

A close-up photograph of a vibrant green leaf, showing a central midrib and numerous secondary veins radiating outwards. The leaf's surface has a fine, textured appearance. The text is centered over the leaf.

Chapter 18

Sections 1 and 2

03.03.08 / 03.04.08

Section 1 Introduction to Ecology

Ecology

- *oikos* = house, and *logos* = study
- **Ecology:** What are the factors that determine the distribution and abundance of organisms, and what will make those change?

Interdependence: A Key Theme in Ecology

- **Organisms and Their Environments**
 - Species interact with both other species and their nonliving environment.
 - **Interdependence** is a theme in ecology—one change can affect all species in an ecosystem.

Interdependence

- All the energy you use to live comes from the Sun.
- Plants use solar energy to grow; herbivores get their energy from eating plants; carnivores get their energy from eating the herbivores

Interdependence

- After the 2004 hurricanes, all the koi at Bok Sanctuary died.
- The hurricanes caused many plants materials to end up in the water; the decomposing plants became food for bacteria; the bacteria population increased and consumed more oxygen; the koi died from lack of oxygen

Interdependence

- Nitrogen is sometimes contained in acid rain
- Nitrogen is a fertilizer for plants, and it is also important for animals
- A researcher studied in the effects increased nitrogen in plants had on caterpillars. He found caterpillars preferred plants grown in higher nitrogen environments, and eating those plants helped the caterpillars grow faster and reproduce more.

Interdependence

- He then tested the hypothesis in two parts of a forest. Over a 15-year period, he fertilized one part and left the other as a control.
- He found the amount of leaves eaten by caterpillars in the fertilized forest was lower than in the control forest.
- Why was this result opposite of the lab result?
- The answer: Birds

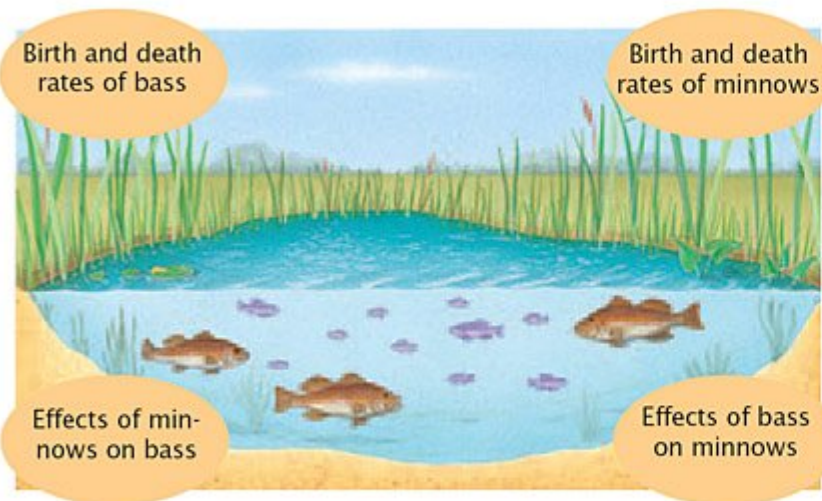
Models

- In science, models are used to represent, explain and predict complex systems
 - Models are ideas, not pictures or scaled-down objects
- Models often use mathematical terms
- Models are based on the most important factors in the system and are designed according to the parameters of those factors

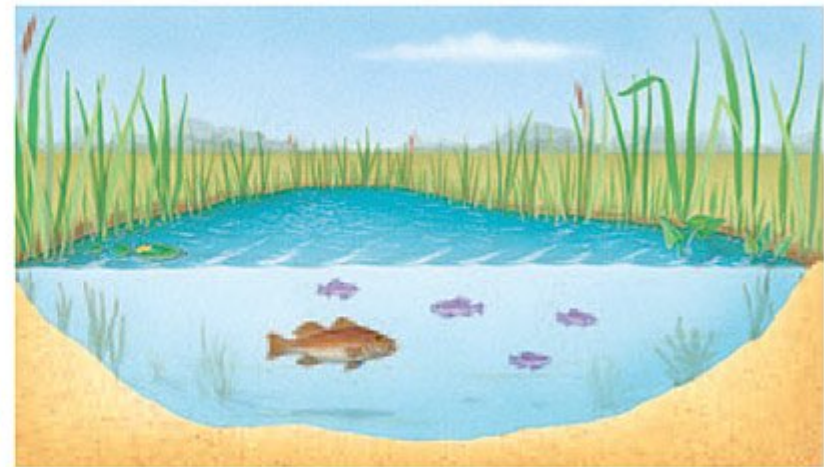
Ecological Models

- **Ecological models** help to explain the environment.

An ecological model can predict how an ecosystem, such as this pond, responds to disturbance.



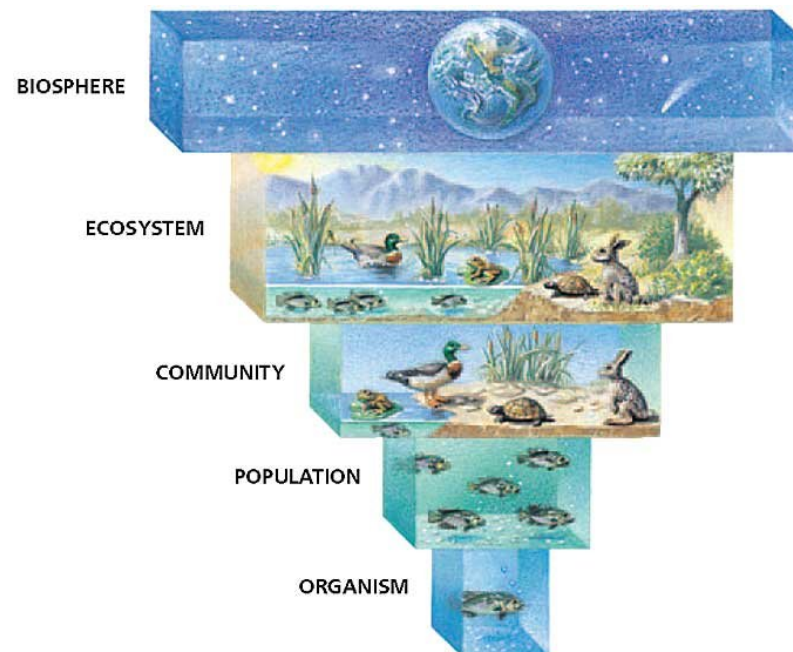
a A scientist making a model of this ecosystem might consider the factors shown in the yellow ovals.



b The model predicts that a disturbance, such as a disease that affects minnows, would cause the number of bass to decrease.

Levels of Organization

- Ecologists recognize a hierarchy of organization in the environment: biosphere, ecosystem, community, population, and organism.



Levels of Organization

- **The Biosphere**

- The broadest, most inclusive level of organization is the **biosphere**, the volume of Earth and its atmosphere that supports life.

Levels of Organization

- **Ecosystems**

- The biosphere is composed of smaller units called ecosystems.
- An **ecosystem** includes all of the organisms and the nonliving environment found in a particular place.



Ecosystem

- Video: Hot Water Ecosystem
 - What do the different colors in the water represent?
 - Identify two animals that are part of the hot water ecosystem.

Florida's ecosystems

- **Hardwood Hammocks**
localized variety of
hardwood trees,
often growing in
shallow soils



Florida's ecosystems

- **Swamps**
frequently flooded, thick
trees and understory



Florida's ecosystems

- **Freshwater marshes**
few, if any trees, and frequently flooded; serve as natural filters



Florida's ecosystems

- **Coral**

can develop into reefs that provide habitat for thousands of species and protect coast from storms



Florida's ecosystems

- **Dunes**

created by wind, but held in place by grasses; provide barrier against shore erosion and habitat for seabirds and turtles



Florida's ecosystems

- **Mangroves**
mangroves grow in saltwater and areas with frequent saltwater flooding; they provide an important barrier against shore erosion



Florida's ecosystems

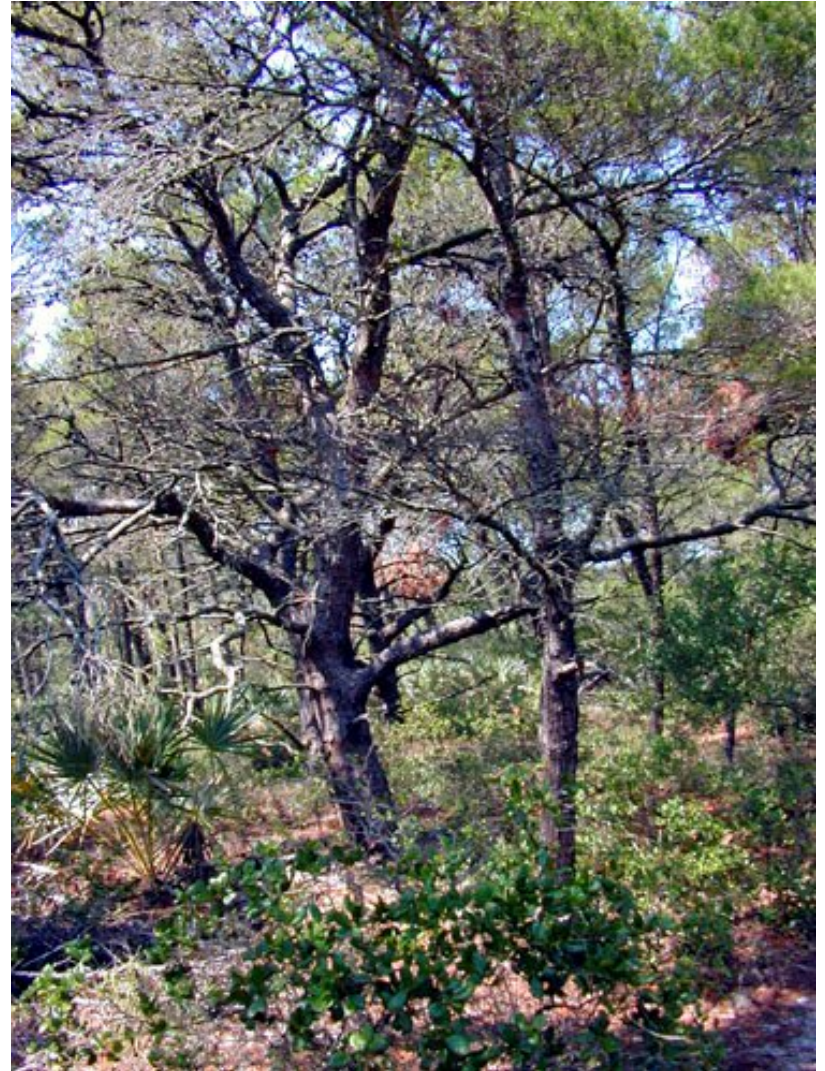
- Pinelands maintained by fire, which keeps hardwoods from dominating



Florida's ecosystems

- **Scrubs**

pinos with thick understory of oaks, palmettos and bush; well-drained, nutrient-poor, sandy soils



Levels of Organization

- **Communities, Populations, and Organisms**
 - A **community** is all the interacting organisms living in an area.
 - Below the community level of organization is the **population** level, where the focus is on the individual organisms of a single species.

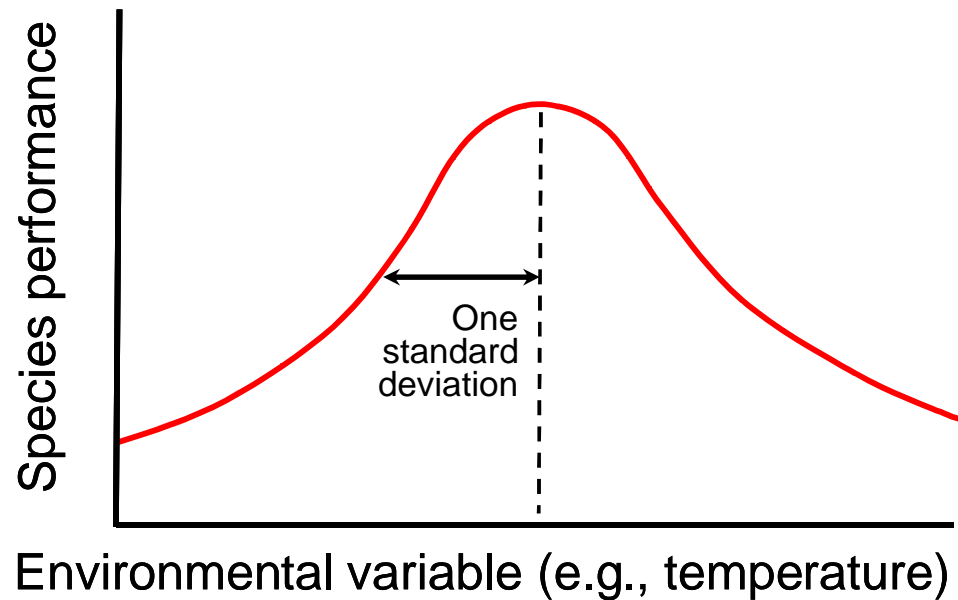


Ecosystem Components

- **Biotic and Abiotic Factors**
 - Both **biotic**, or living, factors and **abiotic**, or nonliving, factors influence organisms. Examples of abiotic factors are climate, sunlight, and pH.

Organisms in a Changing Environment

- **Tolerance Curve** – graphs performance vs. environmental factor (e.g., survival vs. air temperature)



Organisms in a Changing Environment

- **Acclimation** – Some organisms can adjust their tolerance to abiotic factors through the process of acclimation.
 - Through acclimation, the tolerance curve will change
- **Control of Internal Conditions**
 - **Conformers** are organisms that do not regulate their internal conditions; they change as their external environment changes.
 - **Regulators** use energy to control some of their internal conditions.

Organisms in a Changing Environment

- **Escape from Unsuitable Conditions**
 - Some species survive unfavorable environmental conditions by becoming dormant or by migrating.
 - Bear can become dormant in winter
 - Birds can migrate in winter
- **What about humans? How do we react to unsuitable conditions?**

The Niche

- A **niche** is very difficult to define
 - It's the 'job' an organism fills in an ecosystem
 - It's the organism's 'address,' or all the places an organism can live
 - A niche is a way of explaining how an organism fits into an ecosystem and how it interacts with other organisms and competes for resources
 - A niche includes the organism's diet, method of obtaining food, amount, frequency and timing of reproduction, type of shelter, range of conditions tolerated by species (e.g., tolerance curve), etc

The Niche

- According to the **competitive exclusion principle**, two species cannot occupy the same niche for a significant amount of time
 - Neanderthals vs. *H. sapiens sapiens*
 - Invasive species

Taliesin West by Frank Lloyd Wright



Taliesin West by Frank Lloyd Wright



Podcast

- The Relationship Between Humans and the Environment
 - What is biophilia?
 - What percentage of Americans live in urban areas?
 - Why is it not true that 'green' buildings are biophilic?
 - What is Dr. Kellert's goal for the new joint-degree Master's program?

Fallingwater by Wright



Extra credit?

- Write a letter to a company requesting they send you information about their environmental stewardship programs.
 - Bring me a copy of the letter.
 - Bring me the original letter in a SASE ready to be mailed; I'll mail it for you. You get *up to 50* HW points for this.
 - Letters should be typed, well-written and persuasive

Extra credit?

- If the company responds (in any way), you get another 25 points. If they send materials, that's another 25 points.
 - Bring in the company's response (e.g., letter)
- If they send enough copies of the materials for your entire class, that's 100 points.

Extra credit?

- Rules:
 - The company must be a for-profit, national or international corporation
 - You cannot use the following companies: Starbucks, Timberland, Ben & Jerry's, or any company used as an in-class example— unless you send the letter before the example is used in class.
 - Letters must be turned in by Friday, March 14th