity
Fri.	9 Nov.	Biodiversity
Mon.	12 Nov.	Biodiversity
Wed.	14 Nov.	Environmental ethics
Fri.	16 Nov.	Environmental ethics
Mon.	19 Nov.	Environmental ethics

Wed.	21 Nov. - Sun. 25 Nov.	Thanksgiving vacation
Mon.	26 Nov.	Environmental ethics
Wed.	28 Nov.	Third Hour Exam
Fri.	30 Nov.	Environmental economics
Mon.	3 Dec.	Environmental economics
Wed.	5 Dec.	Environmental economics
Fri.	7 Dec.	Policies and strategies
Mon.	10 Dec.	Policies and strategies
Wed.	12 Dec. - Wed. 19 Dec	Final Exams

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TIME LINE FOR READING ASSIGNMENTS ³

<u>Lecture Topic</u>	<u>Reading Assignment</u>	<u>Due Date for Completion</u>
Introduction		
Leopold, Preface and Foreword	xiii – xix	Wed. 29 Aug.
Part I: A Sand County Almanac	pp. 3-100	Wed. 29 Aug.
Part II: Quality of Landscape	pp. 101-176	Fri. 31 Aug.
Part III: A Taste for Country	pp. 177-236	Fri. 31 Aug.

³ 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.

Part IV: The Upshot	pp. 237-295	Mon.	3 Sept.
Homework exercises on ecological footprint		Wed.	5 Sept.
Historical Perspectives ⁴			
Diamond, Prologue: A Tale of Two Farms		Wed.	5 Sept.
Chapter 1: Under Montana's Big Sky		Wed.	5 Sept.
Papers by: Ponting, C. 1990. <i>Environment</i> 32: 4-33		Fri.	7 Sept.
Diamond, J. 1995. <i>Discover</i> . Aug. pp. 63-69		Fri.	7 Sept.
Diamond, J. 1997. <i>Discover</i> . Nov. pp. 69-78		Fri.	7 Sept.
Environmental Trends			
Brown, Preface & Chapters 1-3, pp. 3-58		Mon.	10 Sept.
Chapters 4-6 pp. 59-120		Wed.	12 Sept.
Papers by: Hardin, G. 1968.			
<i>Science</i> 162: 1243-1248		Fri.	21 Sept.
Homer-Dixon et al. 1993.			
<i>Sci. Amer.</i> 286: 38		Fri.	21 Sept.
Societies which collapsed			
Diamond, Chapters 2,3 and 4		Fri.	28 Sept.
Diamond, Chapters 5, 6-8		Mon.	1 Oct.
Societies that succeeded			
Diamond, Chapter 9		Wed.	3 Oct.

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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.	5 Oct.
Societal decisions			
	Diamond, Chapter 14	Wed.	10 Oct.
The world as a polder			
	Diamond, Chapter 16	Wed.	10 Oct.
The science of ecology			
	ESA booklets:	Mon.	15 Oct.

⁴ 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*.

Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems
Biodiversity and Ecosystem Functioning: Maintaining Natural Life Support Processes

Papers by: Vitousek, P.M. et al. 1986. <i>BioScience</i> 36: 368-373	Fri.	19 Oct.
Laurance, W.F. et al. 1997. <i>Science</i> 278: 1117-1118	Fri.	19 Oct.
Paper by: Wuethrich, B. 2000. <i>Science</i> . 289: 35-36	Wed.	24 Oct.
Colburn et al, Prologue, Preface, & pp. 1-121 ⁵	Mon.	5 Nov
Colburn et al, pp. 122-266	Mon.	19 Nov

Biodiversity

Papers by: Gentry, A. 1988. <i>Proc. Natl. Acad. Sci.</i> 85: 156-57	Fri.	26 Oct.
Erwin, T.L. 1991. <i>Conservation Biology</i> 5: 330-333	Fri.	26 Oct.
Erwin, T.L. 1988. In: E.O. Wilson, <i>Biodiversity</i> . Nat. Acad. Press. pp. 13-18	Mon.	29 Oct.
Myers, N. et al. 2000. <i>Nature</i> . 403: 403: 853-858	Mon.	29 Oct.

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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) ⁶	Wed. 14 Nov.

⁵ 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 last exam.

⁶ 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.).

Environmental Ethics

Paper: Hardin, G. 1974. *BioScience*. 24: 561-568 Wed. 14 Nov.

Ecological Economics

Brown, Chapter 10. Stabilizing Climate. pp. 182-203 Mon. 26 Nov.
Diamond, Chapter 12, Chapter 15 Fri. 7 Dec.
Papers by: Bhagwati, J. 1993. *Sci. Amer.* Nov. 42-49 Fri. 7 Dec.
Daly, H.E. 1993. *Sci. Amer.* Nov. 50-57 Fri. 7 Dec.
Pimentel, D. et al. 1992. *BioScience*. Fri. 7 Dec.
42: 750-760

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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

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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

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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")⁷ 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

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

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 5 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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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

