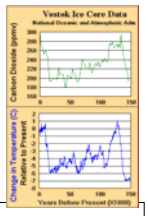
Ecology and Evolution

07 February 2007
12th class meeting

Wilson & Dillard
Thanks to guests



07 February READINGS:
EO Wilson book chapter
Annie Dillard book Chapter
Friday 09 Feb:
Quammen reading, Mayr Interview
Monday 12 Feb:
Exam 1 through 05 Feb material

Lab 07/09 Feb:
Meet in lab, then outside
See assignment on webpage
Lab 14/16 Feb:
Meet in lab;
Data analysis and graphing

Environmental Biology (ECOL 206)
University of Arizona, spring 2007

Kevin Bonine, Ph.D.
Anna Tyler, Graduate TA

http://eebweb.arizona.edu/courses/Ecol206/206_Page2007.html

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Interested in addressing environmental issues on campus?

ECOalition

Who we are: ECOalition is a coalition of student environmental clubs on campus that works to make the university a more environmentally friendly and sustainable place to be.

What we do: ECOalition holds bi-monthly meetings to discuss current events and projects, upcoming grant and conference opportunities, and future projects on campus. We also work on getting the 'green' word out to students and engaging you in addressing topics of global climate change.

Next Meeting!
6pm | Thursday | February 8th | SUMC, Madera Room

Why attend? We're interested in students who want to be involved making the UA a more sustainable campus. Our members come from majors such as: environmental science, economics, natural resources, psychology, sociology, international studies, anthropology… So come by to our meetings!

CONTACT US:
Email: ECOalition@gmail.com
Website: http://u.arizona.edu/~prabjit/ECOalition/

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1) El Niño is a change in oceanic-atmospheric relationship. During El Niño trade winds relax. Normally, warmer water is pushed toward Indonesia/Australia and this causes upwelling of cool, nutrient rich water off the coast of S. America. During El Niño this does not occur as much. Rain and flooding in Peru accompanied by drought in Indonesia and Australia. Also affects primary productivity.

2) A keystone species is one that has a disproportional affect on its community compared to its numbers. Examples include bald eagles, sea otters, elephants, other large herbivores, ants, and star fish.

3) Ecosystem services are processes that naturally occur, such as decomposition, pollination, and nutrient cycling that humans do not pay for but reap the benefits of.

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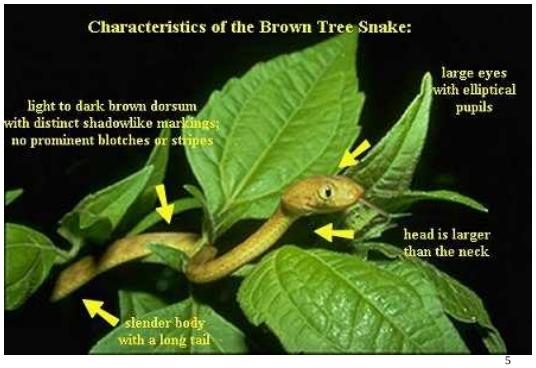
Biological Invasions

Kathy Gerst
Dept. of Ecology and Evolutionary Biology



http://www.fort.usgs.gov/resources/education/bts/bts_home.asp



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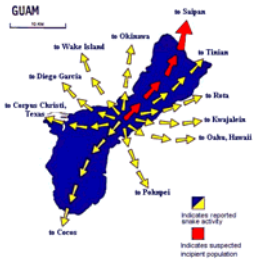

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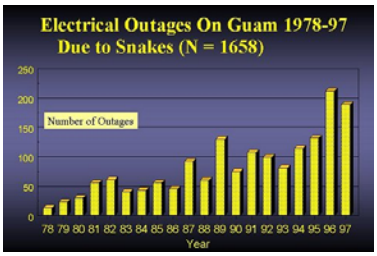

http://www.fort.usgs.gov/Resources/Education/BTS/

The hand of an infant with swelling, discoloration, and bleb formation.

Results of one night's captures by hand.

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Community
Ecology
Keystone Species
Assembly Rules
Ecological Release
Colonization
Dynamic Equilibrium
Character Displacement
Darwin's Finches
Bill Depth
Sexual Selection
Species Recognition
Pisaster
Parasitism (eat less than one individual at a time)
Commensalism (check your forehead)
Mutualism
Termites
Mycorrhiza
Coral

E.O. Wilson

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What ecological concepts does the figure to the right illustrate?

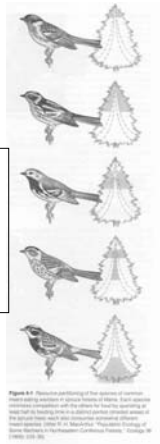
Species Interactions
1. Competition
2. Predation
3. Parasitism
4. Mutualism
5. Commensalism

Intraspecific vs. Interspecific Competition
- migration
- adaptation
- extinction

Resource Partitioning
- time, space, method

Warblers in Maine

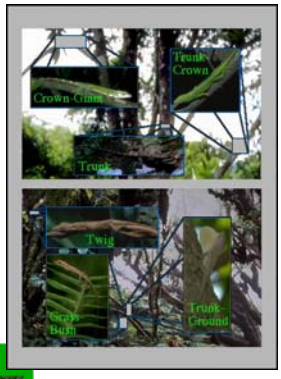
-difft location in spruce and difft prey species

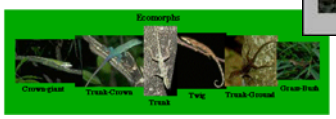


Miller, 2003

1. Competition

Anolis





Ecomorphs on Caribbean Islands

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Pisaster (predatory sea star)
Paine
15 vs. 8 spp.
(mussels)

http://www.washington.edu/research/pathbreakers/1969g.html

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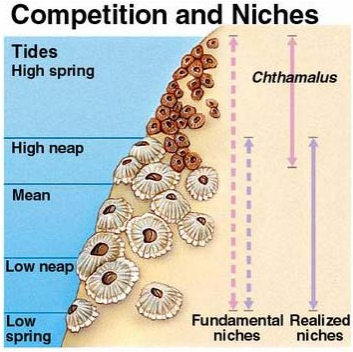
Competition and Niches



Ecological Release

Interspecific Competition

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2. Predation

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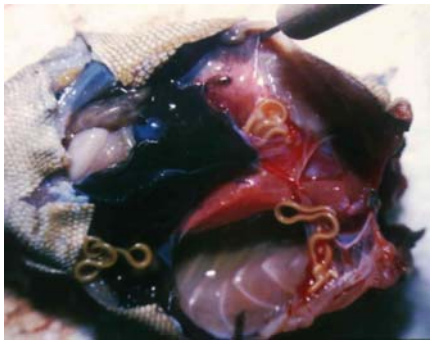
3. Parasitism



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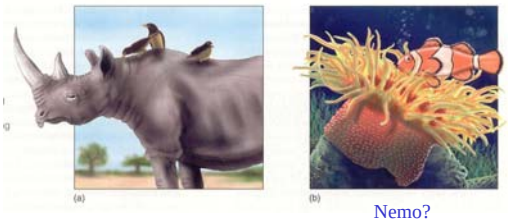
4. Mutualism



Nemo?

See 4-2 in Miller 2003

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Algae
+
Fungi

Lichen

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-Energy
-Nutrients
-Habitat
-Niche

Coral reefs usually occur in nutrient poor waters and must be shallow enough for sunlight to reach them. Contained between the cells of the coral polyp cylinder are single-celled green algae called dinoflagellates. The coral polyp and the dinoflagellates form a complex mutualistic relationship. The coral polyp sweeps organic material from the water and metabolizes this material forming carbon dioxide and nitrogenous wastes. The dinoflagellates use the carbon dioxide and nitrogenous wastes in photosynthesis to form oxygen and sugars that are in turn used by the coral polyps as well as the dinoflagellates in their metabolism, reforming the carbon dioxide and nitrogenous wastes. This cyclical exchange of nutrients, oxygen, and carbon dioxide is beneficial to both the coral polyps and the dinoflagellates, a mutualistic relationship.

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5. Commensalism

Florida

Ecuador

Bromeliads

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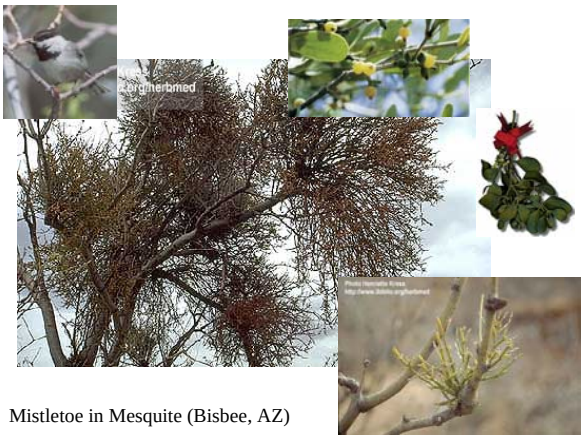
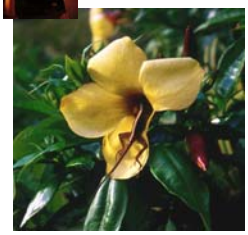


Mistletoe in Mesquite (Bisbee, AZ)

Indicator Species
-migratory birds
-amphibians

Rana pipiens
Northern Leopard Frog

Keystone Species
-top predators
-key pollinators



Umbrella Species
-their protection helps protect other components of ecosystem

Native Species
vs.
Nonnative, exotic, alien

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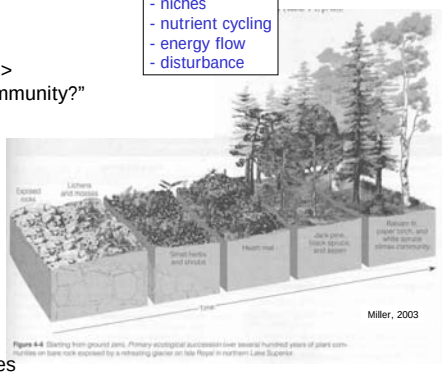
Ecological Succession

- diversity
- structure
- niches
- nutrient cycling
- energy flow
- disturbance

1. Primary
bare rock -->
"climax community?"

2. Secondary



Miller, 2003

Assembly Rules

Distribution of Organisms
~Community Composition

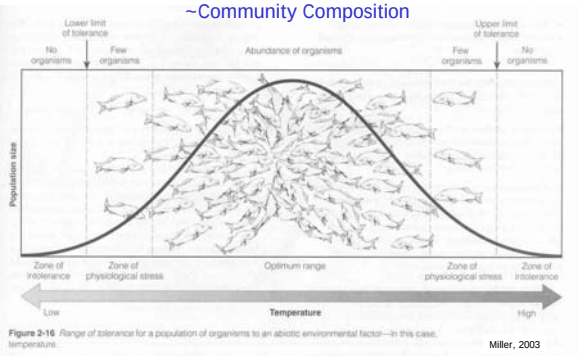


Figure 2-16 Range of tolerance for a population of organisms to an abiotic environmental factor—in this case, temperature.

Miller, 2003

Range of tolerance of abiotic factor(s)

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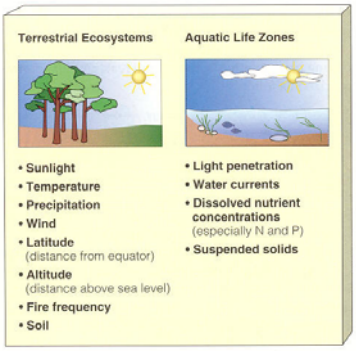
Distribution
and
Abundance



Other Miller 2003

Figure 4-12 Key physical and chemical or abiotic factors affecting terrestrial ecosystems (left) and aquatic life zones (right).

Annie Dillard 1974
Pilgrim at Tinker Creek
Fecundity

- Reproduction
- Exponential Growth

- 9,000 vs. 3 train engines
  "It's a hell of a way to run a railroad"

- Animal vs. Plant

- Age of Reproduction
- Role of old age?
  Gall gnat (fly)
  Miastor (fly)

-Aphids (1/10 inch long)
in one year 2,500 light years

- Role of the individual?
- What evolves? Is death necessary?

- Emotions and values (humans vs. nature)

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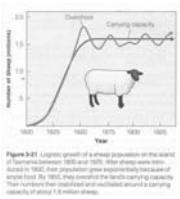
Logistic growth (S vs. exponential J)

Population growth limited
at Carrying capacity (K)



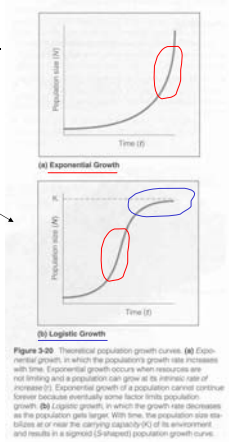


Fig 4-6,7,8 in Miller 2005

r = intrinsic rate of increase

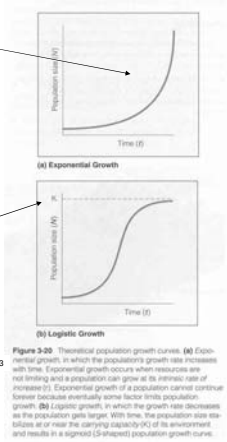
Rate that population could grow
with unlimited resources

"r-selected" organisms:
1. Reproduce early and often
2. Short generation times
3. Many offspring

K = carrying capacity

1. Limited by
   - resources
   - competition
   - predators

Therefore have intraspecific competition.



Miller 2003

Darwin and elephants

There is no exception to the rule that every organic being naturally increase at so high a rate that if not destroyed, the earth would soon be covered by the progeny of a single pair .... The Elephant is reckoned to be the slowest breeder of all known animals, and I have taken some pains to estimate its probable minimum rate of natural increase: it will be under the mark to assume that it breeds when thirty years old, and goes on breeding till ninety years old, bringing forth three pairs of young in this interval; if this be so, at the end of the fifth century there would be alive fifteen million elephants, descended from the first pair
- (*Darwin, 1859,* On the Origin of Species, p.64)

Shortly after this, the eminent physicist William Thompson (later Lord Kelvin) pointed out that Darwin got the math wrong. After about 500 years, there should only be about 16 thousand elephants, not 15 million. Indeed, the engineer Fleeming Jenkin referred to another of Darwin's calculations as guessing at the half and multiplying by two (*fide Burchfield, 1990* p.74). The basic problem, however, remains, **a few elephants can produce lots of elephants**.

http://www.athro.com/evo/elframe.html

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