

14 January 2009
1st class meeting

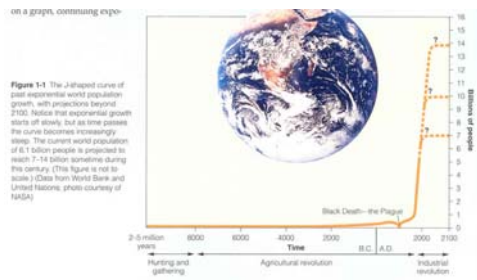
LABS BEGIN TUESDAY

- Introduction
- Course Overview and Objectives
- Syllabus

Please read: [Withgott & Brennan \[2007hardcopy\] Chapter 1](#)
(available as PDF on course website)

Environmental Biology (ECOL 206)
University of Arizona, spring 2009

Kevin Bonine, Ph.D.
Tuan Cao, Graduate TA
Mary Jane Epps, Graduate TA



What is Environmental Biology?

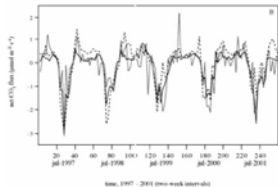
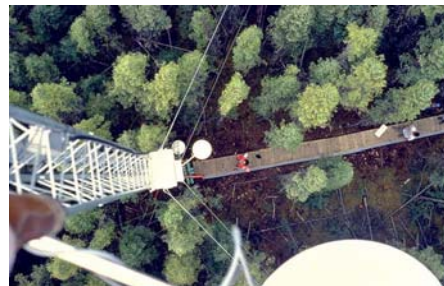
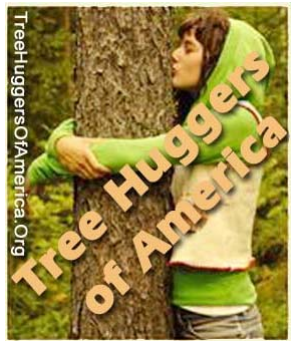


Figure 2. Five-year composite for estimates of net CO_2 flux over the WLEF region measured by eddy correlation (CO_2) and by methods based on the equilibrium boundary layer assumption. Panel A is 30-day and Panel B is 'fair-weather' days ($\text{ppt} < 1 \text{ mm}$).

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Broad Course Overview

1. Environmental Biology/Science (what is it?)

2. Ecology and Evolution

- Energy
- Nutrients
- Interactions among species and the abiotic environment
- Adaptation
- Processes

3. Human Influence

- Society/Culture
- Affluence
- Population
- Roles

Greater Earless Lizard



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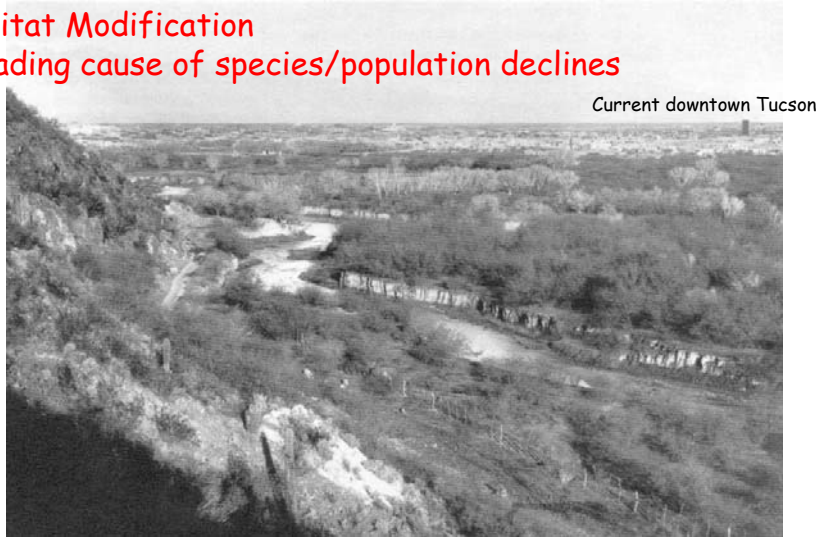
Overall course objectives

- Grasp scientific material (content & literacy)
- Provide real-world relevancy and applications
- Place in context of students' lives
- Foster life-long appreciation and respect for:
 - field, findings, ecosystem services, biodiversity, etc.

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Where and when was this photo taken?

Habitat Modification
= leading cause of species/population declines



Santa Cruz River at A-Mountain, Tucson, early 1900s

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ATHABASCA GLACIER, Jasper National Park, Alberta, Canada, 1917 and 2005



GRINNELL GLACIER, Glacier National Park, Montana, 1911 and 2000

Global Climate Change

Sierra Magazine
Jan/Feb 2006



Magazine Ad
Men's Journal
Jan 2006

IS GLOBAL WARMING MAKING HURRICANES WORSE?

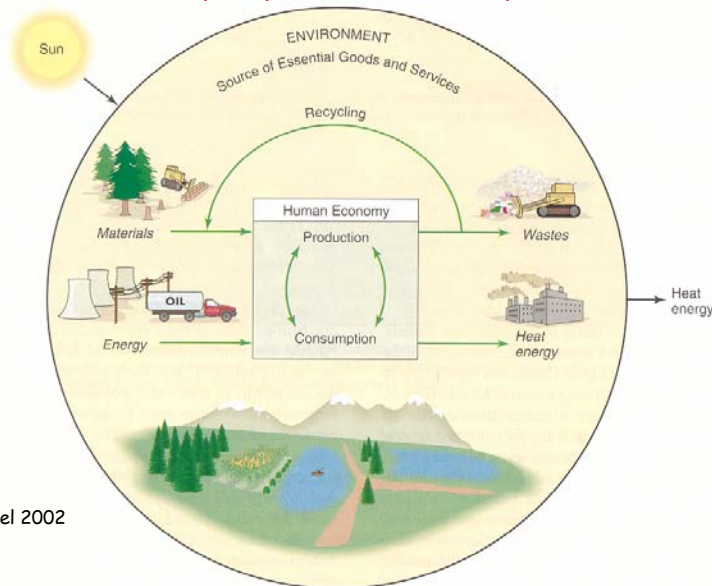
Global warming did not cause Hurricane Katrina. But science tells us that global warming is heating up our oceans, that warmer oceans make hurricanes stronger and that pollution makes global warming even worse. So isn't it time to use cleaner energy and better technology to power our economy? Learn the science behind the storm at nrdc.org



New Ideas. New Answers. A New Tomorrow. NATURAL RESOURCES DEFENSE COUNCIL The Earth's Best Defense

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Human Economy depends on Healthy Environment



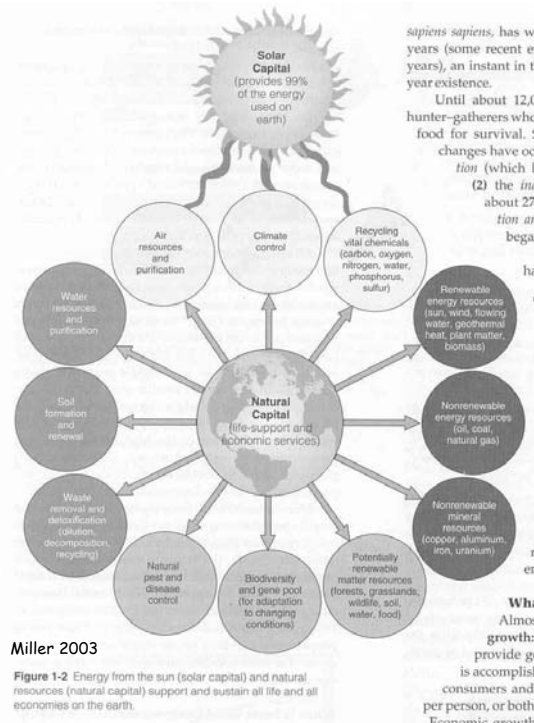
Wright and Nebel 2002

▲ **FIGURE 23-3 Environmental economic view of economic activity.** The natural environment encompasses the economy, which is constrained by the resources found within the environment.

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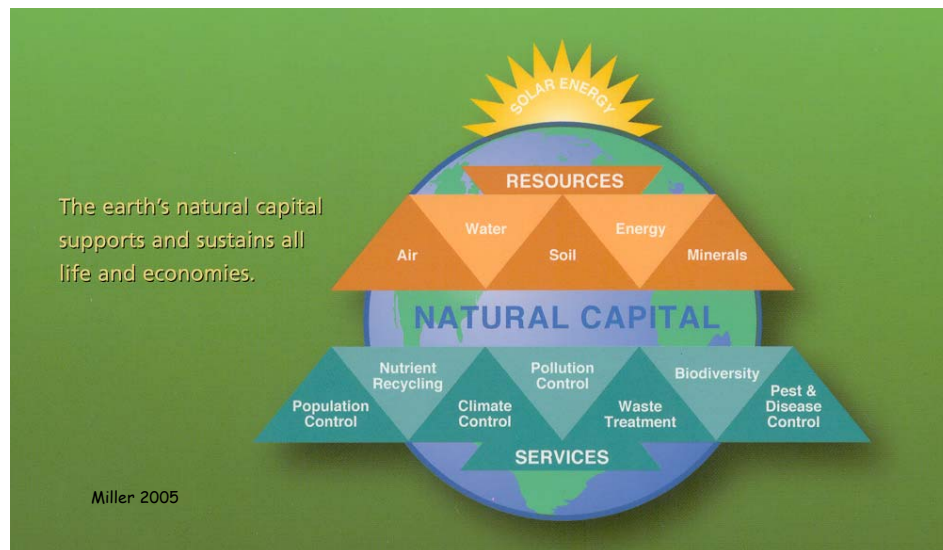
Natural Capital and Natural Resources:

-everything flowing in **natural economy** and human economy



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"Life Support System"



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Ecosystem Services...

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

Syllabus



-No Required Text

(*Ishmael* on Reserve in Science Library)

-Please get a small notebook for lab/field

-Many PDF files

-Website (<http://eebweb.arizona.edu/>)

(http://eebweb.arizona.edu/eeb_course_websites.htm)
then search for ECOL 206

-Schedules and Reading Assignments to be updated
on course website

Syllabus (con't)

Course Work Details



- Exams, Cumulative Final
- Attendance, Participation, and Quizzes
- Current Environmental Events Journal (due Fridays)
- Creativity Project, Debate
- Field Trips and Lab (take notes)
- Lab Assignments, Quizzes, Attendance

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Extra Credit (15 points; you can do this once) for environmentally themed songs. Sign up with your TA in your lab section to present at the beginning of lecture for 5 minutes. You should have the song playing on the computer when the 9am bell rings. Projected on the screen should be the lyrics. Give a brief biography of the artist, explain the lyrics (defining any unclear or important terms) and any specific environmental references, and explain the social context of the time during which the song was written and first performed. Are the environmental issues discussed in the song still relevant/important today? If you have trouble finding an appropriate song your instructors have some suggestions. If you are not prepared to present at the beginning of lecture on the day you signed up then you will lose 15 points from your overall grade.

Tom Lehrer (b. 1928)
"Pollution"
Post WWII Satirist

"As an undergraduate student at Harvard University, studying mathematics, he began to write comic songs to entertain his friends"

Lehrer has commented that he doubts his songs had any real effect on those not already critical of the establishment: "I don't think this kind of thing has an impact on the unconverted, frankly. It's not even preaching to the converted; it's titillating the converted... I'm fond of quoting Peter Cook, who talked about the satirical Berlin cabarets of the '30s, which did so much to stop the rise of Hitler and prevent the Second World War."

http://www.youtube.com/watch?v=JPrAuF2f_oI

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Time was when an American about to go abroad would be warned by his friends or the guidebooks not to drink the water, but times have changed and now a foreigner coming to this country might be told the following advice.

If you visit American city,
 You will find it very pretty.
 Just two things of which you must beware:
 Don't drink the water and don't breathe the air.
 Pollution, pollution,
 They got smog and sewage and mud.
 Turn on your tap and get hot and cold running crud.
 See the halibuts and the sturgeons
 Being wiped out by detergents.
 Fish gotta swim and birds gotta fly,
 But they don't last long if they try.
 Pollution, pollution,
 You can use the latest toothpaste,
 And then rinse your mouth with industrial waste.
 Just go out for a breath of air,
 And you'll be ready for Medicare.
 The city streets are really quite a thrill.
 If the hoods don't get you, the monoxide will.
 Pollution, pollution,
 Wear a gas mask and a veil.
 Then you can breathe, long as you don't inhale.
 Lots of things there that you can drink,
 But stay away from the kitchen sink.
 The breakfast garbage that you throw in to the bay,
 They drink at lunch in San Jose.
 So go to the city, see the crazy people there.
 Like lambs to the slaughter,
 They're drinking the water
 And breathing <cough> the air.

Tom Lehrer "Pollution"



http://www.lyricsfreak.com/t/tom+lehrer/pollution_20138396.html 30

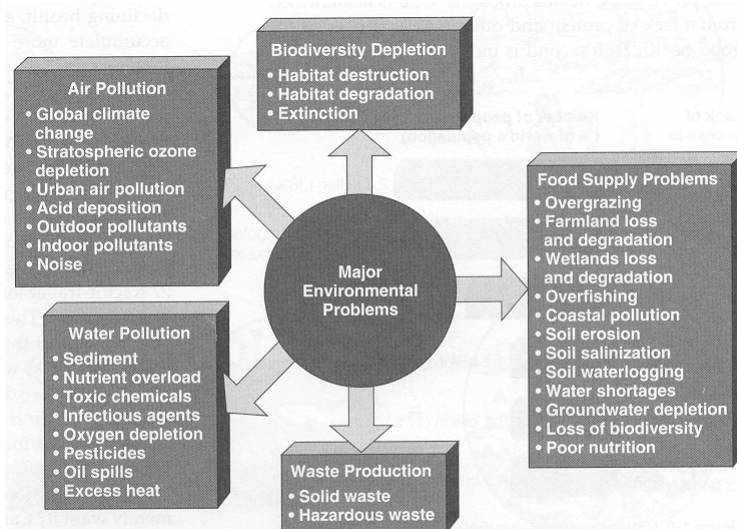


Figure 1-7 Natural capital degradation: major environmental and resource problems.

Miller 2005

I P A T

Developed Countries

1.2 billion people (~19%)
high average per capita purchasing power
have 85% world's wealth
use 88% natural resources
generate 75% waste and pollution

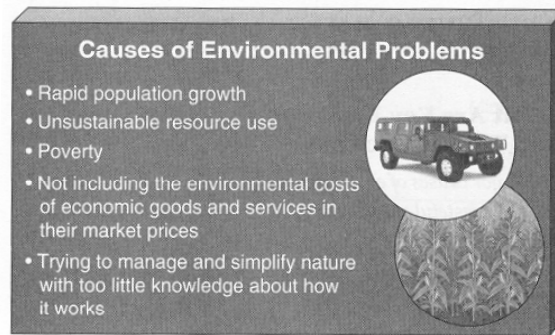
$$\text{Environmental Impact (of a society)} = \text{Population} \times \text{Affluence (consumption)} \times \text{Technology}$$

Developing Countries

81% of the people
have 15% world's wealth
use 12% world's natural resources
produce 25% waste and pollution

Poor parents in a developing country need to have 70-200 children to equal the environmental impact of 2 U.S. children

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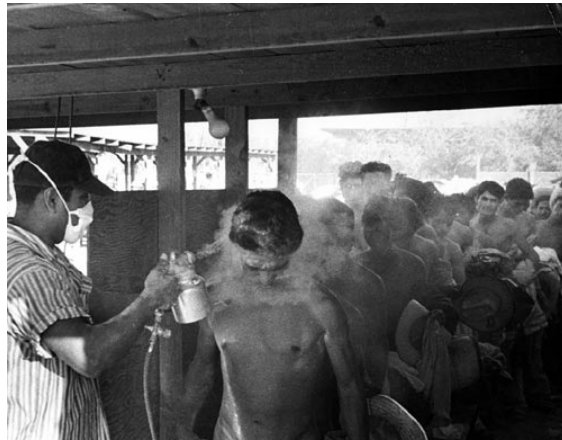


Miller 2005

Figure 1-8 Environmentalists have identified five basic causes of the environmental problems we face.

What would Jesus drive?

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DDT, 1956, Contract Mexican Laborers in Texas

http://www.npr.org/templates/common/image_enlargement.php?imageResId=5176180&imageStoryId=5176177

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Firefighters battle a **fire on Ohio's Cuyahoga River** in 1952. The 1969 blaze, one of nine on the river since 1868, came at a time of increasing environmental awareness and symbolized years of environmental neglect. This, in turn, helped spur grassroots activism that resulted in a wave of federal legislation devoted to clean air, clean water, and natural resource protection.

Credit: United Press International

http://images.google.com/images?imgurl=http://celebrating200years.noaa.gov/events/earthday/cuyahoga_fire650.jpg&imgrefurl=http://celebrating200years.noaa.gov/events/earthday/cuyahoga_fire.html&usq=__FKaMB_0B511ah1wadyGkR0g=&h=343&w=480&sz=46&hl=en&start=3&am=1&bid=IPhwMMag_5o8M.&ctbnh=92&rbw=129&prev=images%3Fq%3Dcuyahoga%2Briver%26um%3D1%26hl%3Den%26client%3Dfirefox-a%26rl%3Dorg.mozilla-en-US.official%26sa%3DN

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Individuals Make a Difference...



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ONE SMALL STEP



Savannah Walters, Odessa, Florida
Pump 'em Up founder, age 13

Sierra Magazine
Jan/Feb 2006

Making Drilling Look Dumb

I studied the Arctic for six weeks in second grade and fell in love with the gray wolf. When I found out the government wanted to drill there, I got really upset. My mom saw a slide show by this guy LeRoy Kahn, who had taken all these pictures of the Arctic, and she asked if I could call and talk to him.

"He told me that Americans waste millions of gallons of gas every day by not properly inflating their tires, and I couldn't believe that!" I said. "Well then, why don't we just pump them up?" I got my Girl Scout troop to go to our local train station and put tire gauges, balloons, and flyers on everyone's car. By then I was in the third grade, and we did that and it was a lot of fun. We got Sears and Roebuck and Good-year to donate a thousand tire gauges, and we handed them out for free.

"People began popping my eyes off the Internet. Now they're handing them out everywhere! My best friend, Claire helps me, and my other best friends, Allie and Sabrina really help me too. People think it's amazing that kids do this stuff, so sometimes kids are more effective."

"I even got to lobby in D.C. One senator didn't agree with me. He said, 'How do you expect people to do this?' I said, 'Whatever! It's easy! And if we do drill the Arctic, we'll only get about six months of oil.'

"It's not just about the Arctic—it's also about drilling off our beaches. We really don't need to. Gas prices are skyrocketing, and if you just inflate the tires, then you save gas, there's less pollution, and you don't have to waste money. We had a big thing on Earth Day to pass out free tire gauges. People said, 'Oh wow, I didn't know that—I'm gonna go check my tires right now!'" —interview by Del Cate

GAS-SAVING TIP: Underinflating tires by as little as five pounds can cut your mileage by 2 percent, according to the U.S. Department of Energy. Use the "recommended pressure" found in the owner's manual and often inside the driver's side front door, not the "maximum pressure" (a limit set to keep tires from exploding).

ON THE WEB Learn more about Savannah's group at pumpemup.org

Savannah Walters Pump 'em Up founder (age 13)

-Properly inflated tires save fuel and reduce greenhouse gas emissions.

-Save much more gas than is under Arctic National Wildlife Refuge



<http://arctic.fws.gov/>

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Twenty-seven percent of Americans' daily trips are one mile or less.



Trendsetter

Toting your kid to school? Hauling a kayak to the water? Leave your car behind and hop on one of Ross Evans' inventions. With its sturdy rear platform and roomy saddlebags, the sleek, shaggy Xtracycle is more maneuverable than a bicycle trailer and can handle loads of up to 150 pounds.

Q: What's your favorite place to take your Xtracycle?

A: The grocery store. Everybody needs to go shopping, and the Xtracycle makes a mundane experience joyful.

Q: How so?

A: People get an Xtracycle for a specific chore, but it makes it possible to live a whole lifestyle that's more sustainable while getting in better shape and being more adventurous.

Q: What about bad weather?

A: Marketers try to sell us on an ideal of comfort: "You've worked hard. You deserve to drive a leather-interior car with the air conditioner on." We're saying you deserve to experience life more fully by getting in touch with the elements and your own self-sufficiency. —interview by Alison Fromme

Sierra Magazine
Jan/Feb 2006

A recent study concluded that switching to organic foods provides kids with "dramatic and immediate" protection from toxic pesticides. ehp.niehs.nih.gov

SIERRA • 37

Ross Evans
grew up in Tucson

Started Xtracycle

-Bikes as trucks in developing countries
-Adds 15" to length of bike
-Hauls ~180 lbs.

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