Wednesday 01 March 2006, 21st class meeting
(Miller Chapter 6 and 7)

Environmental Biology (ECOL 206)
U. Arizona, spring 2006

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Alice Boyle, Kristen Potter, Graduate TAs

1. Conservation Approaches

2. Lecture schedule updates on your website

3. 206 Lab Website for handouts and assignments
   Lab this week in the normal lab room (KOFL410)

06 March, next installment of Group Project due
PUSH BACK TO Wed 08 March

Exam II Friday 10 March 2006

In lab this week we will analyze and discuss the data you collected this past weekend.

Please bring your 2-page Mt. Lemmon lab handout, data, calculator, and cheerful disposition.

(No lab next week, work on your Group Projects and study for your exam)
Can Tropical Rainforests Be Saved?  
(PBS Home Video, 1991)

Think about:
- Global Interconnectedness
- Economics, Politics, Development
- Timeline of Economic Return
- Sustainability
- Consumption
- Human Population
- Developing vs. Developed World
- IMF, World Bank

2. Introduction and Literature Review (30 points)
Due 06 March 2006 (extended to Wed 08 March)

Now is your opportunity to explain in detail the environmental implications of the topic you have chosen. In a 5-7 page paper, you should explain the following:

- What are the ramifications of the current issue continuing on its course?
- What does the literature say about the effects of this issue?
- What are the biological, ecosystem, and economic costs and benefits associated with the issue?
- Have there been other studies or solutions related to the problem you are addressing? What success stories can you draw from in creating a solution?
- Tables and graphs of costs, benefits, effects on the environment, etc. are a useful addition here and are also very useful in the oral presentation.
- Describe how the changes you recommend fit into the bigger picture. Where do the resources involved come from? Who is impacted? What costs are associated? For example, if I were recommending the University purchase vegetables from a local grower, instead of an international conglomerate, whose jobs would be impacted? How much more fossil fuel is burnt shipping from far away as opposed to from close to Tucson, etc.

Your literature cited section should include at least 10 sources. At least half of these should be from peer-reviewed and/or primary literature. Use the parenthetical citation format of Conservation Biology, which you can find by looking up this journal online (the citation format in your syllabus is very similar as well).

These websites can help you understand what meant by primary and peer-reviewed literature:
http://www.lib.ecu.edu/Reference/workshop/primary.html
http://www.bergen.cc.nj.us/Library/userguide/IV_A_prim_sec.html
http://www.usd.edu/lhsl/ref/PublicationProcess.pdf
Biosphere Reserves (UN)

- Core
- Buffer
- Transition

Where?

Why?

The World Network of Biosphere Reserves includes more than 400 sites in 94 countries. It promotes North-South and South-South partnerships and represents a unique tool for international co-operation, through sharing of knowledge, exchanges of experiences and promotion of best practices. Co-operative activities of scientific research, global monitoring and training of specialists are promoted.
Organ Pipe Cactus National Monument
Pinacate Biosphere Reserve
Gulf of California Biosphere Reserve

Sonoran Desert National Park?
Protecting Biodiversity:

1. **amount** of habitat
2. **quality** of habitat
3. **distribution** or configuration of habitat
4. **connectivity** of habitat
Landscape-scale or metapopulation models

Which population is most/least likely to go extinct?
Laws and Treaties

**ESA (1973)**
Endangered species act
- USFWS, NMFS
  1. Critical habitat protection (economic hardship)
  2. Recovery Plans
Habitat Conservation Plans (private land owners)

**CITES (1975)**
Convention on international trade in endangered species
Red list (International Union for Conservation of Nature and Natural Resources)
>150 countries (costs vs. benefits)

Red list
(backend Union for Conservation of Nature and Natural Resources)

Categories of Threat in the IUCN Red List system:
1 Extinct,
2 Extinct in the Wild,
3 Critically Endangered,
4 Endangered,
5 Vulnerable,
6 Near Threatened,
7 Least Concern,
8 Data Deficient, and
9 Not Evaluated.

A species is listed as threatened if it falls in the Critically Endangered, Endangered or Vulnerable categories.
ESA (Endangered Species Act)

“Taking”
Shoot, Shovel, Shut Up

Led to Habitat Conservation Planning (HCP)
Incidental Take Permits (e.g., SDCP with mitigation)

San Bruno Mtns
-negotiate, compromise, all parties involved

“No Surprises”
MOAs
Safe Harbor Agreements

Need to include and motivate private landowners
Endangered Species Act of 1973, as Amended

- Section 3. Definitions
- Section 4. Determination of endangered species and threatened species (Listing)
- Section 5. Land acquisition
- Section 6. Cooperation with States
- Section 7. Interagency cooperation
- Section 8. International cooperation
- Section 8A. Convention implementation
- Section 9. Prohibited Acts
- Section 10. Exceptions
- Section 11. Penalties and enforcement
- Section 12. Endangered Plants

Section 10

Exceptions

10(a)(1)(A) – Recovery Permits
10(a)(1)(B) - HCP
**Extinction Risk Factors**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low reproductive rate</td>
<td>Blue whale, giant panda, rhinoceros</td>
</tr>
<tr>
<td>Specialized niche</td>
<td>Blue whale, giant panda, Everglades kite</td>
</tr>
<tr>
<td>Narrow distribution</td>
<td>Many island species, elephant seals, desert pupfish</td>
</tr>
<tr>
<td>Feeds at high trophic level</td>
<td>Bengal tiger, bald eagle, grizzly bear</td>
</tr>
<tr>
<td>Fixed migratory patterns</td>
<td>Blue whale, whooping crane, sea turtles</td>
</tr>
<tr>
<td>Rare</td>
<td>Many island species, African violet, some orchids</td>
</tr>
<tr>
<td>Commercially valuable</td>
<td>Snow leopard, tiger, elephant, rhinoceros, rare plants and birds</td>
</tr>
<tr>
<td>Large territories</td>
<td>California condor, grizzly bear, Florida panther</td>
</tr>
</tbody>
</table>

*Bats*  
*Passenger Pigeon*

http://www.epa.gov/epaoswer/non-hw/muncpl/reduce.htm
Restoration Ecology:

Science Times

For Iraq's Great Marshes, A Hesitant Comeback

Tuesday 08 March 2005

Bringing the Marshes Back From the Dead

Restoration has begun on wetlands in southern Iraq, which were nearly wiped out in 2003. Damage is extreme in some areas.

Arafa, from the town of Shabab, has made him feel "like a person detained in prison who is set free.

"In certain places, and with a fraction of their former beauty, the marshes have started to come back from the dead."

The project, financed by an array of American, Canadian, British, Italian and French agencies, is an effort to determine how and why this region can return to what was. The work includes soil and water sampling, computer modeling of water flow, training of local scientists and restocking some of the marshes with indigenous fish. One program also counsels with veterinarians and health services for the marsh Arabs.

To do their research, these scientists are deliberately navigating their way around tribal boundaries, as a continuing insurgency and the extreme positions and policies of the militias control the south of Iraq.

"The circumstances faced by the region's long inhabitants is a factor not to be overlooked," said Dr. Ahmad Alwadi, an American civil engineer originally from Iraq who is working in one of the areas.

"I used to call the marshes our sheltered paradise," said Dr. Alwadi, who is project senior director at the Washington research organization E.A.I. and a partner in New Kilani and New Kilani. "It was a place of refuge for people who didn't want to be under the control of the central government."
Biodiversity, the Species Approach

Species and ecosystems provide:

1 Economic Goods
   - Lumber, food, medicine

2 Ecological Services
   - Photosynthesis
   - Pollination
   - Soil formation
   - Nutrient cycling
   - Pest control
   - Climate regulation
   - flood control
   - water
   - waste decomposition
   - detoxification
   - air and water purification
   - etc.

3 Information
   - adaptability
   - medicine
   - science and education

4 Recreation
   - movies or sporting events
   - ecotourism
     tiger skin $1,000
     tiger watching $500,000

5 Ethics...
Nature’s Pharmacy

Rauvolfia
Rauvolfia serpentina, Southwest Asia
Tranquilizer, high blood pressure medication

Pacific yew
Taxus brevifolia, Pacific Northwest
Ovarian cancer

Rosy periwinkle
Catharanthus roseus, Madagascar
Hodgkin’s disease, lymphocytic leukemia

Foxglove
Digitalis purpurea, Europe
Digitalis for heart failure

Cinchona
Cinchona ledgeriana, South America
Quinine for malaria treatment

Neem tree
Azadirachta indica, India
Treatment of many diseases, insecticide, spermicide

“Rosy Periwinkle Argument”

Figure 8-4 Nature’s pharmacy. Plants and animals (many of them found in tropical forests) are used to treat a variety of human ailments and diseases. About 70% of the 3,000 plants identified by the U.S. National Cancer Institute as sources of cancer-fighting chemicals come from tropical forests. Despite their economic and health potential, fewer than 1% of the estimated 125,000 flowering plant species in tropical forests (and a mere 1,100 of the world’s 280,000 known plant species) have been examined for their medicinal properties. Many of these tropical plant species are likely to become extinct before we can study them. Miller, 2003
Ranking Biodiversity?

\[ R_i = (D_i + U_i)(\text{deltaP}_i/C_i) \]

D = distinctiveness
U = utility
delta P = enhanced probability of survival
C = cost of strategy

Direct limited funds...
Ecological Contribution?
‘Reptilia’ (= 4 orders, without birds)

1. Testudines (Chelonia, Turtles)
   - duh
   - shell shape ~ ecology
   - no arboreal or gliding forms

2. Squamata (‘Lizards’ and Snakes)
   - lizards not monophyletic
   - repeated loss of limbs
   - very diverse

See Fig 2-1 (Pough et al., 2001)
‘Reptilia’ (= 4 orders, without birds)

3. Crocodylia (Crocodiles, Alligators, Caiman)  
   - threatened (21 spp. remain)  
   - snout shape ~ diet  
   - related to archosaurs  
     (birds and dinosaurs)

4. Rhynchocephalia (Sphenodontida, Tuatara)  
   - 2 extant species  
   - islands of New Zealand  
   - operate at ~cold temperatures
Tuesday, February 21
Biological Evolution: What It Is and What It Isn't
Joanna Masel, Assistant Professor, Ecology and Evolutionary Biology

Tuesday, March 7
Cosmic Evolution: From Big Bang to Biology
Chris Impey, Distinguished Professor, Astronomy

Tuesday, March 21
Earth Evolution: The Formation of Our Planet
Joaquin Ruiz, Dean of the College of Science and Professor of Geosciences

Tuesday, March 28
Social Evolution: Cooperation and Conflict from Molecules to Society
Rick Michod, Professor, Ecology and Evolutionary Biology

Tuesday, April 11
Animal Evolution: Recycling Ancient Genes for New Uses
Lisa Nagy, Associate Professor, Molecular and Cellular Biology

Tuesday, April 18
Human Evolution: Tracing Our Origins with DNA
Michael Hammer, Research Scientist, Division of Biotechnology and Department of Ecology and Evolutionary Biology

Tuesday, April 25
Disease Evolution: The Example of HIV
Michael Worobey, Assistant Professor, Ecology and Evolutionary Biology