

Lecture 20, 10 Nov 2003

Groves et al. 2002

Walther et al. 2002

Ecological Footprint

Conservation Biology

ECOL 406R/506R

University of Arizona

Fall 2003

Kevin Bonine

1. Walther paper, Groves paper
2. Ecological Footprint
3. Thank you card
4. Bob Steidl on Wednesday
5. Group Presentation Monday



<http://www.ucmp.berkeley.edu/vertebrates/coelacanth/coelacanths.html>

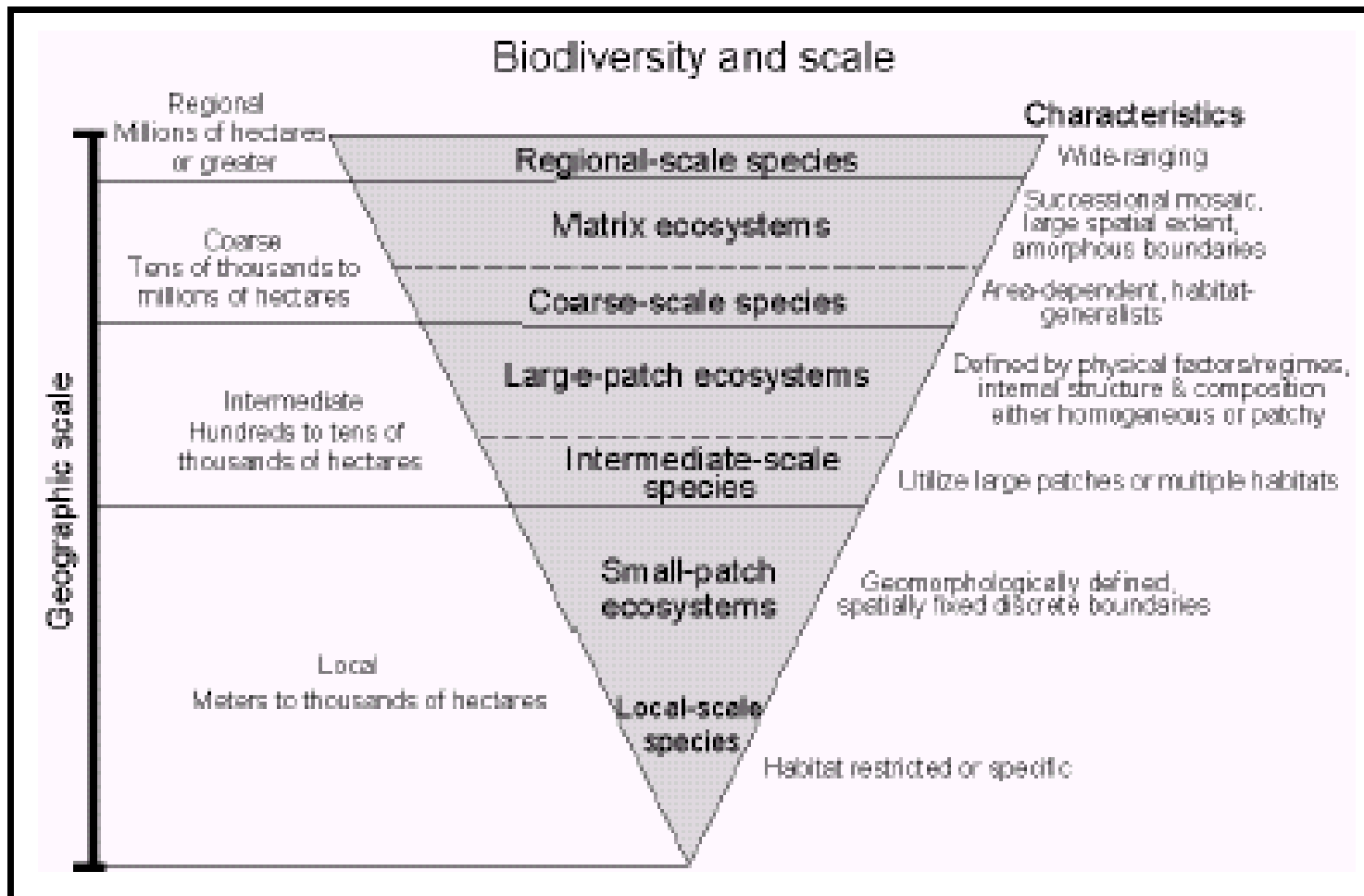
## Groves et al. 2002

### 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**

# Scale



*Figure 2. The spatial scales and levels of biological organization. Conservation targets can be viewed as occurring at four spatial scales from local to regional. The general range in size (hectares) for each spatial scale is indicated to the left of the pyramid and some general characteristics of two types of conservation targets (species and ecosystems) are shown on the right. Reprinted from Poiani et al. (2000), with permission.*

Groves et al. 2002

# 1. Identify Conservation Targets

-Biodiversity:

1. Composition
2. Structure
3. Function

-Biotic and Abiotic (Surrogates)

-Species, Communities, Ecosystems

    ↳ Threatened, Endemic, Focal, Keystone

-Course Filter vs. Fine Filter

-Data Availability



## 2. Collect Information and Identify Gaps

### -Data

Land ownership, Human population, Biology, Ecology

### Gap Analysis

Rapid Assessment, **Pulse**, etc.

## 3. Establish Conservation Goals

- How much, where
- Quality vs. Quantity
- Environmental and Disturbance **Gradients**
- **Replication**



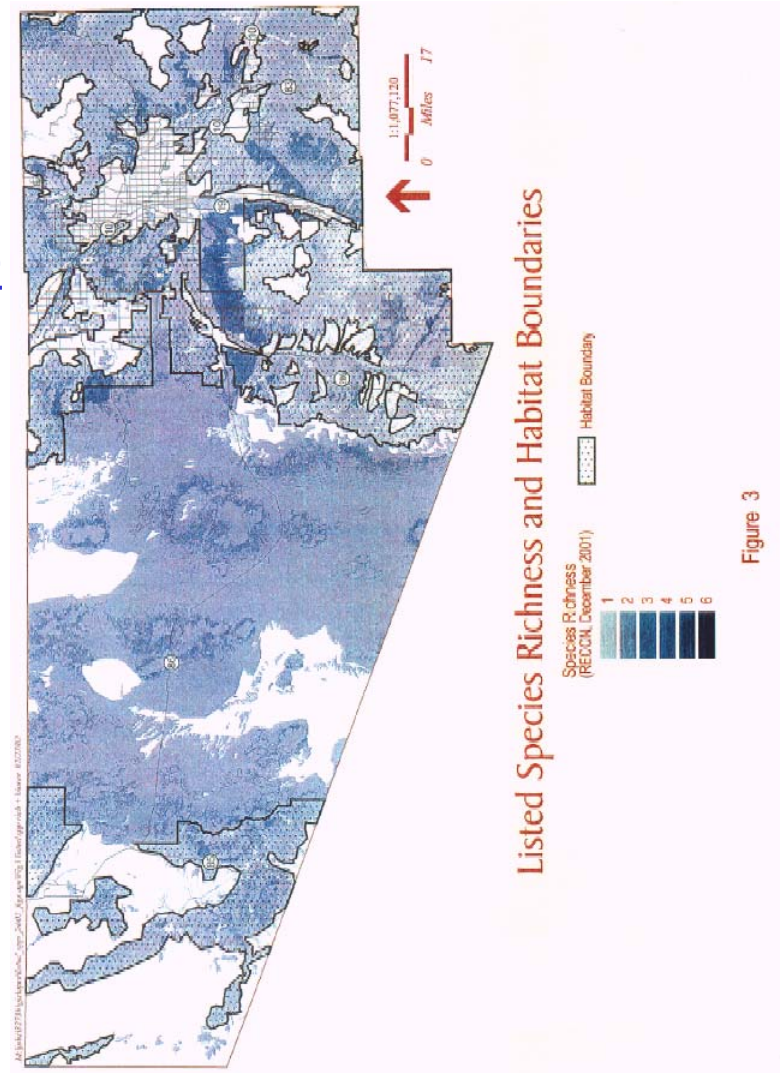
## 4. Assess Existing Conservation Areas

- Which components of conservation targets **already protected**?

## 5. Evaluate Likelihood of Persistence

- Think **long term**
- Incorporate Natural and Human Disturbances

- 1 Size
- 2 Condition
- 3 Landscape context  
processes, connectivity



## 6. Assemble Portfolio of Conservation Areas

- What areas will be consistent with targets/goals
- Based on size, or ownership, etc.

## 7. Identify Priority Conservation Areas

- Resources (and sympathy) are Finite
- Degree of existing protection
- Conservation value
- Threat
- Feasibility
- Leverage

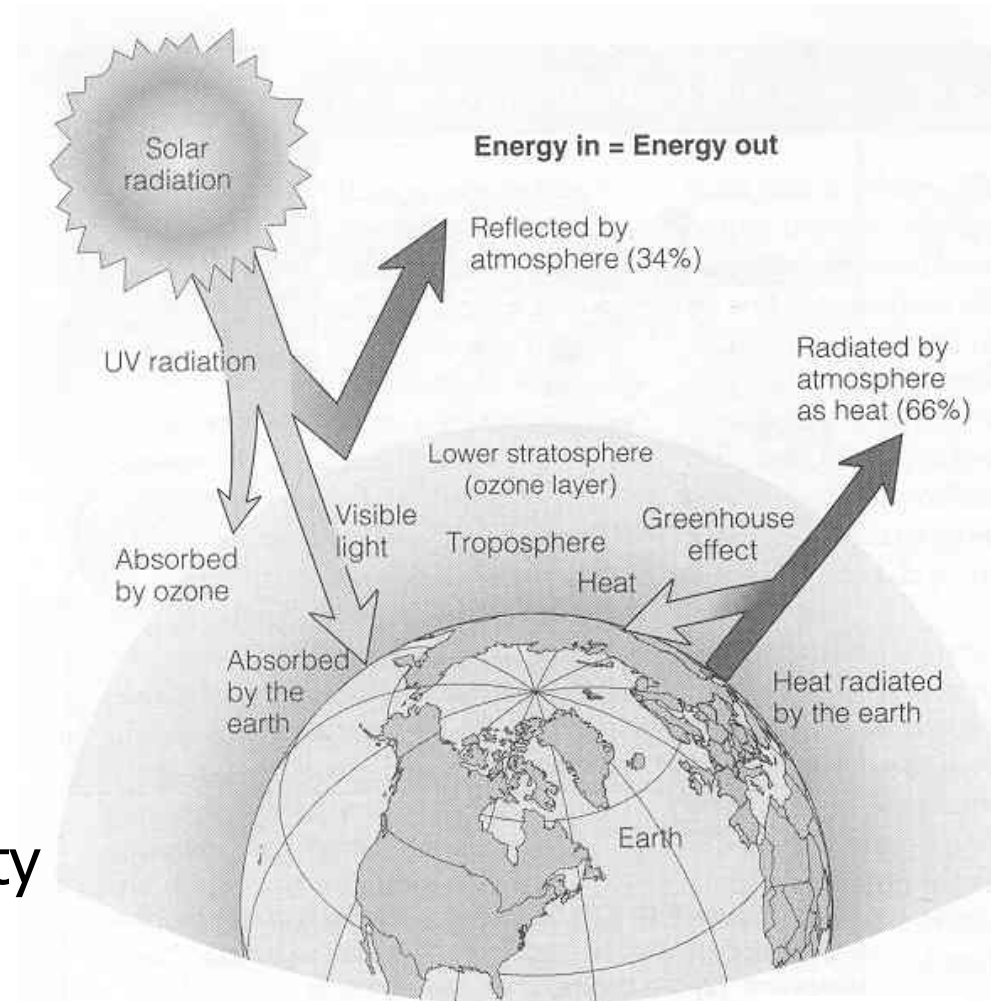
What happens to the **solar radiation** that reaches the earth?

-1 billionth solar output

-visible and ultraviolet (UV)

-greenhouse gases  
(water vapor, CO<sub>2</sub>, methane,  
nitrous oxide, ozone)

-autotrophs/primary productivity



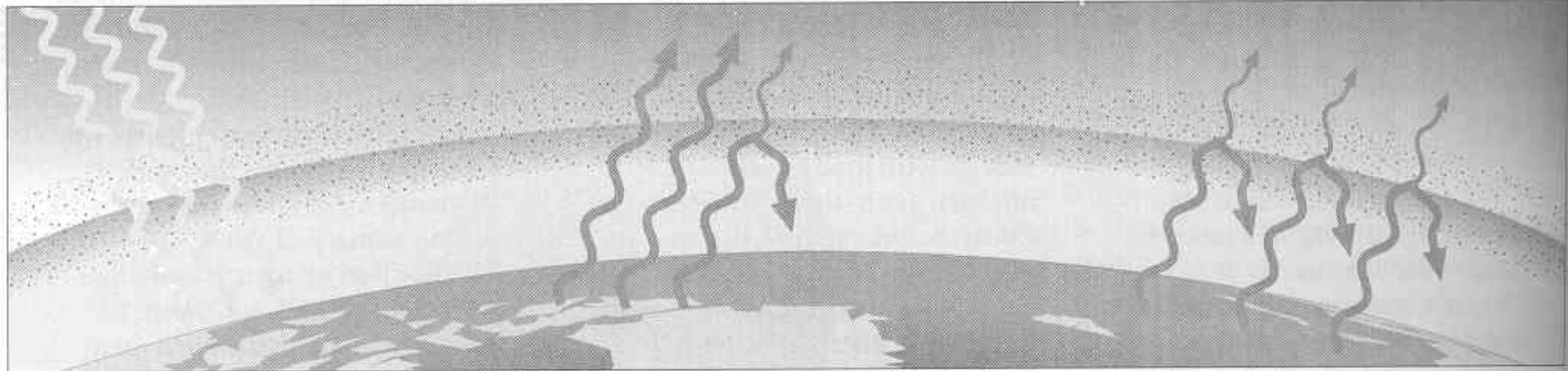
Miller, 2003



Figure 2-11 The flow of energy to and from the earth.

# Greenhouse Effect

- earth's surface **absorbs or reflects**
- reflected either into **space** or absorbed by **gases**
- **greenhouse gases** heat up and emit **infrared radiation**



**(a)** Rays of sunlight penetrate the lower atmosphere and warm the earth's surface.

**(b)** The earth's surface absorbs much of the incoming solar radiation and degrades it to longer-wavelength infrared radiation (heat), which rises into the lower atmosphere. Some of this heat escapes into space and some is absorbed by molecules of greenhouse gases and emitted as infrared radiation, which warms the lower atmosphere.

**(c)** As concentrations of greenhouse gases rise, their molecules absorb and emit more infrared radiation, which adds more heat to the lower atmosphere.



**Figure 2-12** The *greenhouse effect*. Without the atmospheric warming provided by this natural effect, the earth would be a cold and mostly lifeless planet. According to the widely accepted greenhouse theory, when concentrations of greenhouse gases in the atmosphere rise, the average temperature of the troposphere also rises. (Modified by permission from Cecie Starr, *Biology: Concepts and Principles*, 4th ed., Pacific Grove, Calif.: Brooks/Cole, 2000)

**TRANSPORTATION**

AZDStar 05 Nov 2003

# Voters send clear signal with defeat of 200, 201

**By Susanna Cañizo**

ARIZONA DAILY STAR

Tucson voters rejected the idea of paying higher taxes to improve bus service and build light rail by defeating Propositions 200 and 201 on Tuesday.

A would-be celebration turned into a somber gathering as members of Citizens for a Sensible Transportation Solution monitored the election results via computer at Muse, 516 N. Fifth Avenue.

Steve Farley, spokesman for the citizens group, said the effort to improve mass transit will continue. "We don't go away. We keep talking to people," he said.

Proposition 200 was defeated by 63 percent to 37 percent of voters. The ballot item called for increasing the city's regular sales tax and construction sales tax.

The higher taxes would have paid for transportation projects outlined in Proposition 201, which was defeated by 64 percent to 36 percent.

Farley said negative campaigning contributed to the defeat of the two propositions. However, he admitted his group's proposal

SEE TRANSPORT / A8

**Street car line**

Citizens for a Sensible Transportation Solution is working on a plan to build a modern street car line that would connect North Campbell Avenue, the UA, Downtown and Rio Nuevo.

Steve Farley, spokesman for the group, said the new plan targets precincts around the UA and Downtown where a majority of voters supported Propositions 200 and 201.

The propositions, which called for sales-tax hikes to pay for better bus service and a light-rail line, fared much worse in other parts of the city.

"This is in the very early stages of planning," he said. "It's building on that strong level of support in the central city."

Modern streetcars are smaller than light-rail cars. They're also lighter, so underground utilities would not have to be relocated — which translates into lower costs. Farley said area residents and businesses could form an improvement district to pay for the work through property tax increases.

Farley plans to talk to residents and merchants about the idea, and he said a more detailed plan will be ready in December.

**Regional plan**

Last year, PAG conducted an extensive public outreach effort to find out what transportation upgrades are needed in the Tuc-

**Earlier plans**

► In the last two decades, five transportation proposals have been defeated by voters, and one has passed:

- **May 21, 2002:** Tucson voters rejected Propositions 100 and 400 by a margin of 69 percent to 31 percent. Proposition 100 was for a half-cent-per-dollar sales tax to pay for Proposition 400, a 10-year transportation plan.
- **Nov. 11, 1997:** Pima County's \$350 million bond package for transportation improvements passed by a margin of 58 percent to 42 percent.
- **Nov. 6, 1990:** Proposition 401, allowing a half-cent sales tax to pay for road improvements, was rejected by 61 percent of Pima County voters.
- **Dec. 9, 1986:** Pima County voters rejected Proposition 1 by a margin of 57 percent to 43 percent. It would have allowed a half-cent sales tax for road improvements.
- **May 6, 1986:** The \$35.8 million proposed Speedway tunnel was rejected by 69 percent of Tucson voters.
- **Nov. 6, 1984:** Proposition A, the proposed Rillito Parkway, was rejected by a margin of 58 percent to 42 percent.

son area. Based on that input, the agency is creating several scenarios for the 2030 Regional Transportation Plan.

Each scenario will include a mix of transportation projects. One may emphasize road work, while another may focus on mass transit. In the spring, those scenarios will go back to the public for another round of input. People will be asked which scenario they prefer and how they're willing to pay for it.

Si Schorr, a member of PAG's regional council and the State Transportation Board, said the PAG plan is the best bet for reaching a community consensus about transportation.

"It has to address all modes of traffic," he said. "And we need to let everyone know how they would stand to benefit from it."

Walkup says the 2030 Regional Transportation Plan would outline all the projects that PAG would be responsible for implementing, should it become a regional transportation authority.

PAG's regional council is expected to approve the final version of the 2030 plan in the fall of 2005. Visit [www.pagnet.org](http://www.pagnet.org) to learn more about the plan.

**County partnership**

The Tucson Metropolitan Chamber of Commerce is interested in improving Southern Arizona's piece of the Canamex

corridor, a highway route that will eventually link Mexico with Canada.

It wants transportation planners in Pima County to form a partnership with planners in Pinal and Santa Cruz counties to identify improvements for I-10 and I-19.

"Our aim is to develop thruways to move people from community to community," said John Dougherty, the chamber's director of governmental affairs.

He said tremendous growth along the I-10 corridor near Tucson and Casa Grande must be addressed by the counties. Dougherty said the chamber will talk to state legislators about the idea.

Dennis Alvarez, Tucson district engineer for the Arizona Department of Transportation, said the agency has conducted in-depth studies of I-10 and I-19 in the Tucson metropolitan area, but he said it's hard to get funding to study the parts of the freeway that lie in Pinal and Santa Cruz counties.

"We need all the support we can get," he said. "These counties are competing for funding statewide. They're competing with all the other rural counties."

► *Contact Susanna Cañizo at 573-4176 or [slcanizo@azstarnet.com](mailto:slcanizo@azstarnet.com).*

**Vote by ward**

► All six Tucson wards voted against two propositions that called for higher sales taxes to pay for transportation improvements, including extra bus service and light rail. People in Ward 4 disliked the transportation plan the most — 74 percent of South-east Side voters rejected the propositions. The propositions were most popular in Midtown's Ward 6, where 49 percent of voters gave them a thumbs-up. Here are the ward-by-ward results from Tuesday's election:

**PROPOSITION 200**

Ward	Yes	No
1 - West Side	37	63
2 - Northeast Side	31	69
3 - North Side	44	56
4 - Southeast Side	26	74
5 - South Side	38	62
6 - Midtown	49	51

**PROPOSITION 201**

Ward	Yes	No
1 - West Side	37	63
2 - Northeast Side	29	71
3 - North Side	44	56
4 - Southeast Side	26	74
5 - South Side	37	63
6 - Midtown	49	51

For more information about the election, including how the city's precincts voted, go to [www.ci.tucson.az.us/clerks/](http://www.ci.tucson.az.us/clerks/)

Walther et al. 2002

## Ecological Responses to Recent Climate Change

### Spatial Heterogeneity

### Phenology

timing  
frost-free days  
variability

### Range Shifts

1. temperature
  2. precipitation
- latitude and altitude

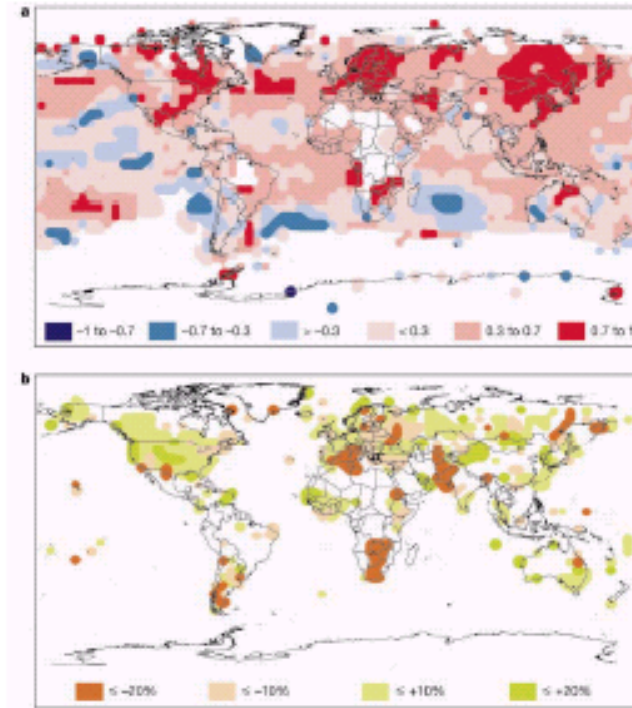
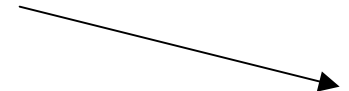


Figure 1. Spatial variability of annual trends in temperature and precipitation since 1936 relative to 1981 to 1990 normals (cf. 1, modified). a, Temperature (°C per decade); b, precipitation (% per decade).

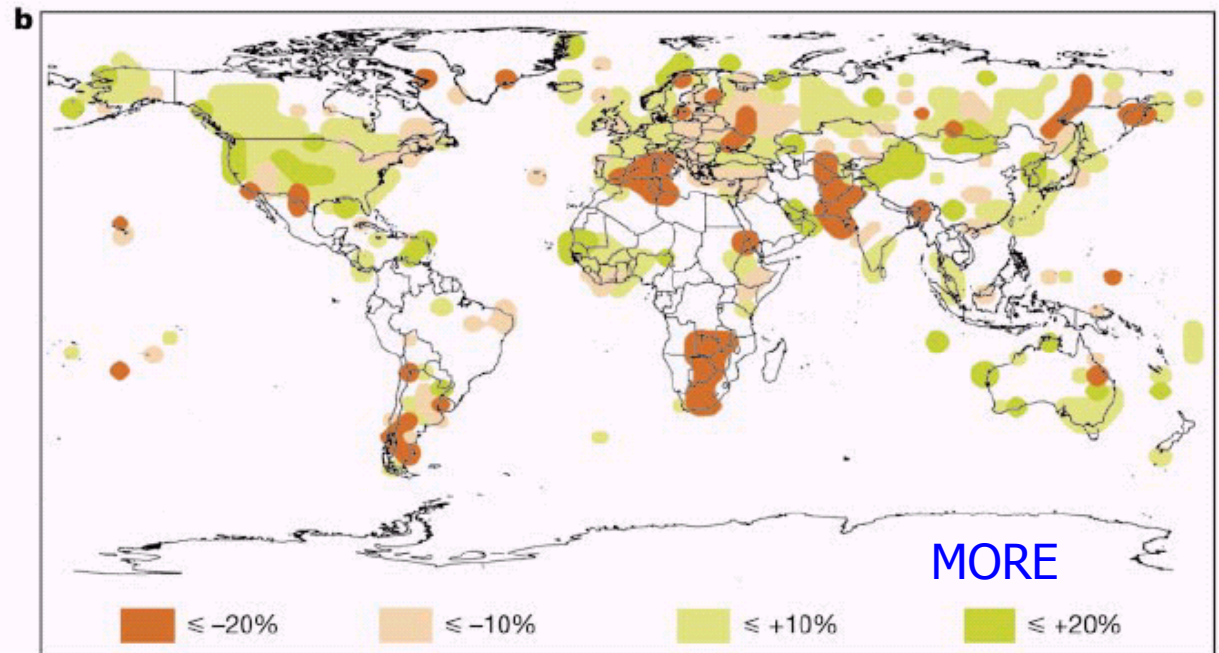
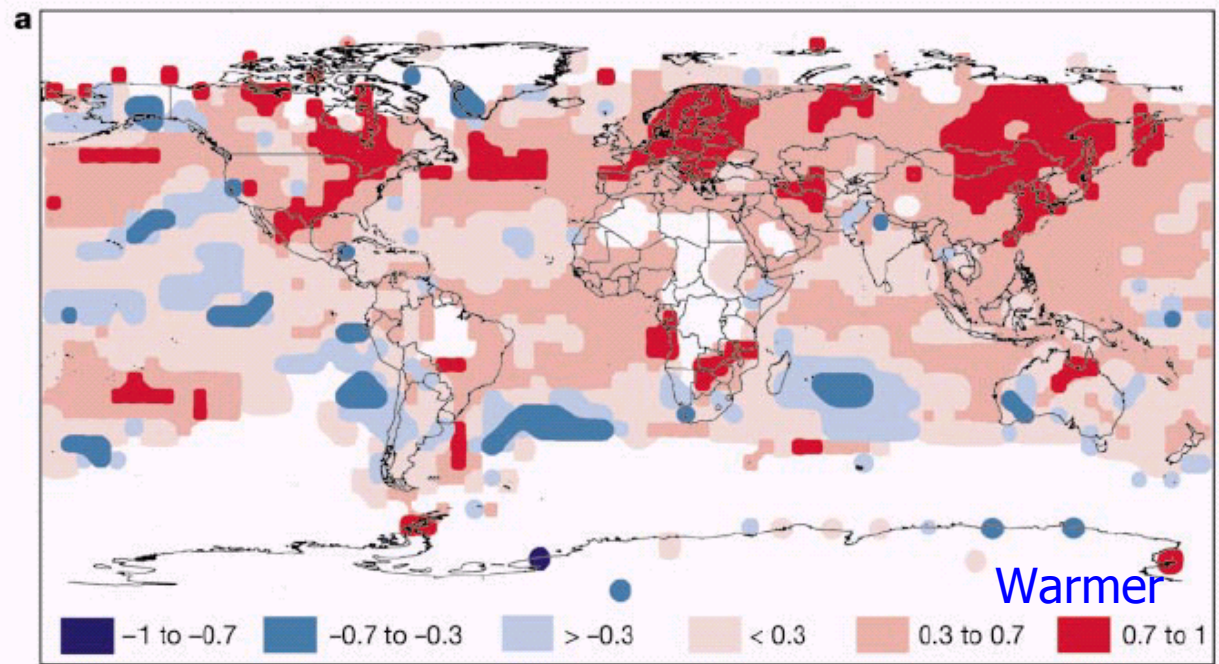
Walther et al. 2002, Fig. 1



Degree C  
per decade

(Spatial  
heterogeneity)

Percent change  
in precipitation



## Walther et al. 2002

## Ecological Responses to Recent Climate Change

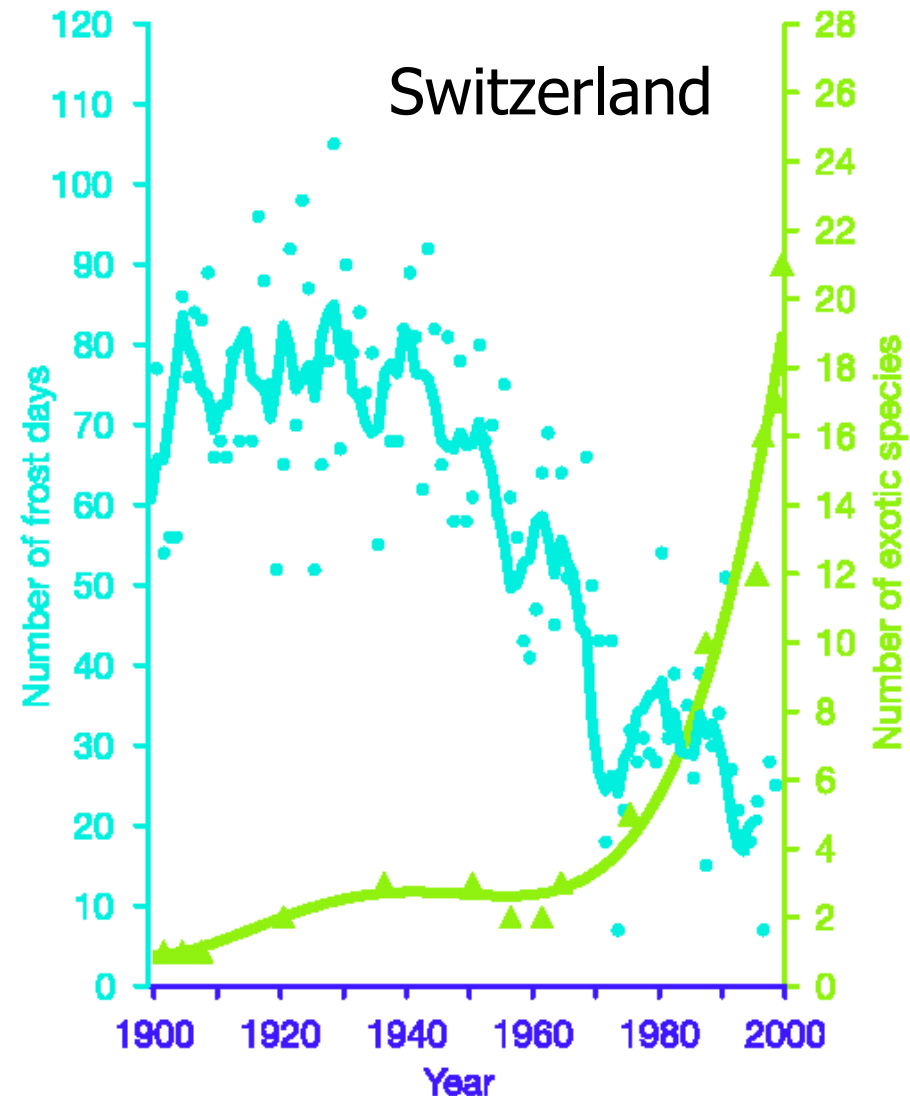
Community Changes

- Plant structure
- animal community
- Bleaching
- Antarctic

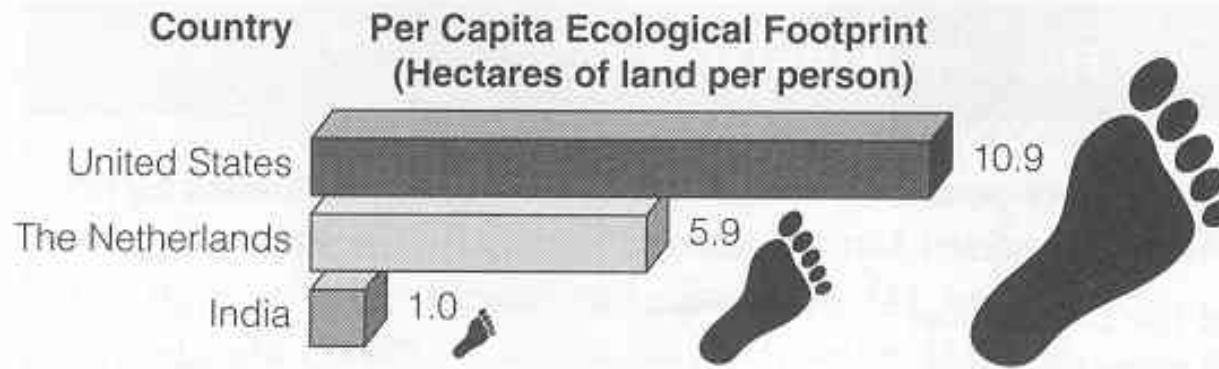
Ecosystem Changes

- Recruitment
- Trophic interactions

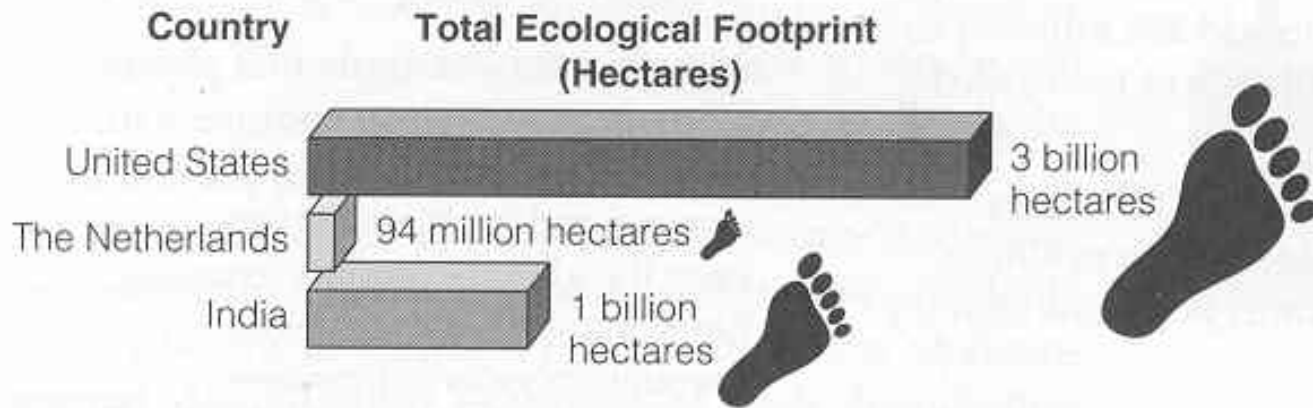
Synergistic Effects  
(~SDCP, Chapter 9)



# Ecological Footprint



1 ha = 2.47 acres



**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. Miller, 2003

# Ecological Footprint

**Def:** Number of productive acres (fishing grounds, forests, agricultural fields) needed to maintain a given lifestyle

- Driving** (roads, vehicles, fuel, etc.)
- Housing (land and resources for construction)
- Food** (land, transport, inputs, **trophic** level)
- Other** goods and services

US citizens use **24 acres/person** on average  
(Canadians 17, Italians 9, Pakistanis 2)

As of ~2002, planet has about 4.5 acres/person

Sustainability?

(1 acre = 0.405 hectare)

# Ecological Footprint



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

$$= \text{mean}/4.5 = ??$$

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

# Ecological Footprint

The big choices seem to matter the most:

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

Recycling etc. important, but not as big an impact

Paper or Plastic? - Bring your own.

## Four Spikes

- 1 Consumption
- 2 Human Population Growth
- 3 Extinctions
- 4 Global Change

What should we do?

# Student Presentation Assignment for 17 Nov.

**LESS is MORE**

How do we reduce ecological footprint, reduce consumption, and fight global warming?

Please be as specific as possible and cite more than your opinion.

Each group will have 15 minutes (suggest: 12 plus 3 min for questions).

## 1. PERSONAL

Amy Tendick, Galia Bobman, Aurora Fabry-Wood, Erica Sontz, Justin Dodds

## 2. FRIENDS AND FAMILY

Ben Joslin, Andrea Vasquez, Bridget Barker, Louise Misztal, Meghan Jarvie

## 3. COMMUNITY

Christopher Deegan, Michael Gilliland, JD Friedrichs, Ginny Newsome, Lauren Merin, Jenna Ramsey

## 4. COUNTRY (AND WORLD)

Dana Backer, Cori Carveth, Sarah Hartwell, Linh Nguyen, Maeveen Behan, Leonides Corral

NYTimes 04 Nov 2003

Please read to inform your group presentation.

Link on course website...



END