

Chapter 37: Communities and Ecosystems



Honors Biology 2011

1

Community

- ❖ Community - all of the populations living close enough for potential interaction
- ❖ Boundaries of a community can be large or small
- ❖ Communities are described by their species composition

2

Interspecific Interactions

- ❖ Interspecific interactions - relationships with individuals of other species in the community
 - ❖ These interactions can be either helpful or harmful
- ❖ Interspecific competition - when populations of two different species compete for the same limited resource
 - ❖ This interaction is generally negative for both populations

Interspecific Interaction	Effect on Species 1	Effect on Species 2	Example
Competition	-	-	Squirrels/black bears
Mutualism	+	+	Hippo/microbes in hippo stomach
Predation	+	-	Crocodile/fish
Herbivory	+	-	Hippo/grasses
Parasites and pathogens	+	-	Heartworm/dog; <i>Salmonella</i> /humans

3

Competition

- ❖ Occurs when a shared resource is limited
- ❖ Ecological niche - the role of an organism in its ecosystem, everything that organism needs to survive
 - ❖ Ex. Virginia's warbler
- ❖ Competition occurs when two niches overlap
- ❖ Competition lowers the carrying capacity of both populations

4

Mutualism

- ❖ Benefits both populations
- ❖ Ex. Reef-building corals and photosynthetic dinoflagellates (unicellular algae)



Fig. 37.4

5

Predation

- ❖ Predation benefits the predator but kills the prey
- ❖ Prey used adaptive strategies
 - ❖ Camouflage
 - ❖ Mechanical defenses
 - ❖ Chemical defenses

6

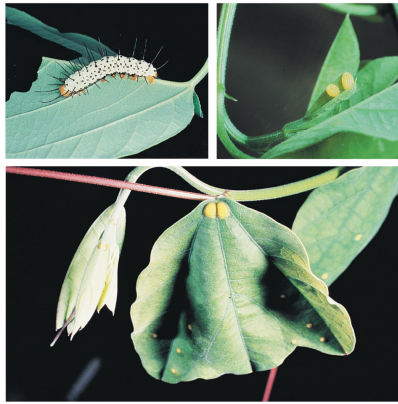
Herbivory

- ❖ Not usually fatal although plants have to expend energy to replace the loss
- ❖ Plants have defenses
 - ❖ Mechanical
 - ❖ Chemical

7

Coevolution

- ❖ Coevolution - similar evolutionary adaptations in two species
- ❖ A change in one species will put pressure on another species to change
 - ❖ Ex. *Heliconius* (type of butterfly) and *Passiflora* (flowering plant)



8

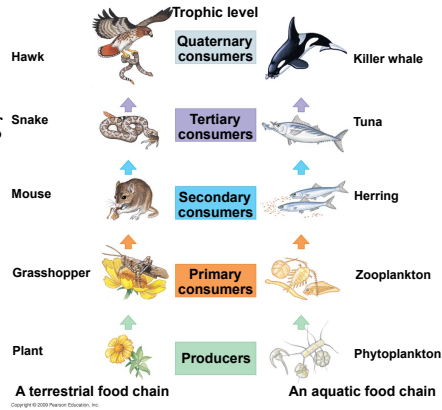
Parasites and Pathogens

- ❖ Parasite - lives on or in a host from which it obtains nourishment
- ❖ Pathogens - disease-causing bacteria, viruses, fungi, or protists (can be thought of as microscopic parasites)
- ❖ Non-native pathogens can cause huge problems

9

Trophic Structure

- ❖ Trophic structure - a pattern of feeding relationships
- ❖ Food Chain - sequence of food transfer up trophic levels



10

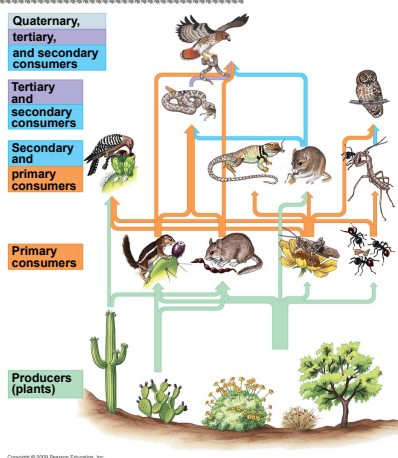
Detritivores and Decomposers

- ❖ Obtain their energy from detritus (dead material produced at all trophic levels)
- ❖ Detritivores - consume detritus (often animals like earthworms, rodents, insects, catfish, and crayfish)
- ❖ Decomposers - prokaryotes and fungi

11

Food Webs

- ❖ Food Web - network of interconnecting food chains



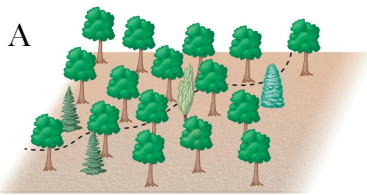
12





Species Diversity

- ❖ Species Diversity has two components
 - ❖ Species richness - the number of different species in a community
 - ❖ Relative abundance - how many of each species are in the community
- ❖ Plant species diversity impacts animal species diversity
- ❖ Species diversity also impacts pathogens
- ❖ Bad for agriculture (monocultures)

13

Species Diversity



Species	Relative Abundance in Woodlot A (%)	Relative Abundance in Woodlot B (%)
	80	25
	10	25
	5	25
	5	25

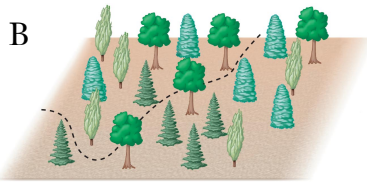


Fig. 37.10 A & B

14

Keystone Species

- ❖ Keystone Species - species whose impact on its community is much larger than its biomass or abundance indicates
 - ❖ occupies a niche that holds the entire community together
- ❖ The only way to study these is to remove the species and see what happens
- ❖ Ex. *Pisaster* (sea star)
- ❖ Ex. *Diadema antillarum* (sea urchins)

15

Disturbances

- ❖ Disturbances - events that damage biological communities, remove organisms from them, and alter the availability of resources
- ❖ Some communities are more prone to disturbances
- ❖ Disturbances are not always ultimately negative

16

Ecological Succession

- ❖ Two types:
 - ❖ Primary succession - when ecological succession begins from a virtually lifeless area with no soil
 - ❖ Secondary succession - after a disturbance has destroyed the existing community but has left the soil intact

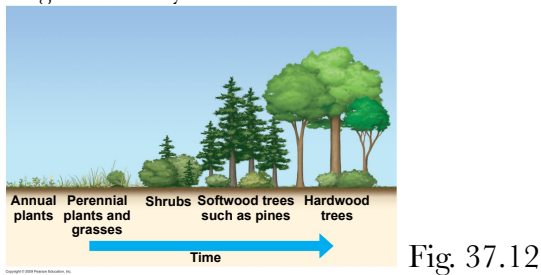


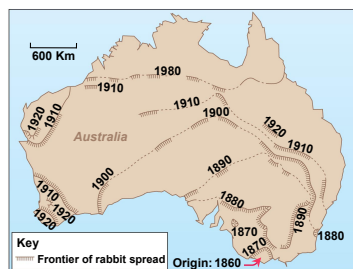
Fig. 37.12

17

Invasive Species

- ❖ Humans transport plants and animals around the globe either intentionally or accidentally
- ❖ Invasive species - a non-native species that can cause environmental damage
- ❖ Invasive species may be able to outcompete the native species
- ❖ Ex. Rabbits in Australia

Fig. 37.13



18

Biological Control

- ❖ Biological control - intentional release of a natural enemy to attack the pest population
- ❖ Ex. Rabbits in Australia

19

Ecosystems

- ❖ Ecosystem - consists of all the organisms in a community as well as the abiotic factors
- ❖ Energy flow - passage of energy through an ecosystem
- ❖ Chemical cycling - transfer of materials within an ecosystem

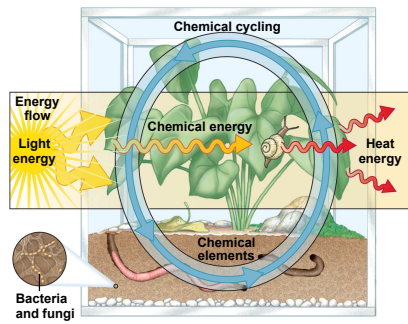


Fig. 37.14

20

Primary Production

- ❖ Primary productivity - the amount of solar energy converted to chemical energy (organic compounds like sugars) in a given area and during a given time period
- ❖ This determines the amount of energy available to the entire ecosystem
- ❖ Biomass - the amount of living organic matter in an ecosystem

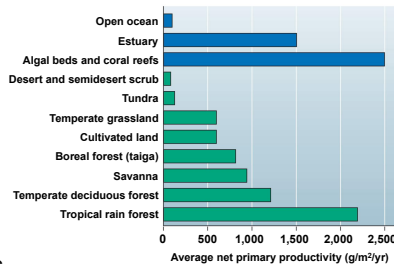


Fig. 37.15

21

Energy Supplies

- ❖ Energy supply limits the length of food chains
- ❖ About 10% of energy goes from one trophic level to the next
- ❖ Most energy is lost as heat

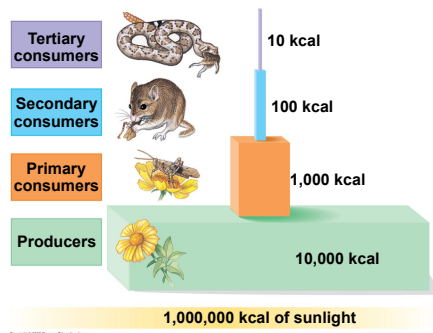


Fig. 37.16

22

Biogeochemical Cycles

- ❖ Biogeochemical cycles - include both biotic and abiotic components
- ❖ Abiotic reservoirs - where chemicals accumulate outside of living organisms
- ❖ Key cycles:
 - ❖ Carbon
 - ❖ Phosphorus
 - ❖ Nitrogen

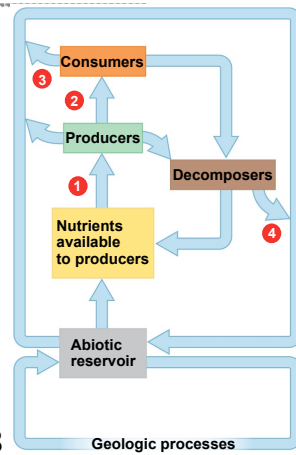


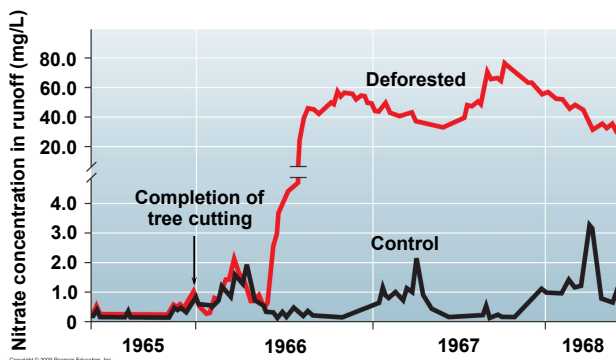
Fig. 37.18

23

Impacts of Deforestation



Fig. 37.22



24