The term “ecology” coined in 1866

“By ecology we mean the body of knowledge concerning the economy of nature - the investigation of the total relations of the animal both to its inorganic and its organic environment; including above all, its friendly and inimical relations with those animals and plants with which it comes directly and indirectly into contact - in a word, ecology is the study of all those complex interrelations referred to by Darwin as the conditions of the struggle for existence.”

Ernst Haeckel 1866

The Modern Definition

Ecology -

Characteristics of Ecology

- Studied at several hierarchical levels
- Uses the scientific method
- Is interdisciplinary
- A great way to make a living

Ecology is studied at many hierarchical levels

Organisms

Populations

Communities

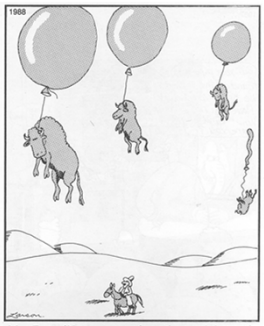
Ecosystems

Landscapes

Ecosphere (A.K.A. The Biosphere)

_____ ecologists

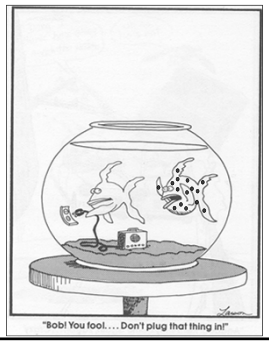
_____ ecologists



More Facts of Nature: As part of nature's way to help spread the species throughout their ecological niche, bison often utilize a behavior naturalists have described as "ballooning."

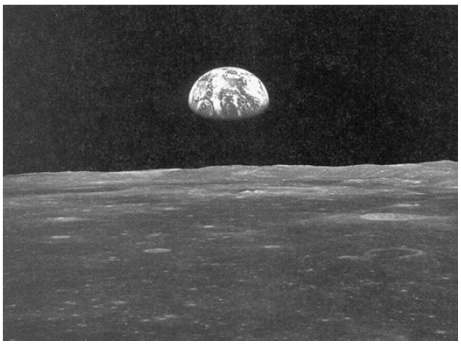
_____ ecologists

_____ ecologists



_____ ecologists.

_____ ecologists



Ecology is different from Environmentalism

Ecologists use the scientific method to understand the order of the natural world

Case Study of Ecology in Action

Observations -

In 1989 scientists meeting in England for a herpetology conference discovered that all over the planet their colleagues were noticing amphibian declines and disappearances. No one knew what to make of it.

Patterns observed in amphibian decline

Rapid declines are widespread

16 countries & 5 continents

Stuart et al. 2004; Blaustein & Wake 1990

Patterns observed in amphibian decline

Many species are threatened

Some declines have been dramatic

Some populations may have gone extinct

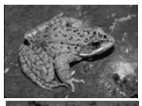
Not all species within the same regions are affected

Declines have been noted in remote areas

Species Examined

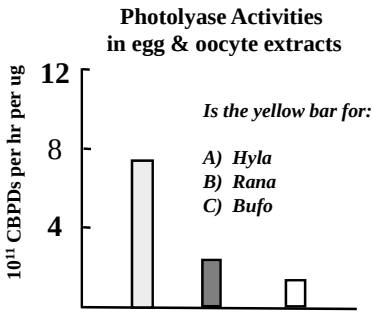
Hyla regilla (Pacific treefrog)

Rana cascadae (Cascades frog)

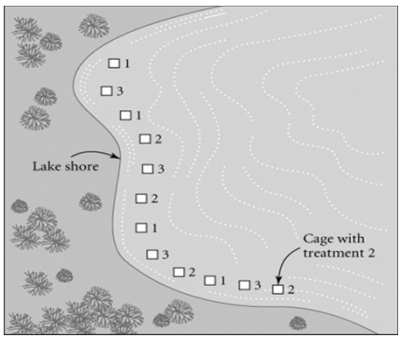


Bufo boreas (Western toad)

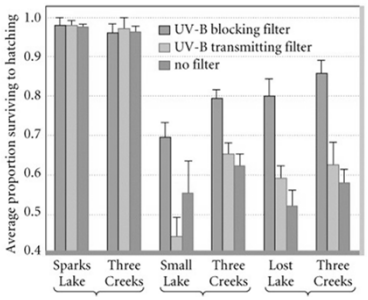
Testing in the Lab



Testing in the Field



Results from field experiment.

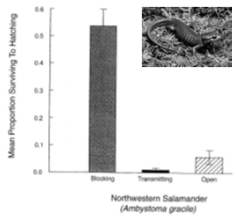


Is the first set of results for:

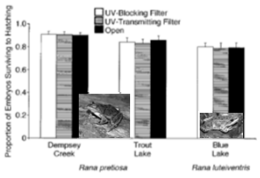
A) Hyla
B) Rana
C) Bufo

Which species belong to which bars?

Results of similar experiments have been published and have shown both similar and contrasting results.



Blaustein et al. 1995



Blaustein et al. 1999

Learn more about amphibian decline

Read Required Article #1

Stuart et al. 2004 & answer study questions

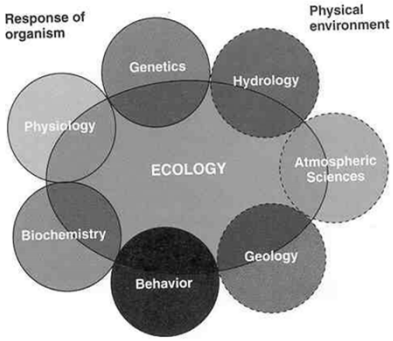
Check out:

http://amphibiaweb.org/declines/declines.html

Consider completing ECO #1

Due Jan. 31st

Ecology is interdisciplinary



It's a great way to make a living!

Career opportunities exist for ecologists !

Check out the following site for information about ecology as a career:

http://www.esa.org/esa/?page_id=2139

On your own, examine the following web site to learn about current jobs:

http://wfscjobs.tamu.edu/job-board/

These sites are available at the Bio. 221 web site.

Homework Assignment

Write down the following information about any ***internship*** opportunity that interests you on the Texas A&M Job Board web site *(see helpful links page on class web site)*:

1) Internship Title
2) Location
3) Agency offering the job
4) Salary
5) Why you find it interesting

Email this information to me by the start of our next class.

Will count as a clicker question for today's class

Major Ecological Lessons

The natural world is diverse, complex, and interconnected

The natural world is organized by physical and biological processes

Natural systems recycle essential nutrients

Natural systems are maintained and constrained by processing energy

Good and bad environments exist for every species

Major Ecological Lessons

Ecological communities can recover from disturbance but not always

All populations can grow exponentially

No population grows without limits

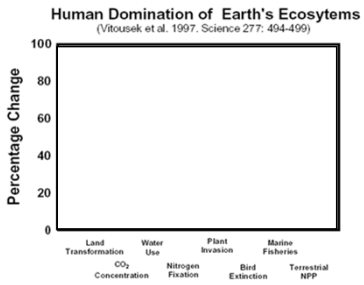
Nothing in biology makes sense except in the light of evolution

Humans depend on and affect natural ecosystems

"The health of an economy cannot be separated from that of its natural support systems."

Lester R. Brown 2006 Plan B 2.0

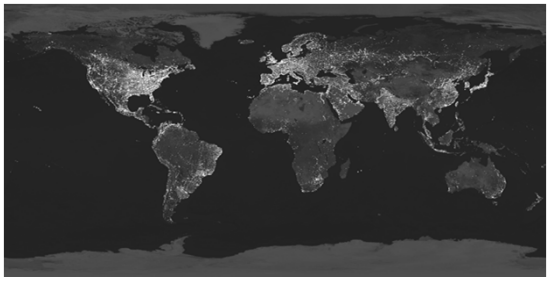
Evidence for the Anthropocene



Assignment

Read required article #2 on the Anthropocene by Kolbert 2011 on the class web site & answer study questions.

I = PAT



Learn about I = PAT by reading required article #3 by Meadows on class web site & answering the study questions.

The term "ecosystem" coined in 1935

"The more fundamental conception is ... the whole system (in the sense of physics), including not only the organism-complex, but also the whole complex of physical factors forming what we call the environment ...the habitat factors in the widest sense .... Our natural human prejudices force us to consider the organisms ... as the most important parts of these systems, but certainly the inorganic "factors" are also parts, ... and there is constant interchange of the most various kinds within each system, not only between the organisms but between the organic and inorganic. These ecosystems, as we may call them, are of the most various kinds and sizes."

A.G. Tansley

Practical problems with the ecosystem concept

If all parts of the systems are to be treated in a similar manner, what common denominator can be used to express their interdependence?

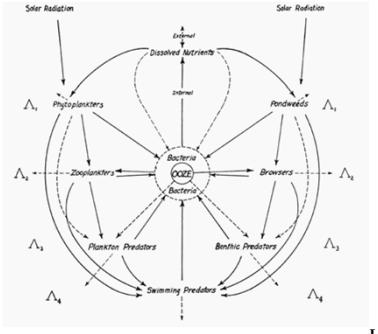
How big is an ecosystem?

Energy and matter are exchanged between organisms and between organisms and their physical environment

"The trophic dynamic viewpoint, as adopted in this paper, emphasizes the relationship of trophic or "energy-availing" relationships within the community unit".

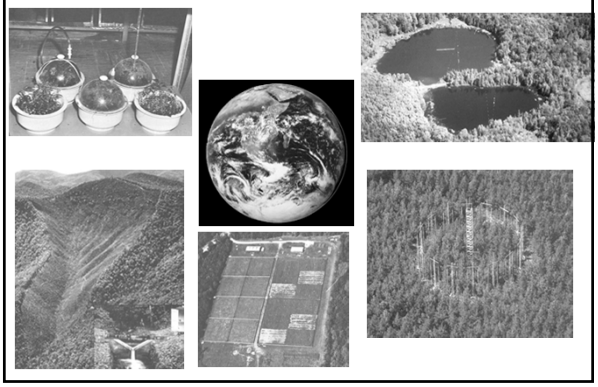
Lindeman 1942

The Trophic-Dynamic View of Cedar Bog Lake



Lindeman 1942

Ecosystems have many shapes & sizes



Ecosystems are Maintained by

- **A continuous flow of energy**
- **The continuous cycling of essential materials**

Ecosystems provide a variety of services that benefit humans

- Moderation of climate.
- Supply of food and fiber.
- Pollination
- Pest control
- Waste purification.
- Maintains a “genetic library”.
- Recycles essential materials.

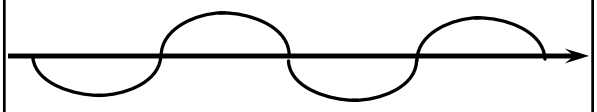
The fundamentals of energy

- Energy is …
- Energy comes in many interchangeable forms:
- 1st law of thermodynamics -

Electromagnetic Radiation

Has the following properties:

Energy content of EMR is related to its wavelength



λ = wavelength

Common types of EMR

Type	λ		Energy Content
Radio	1-10	m	
Microwaves	0.01-0.3	m	
Infrared	0.71-100	um	
Visible light	0.4-0.71	um	
Ultraviolet	0.1-0.4	um	
X-rays	10^{-5}-10^{-2}	um	

um = 10^{-6} m

(From Ehrlich et al. 1977)

Electromagnetic Radiation (cont.)

- Everything with a temperature emits electromagnetic radiation.

  Stephan-Boltzmann Law: $\mathbf{E = \sigma T^4}$

- Wavelength of maximum emission depends on the temperature of the object.

  low temp. => longer λ_{max}

  high temp. => shorter λ_{max}

What does the area under each curve represent?