Upcoming Readings

today: Leopold readings, Text Ch. 4, Costanza et al. 1997, Driessen 2004

Thurs 06 Sept: Walther et al. 2002, Peak Oil Link, (optional: National Geographic)

Tues 11 Sept: Text Ch. 4, and pp. 207-213

Conservation Biology Lab 406L/506L

Next Lab Friday 07 September
1230 S or W side BSE
(4th and Highland)

Hat, water, sunscreen, close-toed shoes

Readings on Course Website

07 September - Sabino Canyon
VAN
Flooding, Wilderness, Forest Management, Nuisance Wildlife
Especially relevant for 506 students:

**Conservation Seminar**

If you are interested in participating in the Conservation Seminar (RNR696a – but you don’t need to enroll) please attend **Wednesday at 3:30 in BSE 218**.

Chris McDonald
cmcdon@email.arizona.edu
(contact for readings)

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**Public Water Lecture with Peter Gleick**

Fresh water availability is a growing issue of concern across the world, but nowhere more than in arid lands. Tucson is no exception.

Will projections of our water supply in the distant future - even in the next decade or two - be accurate? How will prolonged drought affect both water quantity and quality? What impacts will water supply have on the region's economic viability?

Sustainable Tucson is co-host of a public lecture by international water expert, Peter Gleick, along with the Water Resources Research Center (WRRC) and Institute for the Study of Planet Earth (ISPE) at the University of Arizona, and the Southern Arizona Leadership Council (SALC).

A **MacArthur Fellow** and widely published in leading scientific journals, Dr. Peter Gleick is one of the world's top experts on the impacts of climate change on water supply. His work with communities and governments across the Southwest and the world brings a broad perspective to the local discussion.

How can we define **sustainable water policies**, based on sound laws and science? To what extent will water transfers and markets - the economics of shifting water - help us reconcile growth and supplies which are limited, keeping in mind that global warming, as well as land-use changes, will likely affect both surface and groundwater systems?

Sustainable Tucson believes Dr. Gleick's vision can help inform local planning by bringing the experience of many communities to bear on Tucson's creative solutions to long-term water security.

Dr. Gleick will address water experts and other leaders at the Arizona Hydrologic Society's regional conference, "Sustainable Water, Unlimited Growth, and Quality of Life: Can We Have It All?" to be held August 27 – 30 in Tucson.

The joint planning of this public lecture amongst university departments, civic, business, and community groups, points to exciting new dialogue over water and sustainability taking place in our community.

The lecture will take place in **Tucson on August 30, at 7:30 p.m. at Temple Emanu-El - 225 N. Country Club Rd.**

**Contact Madeline Kiser (mkiser@dakotacom.net) or Susan Williams (susanleewilliams@cox.net) for more information.**
Debate 20 Sept 2007:
Should the flat-tailed horned lizard (*Phrynosoma mcallii*) be ESA listed?

Three groups – one will debate, another will evaluate, third will observe, then we rotate.

<table>
<thead>
<tr>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
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<tbody>
<tr>
<td>Debate 1 (20 Sept.)</td>
<td>506 A assist</td>
<td>506 B observe</td>
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<tr>
<td>Group A debate</td>
<td>506 B assist</td>
<td>506 C assist</td>
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<td>Group B evaluate</td>
<td>506 C observe</td>
<td>506 C observe</td>
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<td>Group C observe</td>
<td>Debate 2 (23 Oct.)</td>
<td>506 A observe</td>
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<td>Debate 2 (23 Oct.)</td>
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<td>Group B debate</td>
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<tr>
<td>Group C evaluate</td>
<td>Debate 3 (15 Nov.)</td>
<td>506 A assist</td>
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<tr>
<td>Debate 3 (15 Nov.)</td>
<td>506 A assist</td>
<td>506 B observe</td>
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<td>Group A evaluate</td>
<td>506 B observe</td>
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<td>506 C observe</td>
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</table>
“Objectivity is only possible in matters too small to be important, or in matters too large to do anything about.” (p. 226)

-Leopold
Aldo Leopold:

Thinking Like a Mountain
Escudilla

The Land Ethic

The Outlook for Farm Wildlife
The Land-Health Concept and Conservation
Aldo Leopold

“An ethic, ecologically, is a limitation on freedom of action in the struggle for existence.

An ethic, philosophically, is a differentiation of social from anti-social conduct.”

(p. 238)

Aldo Leopold Land Ethic

- social evolution (social disapproval for wrong actions)
- land ethic enlarges the community to include biota
- human as plain member and citizen, not ruler
- conqueror self defeating because falsely thinks s/he understands how the system works and can control it
Leopold Land Ethic

- Property vs. propriety
- Role of land [biology] in human history (Diamond, *Guns Germs and Steel*)
- Sacrifice
- Obligation of private landowner
- Livestock, Violence
- Economics?
  Farm as Factory or Place to Live?

Aldo Leopold Land Ethic

- What is “land-health?”
- processes
  - evolutionary/ecological biology
- complexity & quality
- invasives
“a thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise”

Aldo Leopold
Leopold

Thinking like a mountain
“a mountain lives in mortal fear of its deer”

Escudilla
progress?
“It’s only a mountain now.”

The planet will survive, will we?

“In our attempt to make conservation easy we have made it trivial” (p.246)

-Leopold
The Land-Health Concept and Conservation

Conservation is a series of ecological predictions made by beginners because ecologists have failed to offer any.

Leopold, p. 220

“Whether you will or not
You are a King, Tristram, for you are one
Of the time-tested few that leave the world,
When they are gone, not the same place it was.
Mark what you leave.”

As quoted in Leopold, 1949
p. 261 (The Land Ethic)
Human Population?

Discussion:

1. How do conservationists respond to the question, “What good is it?”

2. How do we verify that humans, or anything, has intrinsic value?

3. “Enclosed/Private” Goods, or “Common” Goods - Which of these is a better approach for conservation? Why?

4. What is the conservation role of the world’s religions?
The value of the world’s ecosystem services and natural capital

Robert Costanza 1*, Robert d’Arge 2, Releuf de Groot 3, Stephen Farber 4, Monica Grasso 5, Bruce Hannon 6, Karin Limburg 7, Shahid Nasr 8, Robert V. O’Neill 9, Jose Paruelo 10, Robert G. Raskin 4, Paul Sutton 5 & Marjan van den Belt 11

1 Center for Environmental and Ecotonic Studies, Environmental Studies, and 1 Institute for Ecological Economics, University of Maryland, 3608 Solomons, Maryland 20688, USA
2 Economics Department (econometrics), University of Wyoming, Laramie, Wyoming 82070, USA
3 Center for Environmental and Economic Studies, Wageningen Agricultural University, PO Box 1045, 6700 AA Wageningen, The Netherlands
4 Graduate School of Public and International Affairs, University of Pittsburgh, Pittsburgh, Pennsylvania 15260, USA
5 Geography Department and NCSE, University of Illinois, Urbana, Illinois 61801, USA
6 Nature of Economic Studies, New York, NY, USA
7 Center for Environmental Studies, University of Minnesota, St Paul, Minnesota 55108, USA
8 Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6178
9 Department of Zoology, Faculty of Agronomy, University of Buenos Aires, Av. San Martin 4455, 1428 Buenos Aires, Argentina
10 Institute of Anthropology, University of California at Santa Barbara, Santa Barbara, California 93106, USA
11 Biological Sciences and Environmental Studies, University of Maryland, 3608 Solomons, Maryland 20688, USA

The services of ecological systems and the natural capital stocks that produce them are critical to the functioning of the Earth’s life-support system. They contribute to human welfare, both directly and indirectly, and therefore represent part of the total economic value of the planet. We have estimated the current economic value of 17 ecosystem services for 16 biomes, based on published studies and a few original calculations. For the entire biosphere, the value (most of which is outside the market) is estimated to be in the range of US$18 - $48 trillion (1015) per year, with an average of US$33 trillion per year. Because of the nature of the uncertainties, this must be considered a minimum estimate. Global gross national product total is around US$18 trillion per year.

Lesser long-nosed bat (Leptonycteris curasoae) pollinating saguaro flower (Carnegia gigantea)
Figure 3: Global map of the value of ecosystem services. See Supplemental Information for details.

Costanza et al. 1997

$33 trillion/yr (16-54)
Global GNP = $18 trillion

[excluded non-renewable]

Gas regulation $1.3 trillion
Disturbance reg. $1.8 trillion
Waste treatment $2.3 trillion
Nutrient cycling $17 trillion

Marine Services $20.9 trillion
(coastal $10.6 trillion)
Forests $4.7 trillion
Wetlands $4.9 trillion

<table>
<thead>
<tr>
<th>No.</th>
<th>Ecosystem service and functions used in this study</th>
<th>Economic function</th>
<th>Economic value (in 1997 USD)</th>
</tr>
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<tbody>
<tr>
<td>1.</td>
<td>Gas regulation</td>
<td>Climate regulation</td>
<td>$1.3 trillion</td>
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Costanza et al. 1997
Table 1
Focus: Consequences of Ecosystem Change for Human Well-being

Costanza et al. 1997  Table 2
Chapter Five Footnotes

5. A more recent version of Malaria and the DDT story can be downloaded from the Institute of Economic Affairs website at http://www.itea.org.uk/lbdc.php?pubID=11
7. The chemical DDT was used to regulate the growth and opening of apples, until it became the subject of an attack launched by Fossen Communications, the NRDC, and CBS’s "60 Minutes." In a later interview, David Fossen admitted that the FR campaign was designed so that revenue would flow back to NRDC from the public." See Banner Cohen, John Carillo, et al., The Fear Profiteers: Do socially responsible businesses view health scares to reap monetary rewards? Arlington, Va: Lexington Institute (2000).
8. In its filing, Backlashes ignored thousands of pages of scientific evidence attesting to the pesticide’s safety and expert recommendations that its use be continued for malaria control.
Biodiversity (Biological Diversity)

“structural and functional variety of life forms at genetic, population, community, and ecosystem levels”

Nothing in biology makes sense except in the light of evolution.

Theodosius Dobzhansky
Miller 2003

Evolution of Life on Earth

Figure 5-9: Greatly simplified overview of the biological evolution of life on Earth, which was preceded by

Figure 5-8: Fossils and radiometric dating indicate that five major mass extinctions (indicated by arrows) have taken place over the past 650 million years. Most extinctions leave large numbers of organisms (shaded unoccupied) and create new ones. As a result, each mass extinction has been followed by periods of recovery preponderated by the wedge-shaped colonized adaptive radiations. During these periods, which last over 10 million years or more, new species evolve to fill now-vacant ecological roles (shaded). Many experts believe that we are now in the midst of a sixth mass extinction, caused primarily by human activities.

Major Extinction Events
Adaptive Radiation

Figure 5-10 Adaptive radiation of mammals began in the first 10-12 million years of the Cenozoic era (which began about 65 million years ago) and continues today. This evolution of a large number of now species is thought to have resulted when huge numbers of new and unclad ecological niches became available after the mass extinction of dinosaurs near the end of the Mesozoic era. (Used by permission from Ceco Starr and Ralph Taggert, Biology: The Unity and Diversity of Life, 8th ed., Belmont, CA: Wadsworth, 1998.)

Miller 2003
What is biodiversity?

![Pyramid of diversity diagram](image)

~12-14 million total species (50-90% in tropical forests)
~1.7 identified

most

least

Scientific American
November 2001

Primack 2006, Fig 3.6
How many species on earth?

Primack 2006, Fig 3.6

Research Focus?

Primack 2006
Biodiversity

1. Genetic  
   (nat. sel.)

2. Species

3. Ecological  
   forests, deserts, lakes, wetlands, reefs etc.

4. Functional  
   energy flow  
   nutrient cycling  
   etc.
Levels of Biological Organization.

Scaling.

Figure 4.15  Van Dyke 2003

Biodiversity and scale. A method of categorizing biodiversity at regional, coarse, intermediate, and local geographic scales.

Where is biodiversity?

One tree in Peru with same ant diversity as Britain
Species Richness and Latitude

**Figure 3.5** In North America, as in all the continents, the numbers of bird, tree, and mammal species increase toward the Tropics. The numbers of species indicated in the bar graphs correspond to latitude in the map at left. Tree species diversity is not available for some lower latitudes. (From Briggs 1995.)

Altitude?

**Figure 4.12**

Latitudinal patterns in species richness from tropical to temperate regions. In most taxa the number of species increases from temperate to tropical regions.

*Van Dyke 2003*

*After Reid and Miller (1989); Reprinted from Huston (1994).*