Lecture 02, 24 Aug 2006
Ch1

Conservation Biology
ECOL 406R/506R
University of Arizona
Fall 2006

Kevin Bonine
Kathy Gerst

1. Syllabus
2. Ecological Footprint

3. What is Con Bio?
   -origins

Read Noss 1999 and Ch1 for Tuesday
Ch3 and Callicott reading for Thursday

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Housekeeping, 24 August 2006

If not in lecture on Tuesday, please see us after class.

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Upcoming Readings

today: Textbook, chapter 1
Tues 29 Aug: Textbook, chapter 1; Noss 1999
Thurs 31 Aug: Textbook chapter 3; Callicott 1997

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Short oral presentations
29 Aug Kevin Gilliam and Whitney Henderson
31 Aug open

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## Conservation Biology 406R/506R

Lab Friday (tomorrow)
1230 S side BSE
(4th and Highland)
Hat, water, sunscreen
Tumamoc Hill website:
http://wwwpaztcn.wr.usgs.gov

For this week, see 2005 lab website (linked from main page)

26 Aug. Tumamoc Hill and Introduction, VAN
ecological research, study plots, geology, Tucson basin, desert vegetation, introductions and schedules
→ Tumamoc Hill Research,
→ Tumamoc Hill Reading by Nancy Wall,
Views of the Changing Sonoran Desert (large file)
(10 points)

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## Global Climate Change Lecture Series

All lectures will take place at UA Centennial Hall.

All lectures begin at 7pm and are free to the public. Call 520.621.4090 for more information.

Tuesday, October 17
Global Climate Change: The Evidence
Malcolm Hughes, Professor of Dendrochronology

http://cos.arizona.edu/climate/

Tuesday, October 24
Global Climate Change: What's Ahead
Jonathan Overpeck, Director of the Institute for the Study of Planet Earth and Professor of Geosciences

Tuesday, October 31
Global Climate Change: The Role of Living Things
Travis Huxman, Assistant Professor of Ecology and Evolutionary Biology

Tuesday, November 7
Global Climate Change: Ocean Impacts and Feedbacks
Julia Cole, Associate Professor of Geosciences

Tuesday, November 14
Global Climate Change: Disease and Society
Andrew Comrie, Dean of the Graduate College and Professor of Geography and Regional Development

Tuesday, November 21
Global Climate Change: Could Geoengineering Reverse It?
Roger Angel, Regents' Professor of Astronomy

Tuesday, November 28
Global Climate Change: Designing Policy Responses
Paul Portney, Dean of the Eller College of Management and Professor of Economics

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Syllabus…

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**Table 2.1 Ecosystem Services and Functions**

| Ecosystem service* | Examples |
|---|---|
| Gas regulation | Carbon dioxide/oxygen balance, ozone for protection against ultraviolet light |
| Climate regulation | Greenhouse gas regulation, dimethyl sulphide production affecting cloud formation |
| Disturbance regulation | Storm protection, flood control, drought recovery, and other aspects controlled by vegetation structure |
| Water regulation | Provisioning of water for agricultural (such as irrigation) or industrial (such as milling) processes or transportation |
| Water supply | Provisioning of water by watersheds, reservoirs, and aquifers |
| Erosion control and sediment retention | Prevention of loss of soil by wind, runoff, or other removal processes; storage of silt in lakes and wetlands |
| Soil formation | Weathering of rock and the accumulation of organic material |
| Nutrient cycling | Nitrogen fixation, nitrogen, phosphorus, and other elemental or nutrient cycles |
| Waste treatment | Waste treatment, pollution control, detoxification |
| Pollination | Provisioning of pollinators for the reproduction of plant populations |
| Biological control | Keystone predator control of prey species; reduction of herbivory by top predators |
| Refugia | Nurseries, habitat for migratory species, regional habitats for locally harvested species, or overwintering grounds |
| Food production | Production of fish, game, crops, nuts, and fruits by hunting, gathering, subsistence farming, or fishing |
| Raw materials | The production of lumber, fuel, or fodder |
| Genetic resources | Medicine, products for materials science, genes for resistance to plant pathogens and crop pests, ornamental species (pets and horticultural varieties of plants) |
| Recreation | Ecotourism, sport fishing, and other outdoor recreational activities |
| Cultural | Aesthetic, artistic, educational, spiritual, and/or scientific values of ecosystems |

*Ecosystem "goods" included in ecosystem services.
*Source:* Adapted with permission from Robert Costanza et al., "The value of the world's ecosystem services and natural capital," *Nature*, May 1997.

Brennan and Withgott 2005

## Consilience* in Conservation Biology

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## Science and the Humanities

* the uniting of knowledge



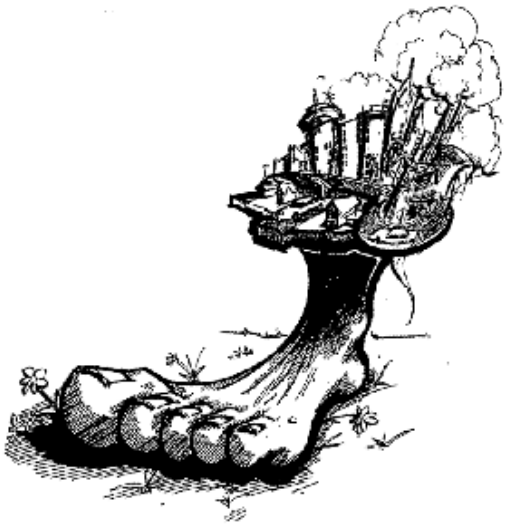
Competent before radical...

Data and science, then fingerpainting


2003



Photos courtesy of Ben Joslin

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## Ecological Footprint

The big choices seem to matter the most:

- -transportation
- -food (unprocessed, local, trophic level)
- -housing
- -reproduction


**Figure 1-5** Relative ecological footprints of the United States, the Netherlands, and India. An *ecological footprint* is the amount of land needed to produce the resources needed by an average person in a country. It would take the land area of about three planet earths if all the world's 6.2 billion people consumed the same amount of resources as is consumed by the 288 million people in the United States.

Recycling etc. important, but not as big an impact

Paper or Plastic? - Bring your own.

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Ecological Footprint
HOMEWORK!


How many planets needed, at 4.5 acres/person, to live like the mean ECOL406R/506R student?

= mean/4.5 = ??

Compare US to other countries using same answers.

AVERAGE ECOLOGICAL FOOTPRINT IN USA IS 24 ACRES PER PERSON.
WORLDWIDE, THERE EXIST 4.5 BIOLOGICALLY PRODUCTIVE ACRES PER PERSON.

http://www.earthday.net/footprint/index.asp 37

Ecological Footprint

-Reproduction
-Housing
-Travel
-Food
-Etc.

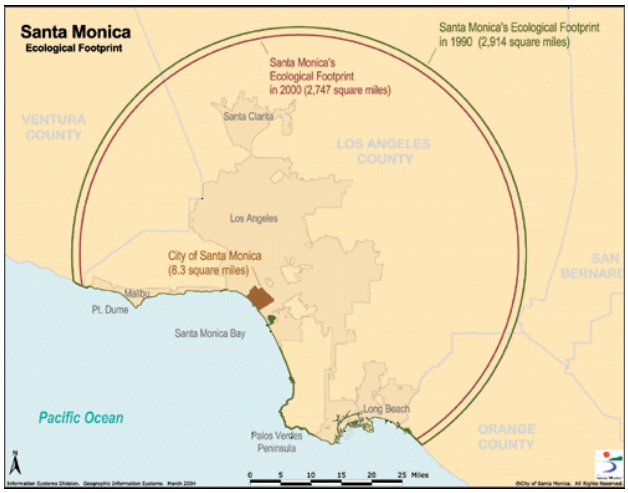


**Figure 1.5** The first issue of the journal *Conservation Biology*, published in May 1987. (Photograph courtesy of E. P. Pister.)

Meffe and Carroll 1997

What is Conservation Biology?

When and what were the origins of the discipline?

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Ethical and Conceptual Roots

1. Intrinsic Value

2. Ecosystem services

3. Aesthetic, spiritual enrichment

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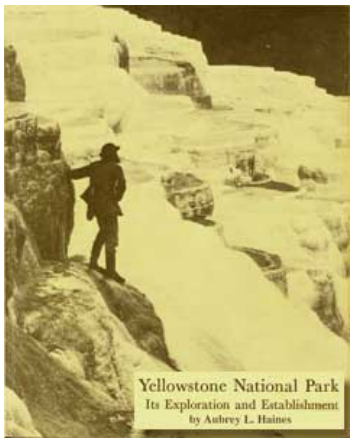
## It all starts in Colter's Hell…




Thomas Moran on the Mammoth Terraces
Photograph by William H. Jackson, 1871.
*(National Park Service)*

John Colter 1807
(~Lewis and Clark)
Yellowstone Area

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Romantic-Transcendentalist Ethic
vs.
Resource Conservation Ethic

Preservation
vs.
Conservation

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~Romantic-Transcendentalist Ethic:

Ralph Waldo Emerson
Henry David Thoreau
John Muir
-Sierra Club 1892
-NGO
-Education, Lobby, Law/Politics

Yellowstone National Park 1872
Yosemite National Park 1890

ESA 1917 --> Nature Conservancy 1950

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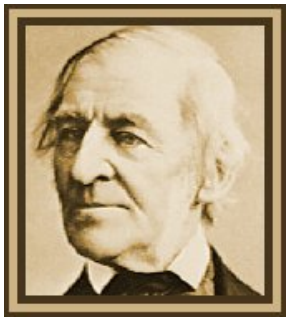

***Ralph Waldo Emerson***
***1803-1882***

**A Successful life**

**"To laugh often and much; to win the respect of intelligent people and the affection of children; to earn the appreciation of honest critics and endure the betrayal of false friends; to appreciate beauty; to find the best in others; to leave the world a bit better, whether by a healthy child, a garden patch, or a redeemed social condition; to know even one life has breathed easier because you have lived."**
**- Ralph Waldo Emerson -**

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**Henry David Thoreau (1817-1862)**

"Many go fishing all their lives without knowing that it is not fish they are after."

"Beware of all enterprises that require new clothes. "

"It is not worthwhile to go around the world to count the cats in Zanzibar. "

"Wherever a man goes, men will pursue him and paw him with their dirty institutions, and, if they can, constrain him to belong to their desperate oddfellow society. "

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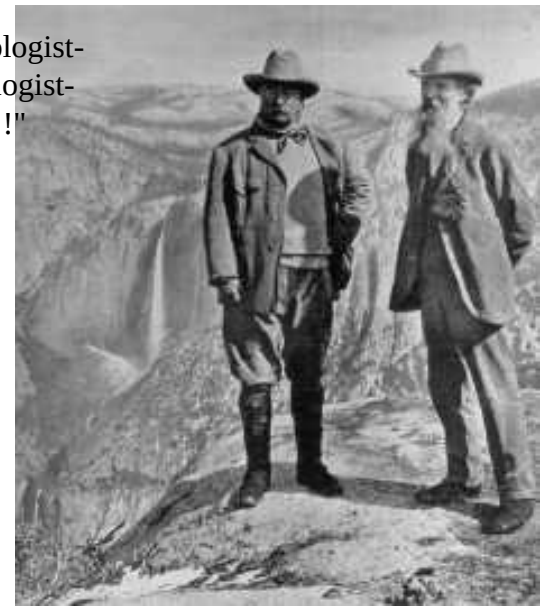
"poetico-trampo-geologist-botanist and ornithologist-naturalist etc. etc. !!!!"

John Muir (1838-1914)



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Teddy Roosevelt
(president 1901-1909)

~resource conservation ethic:

**Figure 1.3** VanDyke 2003
Theodore Roosevelt, the twenty-sixth president of the United States (1901–1909), greatly supported the role of the federal government in conservation.

"To Roosevelt, it was clear that a handful of individuals and their companies were reaping most of the profits from natural resources that rightfully belonged to all citizens." Van Dyke 2003, p. 10

early 1900s "Trustbuster"

Resources for use, but forever.

National Wildlife Refuge System (52 designations by TR)

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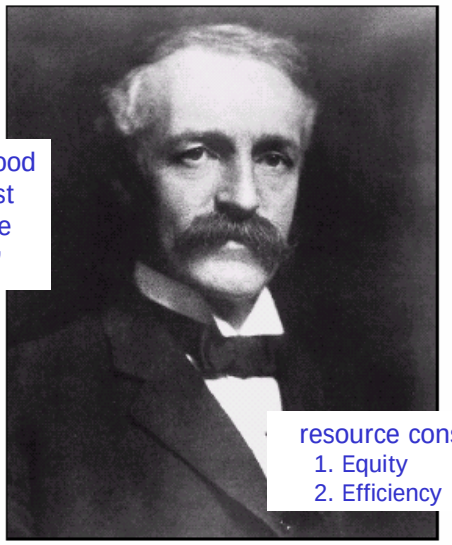
"The greatest good for the greatest number for the longest time"



Gifford Pinchot

resource conservation ethic:
1. Equity
2. Efficiency

**Figure 1.4** VanDyke 2003
Gifford Pinchot, early head of the U.S. Forest Service and father of the resource conservation ethic. From an original staff of only 123 in 1898, Pinchot built the Forest Service to an organization of 1,500 people administering 150 million acres of public land within 10 years.

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Sustainable Use
Maximum Sustained Yield

USE those resources!

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Modern Conservation Biology
National Parks
U.S.

Transferable?

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**Figure 1.5** Van Dyke 2003
Aldo Leopold, early twentieth-century conservationist and father of the modern land ethic.

Aldo Leopold

Game Management 1932

A Sand County Almanac (1966)
-evolution/ecology land ethic

Land Health and the A-B Cleavage

Commodities (A)
vs. Processes (B)

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Rachel Carson
Silent Spring 1962

-Bioaccumulation

-Levels and scale

-Environmental degradation
threaten human health

-Increased Public Awareness

**Figure 1.6** Van Dyke 2003
Rachel Carson, U.S. Fish and Wildlife Service biologist and author of *Silent Spring* (1962), a seminal book in the modern environmental movement.

Problems Addressed by Conservation Biologists:

1 Genetic Diversity
variation, inbreeding, drift, hybridization

2 Species
MVP, PVA
small populations
declining populations
metapopulations

3 Habitat
loss, fragmentation, isolation, heterogeneity

4 Ecosystem Processes
scale

5 Human sustainability
the crux

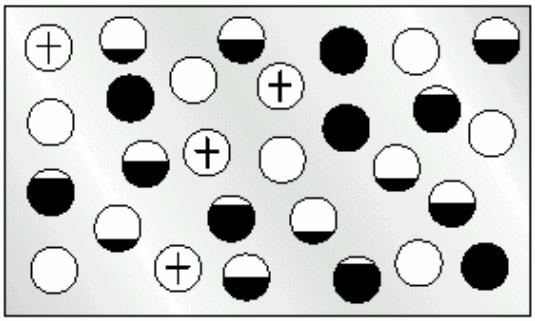

**Figure 1.8**
Diagrammatic representation of an arrangement of local populations ("metapopulation") based on Andrewartha and Birch (1954). Empty circles represent favorable habitats that individuals do not occupy. Partially or completely filled circles represent favorable habitats and relative densities of individuals in them as a proportion of the habitat's maximum capacity. Crosses indicate habitats in which local populations recently became extinct.

-Metapopulations

-Island Biogeography
MacArthur and
Wilson 1963

-Testable Hypotheses

-Thresholds

Van Dyke 2003

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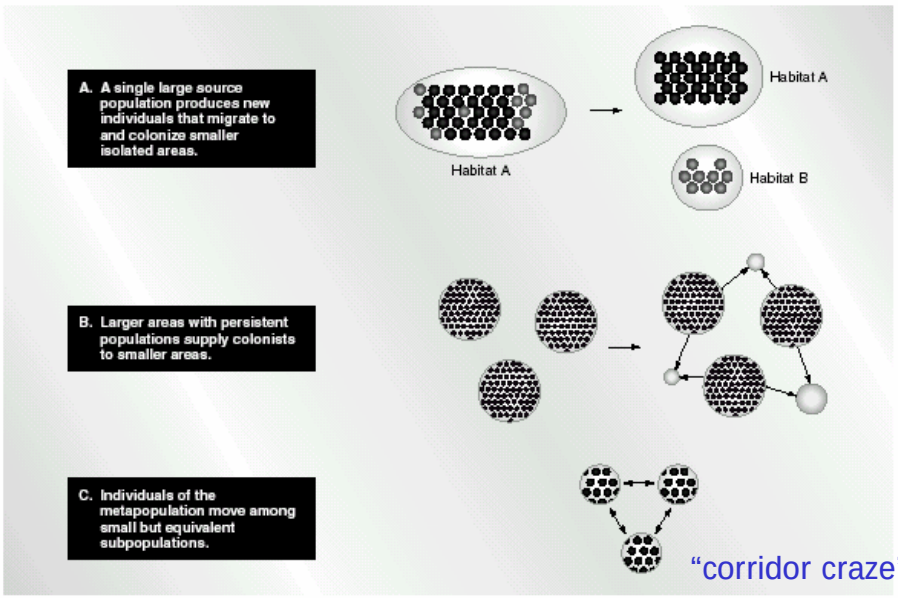


**Figure 1.9** Van Dyke 2003
Three variations of the metapopulation concept. Although different in detail, all represent metapopulations as spatially distinct groups (subpopulations) that disperse to or among physically separated habitats.

Journal of Wildlife Management (1937)
Wildlife Society Bulletin

vs.

Conservation Biology
Biological Conservation

(movement from individual game species to large scale and generalized approaches)

Meffe and Carroll 1997


**Figure 1.5** The first issue of the journal *Conservation Biology*, published in May 1987. (Photograph courtesy of E. P. Pister.)

Is conservation biology a distinct discipline?

-Biodiversity (levels and scales)
-Prevent degradation and loss

1. Scarcity and Abundance

2. Value laden and mission driven

3. Diversity and complexity good
   Untimely extinction bad

4. Evolution is good (genotypic variation)
   -process

5. Biotic diversity has intrinsic value

(see 8 traits in Van Dyke Ch1)

(~Soulé's normative postulates)

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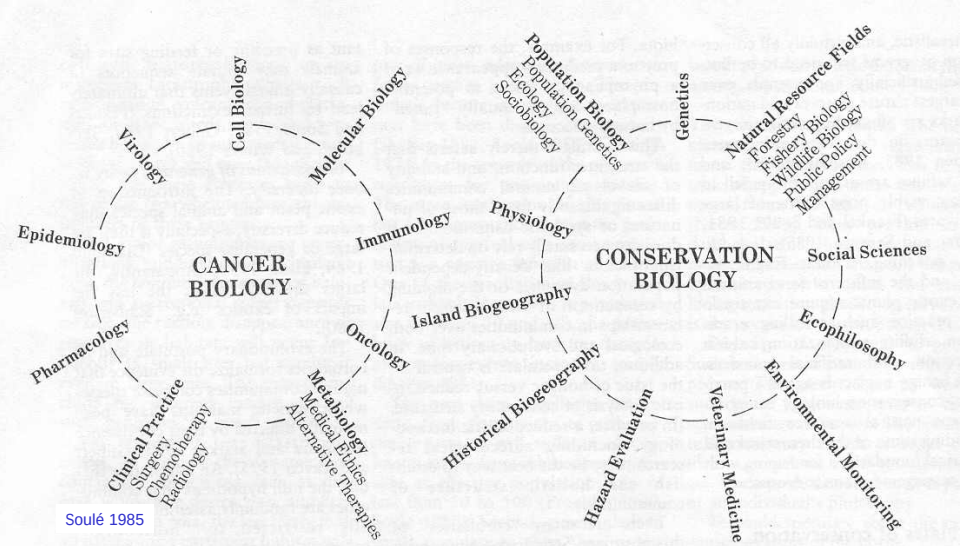


Soulé 1985

Figure 1. Cancer biology and conservation biology are both synthetic, multidisciplinary sciences. The dashed line indicates the artificial nature of the borders between disciplines and between "basic" and "applied" research. See text.

## 6. Crisis Discipline?

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## Objectivity vs. Neutrality (Van Dyke p. 57)

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