

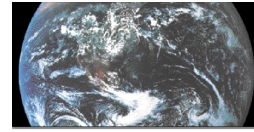
ECOLOGY

- What is ecology?
- How do we study ecology?
- Review of scientific method
- Ecological questions relevant to each level of biological investigation (individual, population, community....)

What is ecology?

Ecology is the scientific study of the interactions between organisms and their environment.

Taken from the Greek *oikos*, meaning home



Ecology vs. Environmentalism

Ecology can provide a scientific context for understanding and evaluating environmental issues (i.e. conservation biology), but the science of ecology should not be confused with environmentalism



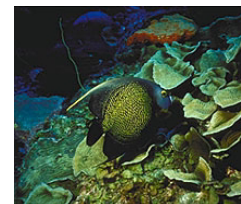
"Ecological Theater, Evolutionary Play"

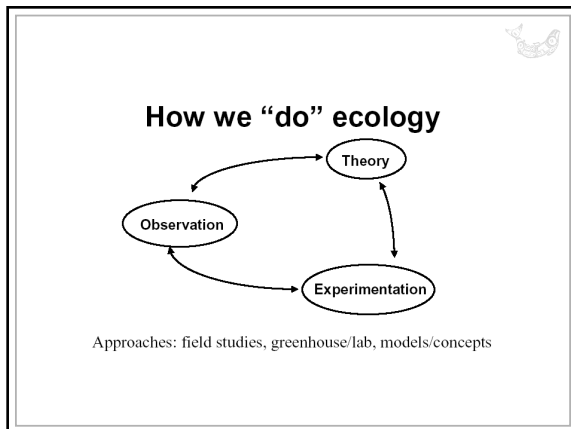
- Short-term ecological response mechanisms
- Long-term evolutionary framework



How we study ecology

- Ecology is a multi-disciplinary science.
- Methods of study:
 - reductionist
 - holistic





Modes of Ecological Inquiry

All ecological studies must address trade-offs between realism, precision, and generality

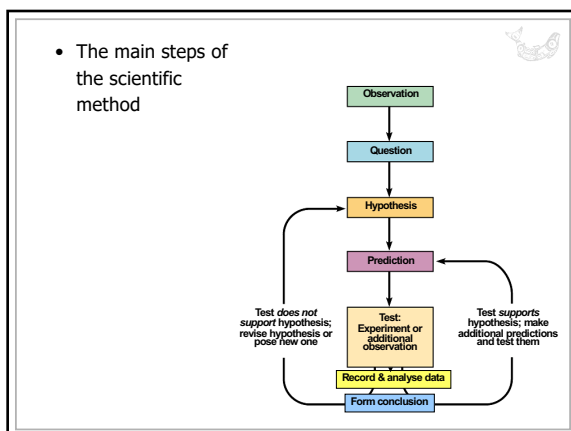
- *Observational* – incorporates a knowledge of natural history and long-term monitoring
- *Experimental* – involves controlled laboratory, greenhouse, and field study manipulations
- *Theoretical* – uses mathematical models and computer simulations to understand concepts

Scientists use different methods to learn about nature

- Discovery method - describe some aspect of the world
- Example: how newborn flying foxes cling to their mother's chest for the first weeks of life

Presentation adapted from: Campbell, N., Reece, J., Mitchell L., Taylor M., 2003. Biology: Concepts and Connections. Powerpoint lectures. Pearson Education, Inc. publishing as Benjamin Cummings

- The scientific method
 - Pose and test hypotheses



- Cosmos
- Galaxy
- Solar System
- Biosphere
- Biome
- Ecosystem
- Community
- Population
- Organism
- Organ System
- Organ
- Tissue
- Cell
- Organelle
- Molecules / Biochemical Pathways
- Atoms (including protons, neutrons, electrons)
- Quarks, Leptons, Gluons

Organism

- Most fundamental unit of ecology
An individual of a species

Studies:

*morphological, physiological
and behavioural adaptations used by
organisms interacting with their
surroundings*



Photo: Greg Mortimer



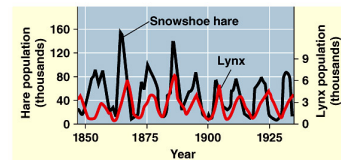
Population

- A group of individuals of one species in
a geographical area

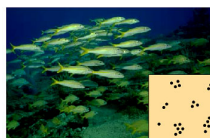
Studies:

*population dynamics: stable,
increasing, decreasing.*

Spatial distribution



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(a) Clumped



(b) Uniform



(c) Random

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Community

Interacting populations in a particular area

Community Ecology Questions

- Why are there more species in the tropics?
- What is the role of predators in maintaining rocky intertidal diversity?
- What is the role of fire in natural communities?



Ecosystem

Assemblages of organisms together with their biotic and abiotic environments.

Ecosystem Ecology Questions

- What are the fluxes of nutrients in a forest?
- What is the role of vegetation in retaining nutrients?
- How are diversity and productivity related?
- What limits open ocean productivity?



Biome

Region of a dominant vegetation type determined by climate and geology.

- Why is a species confined to its present range and what prevents it from colonizing other areas?
- What scale, shape and components are necessary for a particular conservation goal?



Figure 1. Current and Historic Grizzly Bear Distribution in North America



Biosphere

The part of earth where life exists

Global Ecology Questions

- What is the effect of increasing global temperatures, soil erosion, aquifer depletion, etc?
- What is the effect of "homogenisation" of species composition?
- What portion of productivity is controlled by humans?



Living organisms and their environments form interconnecting webs

A web of interactions in a rainforest ecosystem

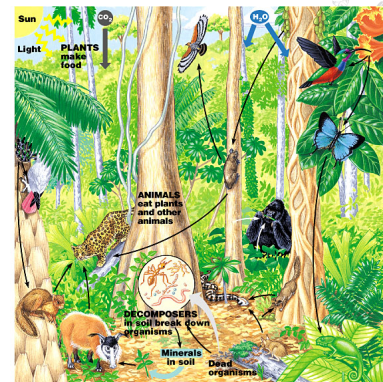


Figure 1.7A

Plants (or plant products) are the ultimate sources of food in an ecosystem

- This African sunbird is consuming nectar, a plant product



Figure 1.7B

- Chemical nutrients cycle within an ecosystem's web

- Energy flows in and out constantly

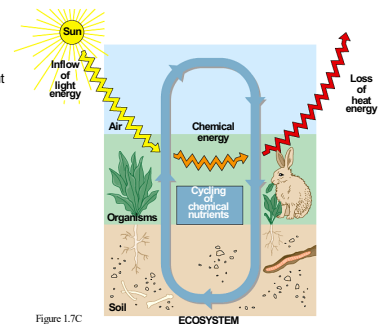


Figure 1.7C



– In order to understand how rain forest destruction impacts global climate, it is important to understand biology from the molecular to the ecosystem level



Figure 1.8B