07 March 2005
23rd class meeting
(Miller Chapters 6n7)

Environmental Biology
ECOL 206
University of Arizona
spring 2005

Kevin Bonine, Ph.D.
Alona Bachi, Matthew Herron, Graduate TAs

Environmental Biology 206
- SE Chapters 6, 7
- Push back the readings for food production (not on EXAM2)
  (SE8, Levidow, Rifkin)

- 07 March Group Project (or Wed. 09 March)
- 11 March Exam2
- 11 March Lab Binder due (through this week’s lab)
- 11 March current events

-No lab this week. Work on your group projects.

206 Course Web Link:
Southern Arizona Home Builders Association

SAHBA won’t oppose $174M bond issue to pay for open space

By Tony Benda

The Southern Arizona Home Builders Association, a leading voice of the Southern Arizona Desert Conservation Plan, announced Monday that it will not oppose the ballot measure that would generate $174 million in open space bonds.

SABHA’s board members said the entire 12-county region would experience a net increase in open space, with a net increase in the number of people who would benefit from the bond.

The bond, known as the Southern Arizona Desert Conservation Plan, would provide $174 million in funding for open space projects across the region.

The bond issue is one of a series of initiatives aimed at protecting open space and preserving natural landscapes.

The Southern Arizona Home Builders Association (SAHBA) is a non-profit organization representing the residential construction industry in Southern Arizona.

SAHBA, along with other organizations, has been a strong advocate for open space preservation and has actively supported measures to protect and expand public lands.

With the passage of the bond measure, the region will be able to continue its efforts to conserve and protect open space for future generations, ensuring that the beautiful landscapes and natural resources of Southern Arizona are preserved for all to enjoy.

The bond will fund various projects aimed at enhancing public access to open space, including the development of trails and greenspaces.

The Southern Arizona Desert Conservation Plan (SADCP) is a collaborative effort led by various local, state, and federal agencies, working together to protect and preserve the region’s open space and natural resources.

The plan is designed to balance the needs of the growing population with the preservation of the natural environment, ensuring a sustainable future for the region.

The bond will provide the necessary funds to acquire and protect critical open space areas, including preserved landscapes, wildlife habitats, and important ecological corridors.

The Southern Arizona Home Builders Association has been a strong supporter of these efforts, recognizing the importance of open space in maintaining healthy ecosystems and providing recreational opportunities for residents and visitors alike.

SDCP open space
Santa Cruz River

Cienega Creek Preserve
Ecosystem Approach

- Function/Process
- Admit Ignorance
- Dynamic
- Time Lags

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)
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.

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
- detoxication
- 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...
Intrinsic vs. Utilitarian Values

Nature’s Pharmacy

**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 260,000 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*

*“Rosy Periwinkle Argument”*
Biodiversity, the Species Approach:

**EXTINCTION**

1. Local
2. Ecological
3. Biological

<table>
<thead>
<tr>
<th>Threatened</th>
<th>Endangered</th>
</tr>
</thead>
<tbody>
<tr>
<td>34% Fish</td>
<td>33% Freshwater</td>
</tr>
<tr>
<td>25% Amphibs</td>
<td></td>
</tr>
<tr>
<td>24% Mammals</td>
<td></td>
</tr>
<tr>
<td>20% Reptiles</td>
<td></td>
</tr>
<tr>
<td>14% Plants</td>
<td></td>
</tr>
<tr>
<td>12% Birds</td>
<td></td>
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</tbody>
</table>

- Extinction Rates
  - 100-10,000 x normal
  - 99.9%

- Speciation/Biodiversity
- Adaptive Radiation
  - (~5 million years)

Loss of Habitat  Loss of Habitat  Loss of Habitat  Loss of Habitat
### 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 orchids</td>
</tr>
<tr>
<td>Large territories</td>
<td>California condor, grizzly bear, Florida panther</td>
</tr>
</tbody>
</table>

**Figure 8-3** Characteristics of species that are prone to ecological and biological extinction. (Miller, 2003)

### Endangered Biodiversity Hotspots:

*Figure 7-16* Twenty-five hot spots (most in tropical forests) identified by ecologists as being important but endangered centers of biodiversity that contain a large number of plant and animal species found nowhere else. (Data from Conservation International) (Miller, 2003)
Island Biogeography Model  
(MacArthur and Wilson 1967)

- Metapopulations
- Spatial Relationships
- Nature Reserves

Reserve Design

Habitat - physical and biological surroundings of an organism

Landscape - Large area that comprises more than one type of habitat distributed in numerous patches

- Fragmentation
- Habitat Use
- Temporal and spatial scales important
- Succession

Species vs. Process (practicality, ideal)
Protecting Biodiversity:
(Reserve Design Elements)

1. amount of habitat
2. quality of habitat
3. distribution or configuration of habitat
4. connectivity of habitat

Landscape-scale or metapopulation models

**Patch quality matters**

populations in habitat patches of higher quality are less likely to go extinct than populations in patches of lower quality

A “**source**” is an area where \( b > d \). Excess individuals may emigrate from a “source” patch.

A “**sink**” is an area where \( d > b \). Populations in sink patches are certain to go extinct. Sink populations may be “rescued” by immigration from source populations (the **rescue effect**).
Landscape-scale or metapopulation models

**Patch size matters**
populations in smaller habitat patches (‘islands”) are more likely to go extinct than populations in larger habitat patches

**Patch isolation matters**
the more isolated an unoccupied habitat patch is from occupied habitat patches, the less likely that it will be colonized

The Theory of Island Biogeography (MacArthur and Wilson 1967)
Metapopulation Theory (Levins 1969 and others)
Landscape-scale or metapopulation models

Which population is most/least likely to go extinct?

Groves et al. 2002

TNC Seven Step Program:
1 Identify Conservation Targets
2 Collect Information and Identify Gaps
3 Establish Conservation Goals
4 Assess Existing Conservation Areas
5 Evaluate Likelihood of Persistence
6 Assemble Portfolio of Conservation Areas
7 Identify Priority Conservation Areas

-Landscapes (> 1 type habitat)
-Habitat Loss and Degradation
-Scale, Ecoregions, Species and Ecological Processes
-Focal Species
-Management of Conservation Areas left until later