Ch. 40 Warm-Up

1. If a population has a birth rate of 0.07 and a death rate of 0.01, calculate the number of individuals added/subtracted from a population of 1,000 individuals in one year.

2. In a mark-recapture experiment, scientists tagged 300 birds in one month. Several months later, they returned and captured 500 birds. 75 of those birds had a tag on them. What is the size of the entire population?

3. What are ways that you can reduce your ecological footprint?

Ch. 41 Warm-Up

1. Using +/-/0, indicate the relationships in:
   a) Predation
   b) Parasitism
   c) Mutualism
   d) Commensalism

2. What is an invasive species? Give an example of one in British Columbia.

Define the following terms:

- Fundamental niche
- Realized niche
- Symbiosis
- Parasitism
- Mutualism
- Commensalism
- Keystone species
- Invasive species
- Ecological succession
- Primary succession
- Secondary succession

Chapter 41: Community Ecology

Community = group of populations of different species living close enough to interact

Interspecific interactions

- Can be positive (+), negative (-) or neutral (0)
- Includes:
  - Competition (-/-)
  - Predation (+/-)
  - Herbivory (+/-)
  - Symbiosis – parasitism, mutualism, commensalism
  - Facilitation (+/+ or 0/+)

Interaction	Description
Competition (–/–)	Two or more species compete for a resource that is in short supply.
Exploitation (+/–)	One species benefits by feeding upon the other species, which is harmed. Exploitation includes:
Predation	One species, the predator, kills and eats the other, the prey.
Herbivory	An herbivore eats part of a plant or alga.
Parasitism	The parasite derives its nourishment from a second organism, its host, which is harmed.
Positive interactions (+/+ or +/0)	One species benefits, while the other species benefits or is not harmed. Positive interactions include:
Mutualism (+/+)	Both species benefit from the interaction.
Commensalism (+/0)	One species benefits, while the other is not affected.

- **Interspecific competition**: resources are in short supply
  - Species interaction is -/-

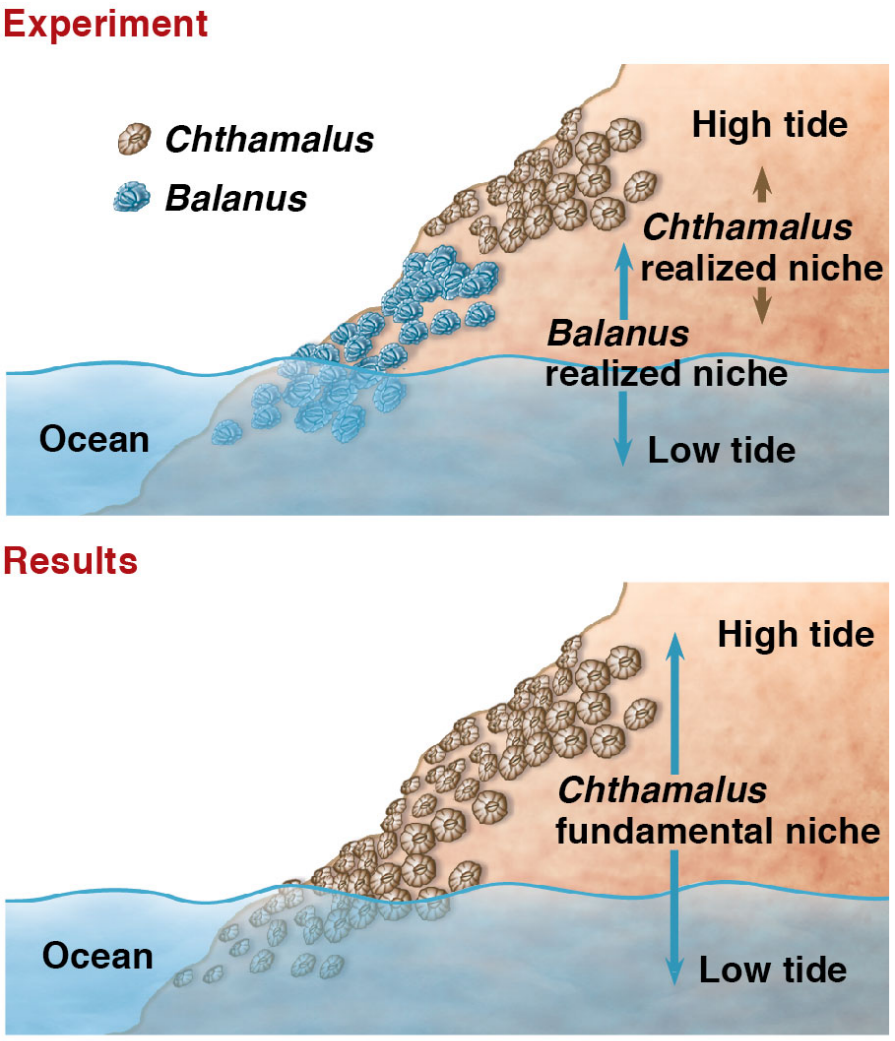
- **Competitive exclusion principle:** Two species cannot coexist in a community if their niches are identical.
  - The one with the slight reproductive advantage will eliminate the other

- **Resource partitioning:** differences in niches that enable similar species to coexist

Ecological niche: the sum total of an organism's use of abiotic/biotic resources in the environment

- Fundamental niche: niche potentially occupied by the species

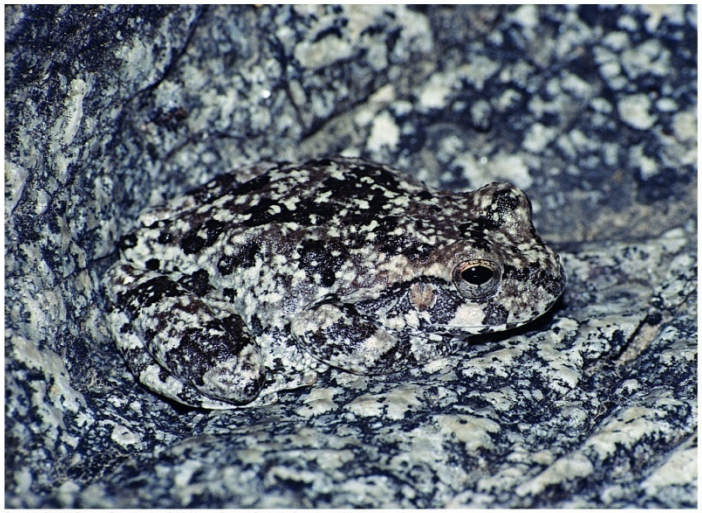
- Realized niche: portion of fundamental niche the species *actually* occupies



Predation (+/-)

Defensive adaptations include:

- Cryptic coloration – camouflaged by coloring
- Aposematic or warning coloration – bright color of poisonous animals
- Batesian mimicry – harmless species mimic color of harmful species
- Mullerian mimicry – 2 bad-tasting species resemble each other; both to be avoided
- Herbivory – plants avoid this by chemical toxins, spines, & thorns



(a) Cuckoo bee

(b) Yellow jacket

(a) Hawkmoth larva

(b) Green parrot snake

Symbiosis: 2+ species live in direct contact with one another

- Parasitism (+/-), mutualism (+/+), commensalism (+/0)

Mutualism

Commensalism

Community Structure

- Species diversity = species richness (# of different species) + relative abundance of each species.
- Which is most diverse?
  - Community 1: 90A, 10B, 0C, 0D
  - Community 2: 25A, 25B, 25C, 25D
  - Community 3: 80A, 5B, 5C, 10D
- Shannon Diversity Index: calculate diversity based on species richness & relative abundance
- Highly diverse communities more resistant to *invasive species*

Invasive Species

- Organisms that become established outside native range

- Kudzu – vine plant from Japan, noxious weed that kills trees & shrubs

Invasive Species

- Dutch elm disease – fungus carried by beetles
  - Arrived in U.S. on logs imported from Netherlands
  - Death of many elm trees across U.S., Europe, Canada
- Try to cultivate resistant strains of elm trees

Invasive Species

- Potato Blight – fungus-like disease caused Irish Potato Famine in 1840's
  - Arrived in Ireland from ships coming from U.S.
  - Only 1 species of potato planted in Ireland → all susceptible to disease
  - 1 million people died
  - Problem with monoculture & lack of genetic diversity of crops

Trophic Structures

- The **trophic structure** of a community is determined by the feeding relationships between organisms.
- Trophic levels = links in the trophic structure

- The transfer of food energy from plants → herbivores → carnivores → decomposers is called the food chain.

What limits the length of a food chain?

- Inefficiency of energy transfer along chain
- Long food chains less stable than short chains

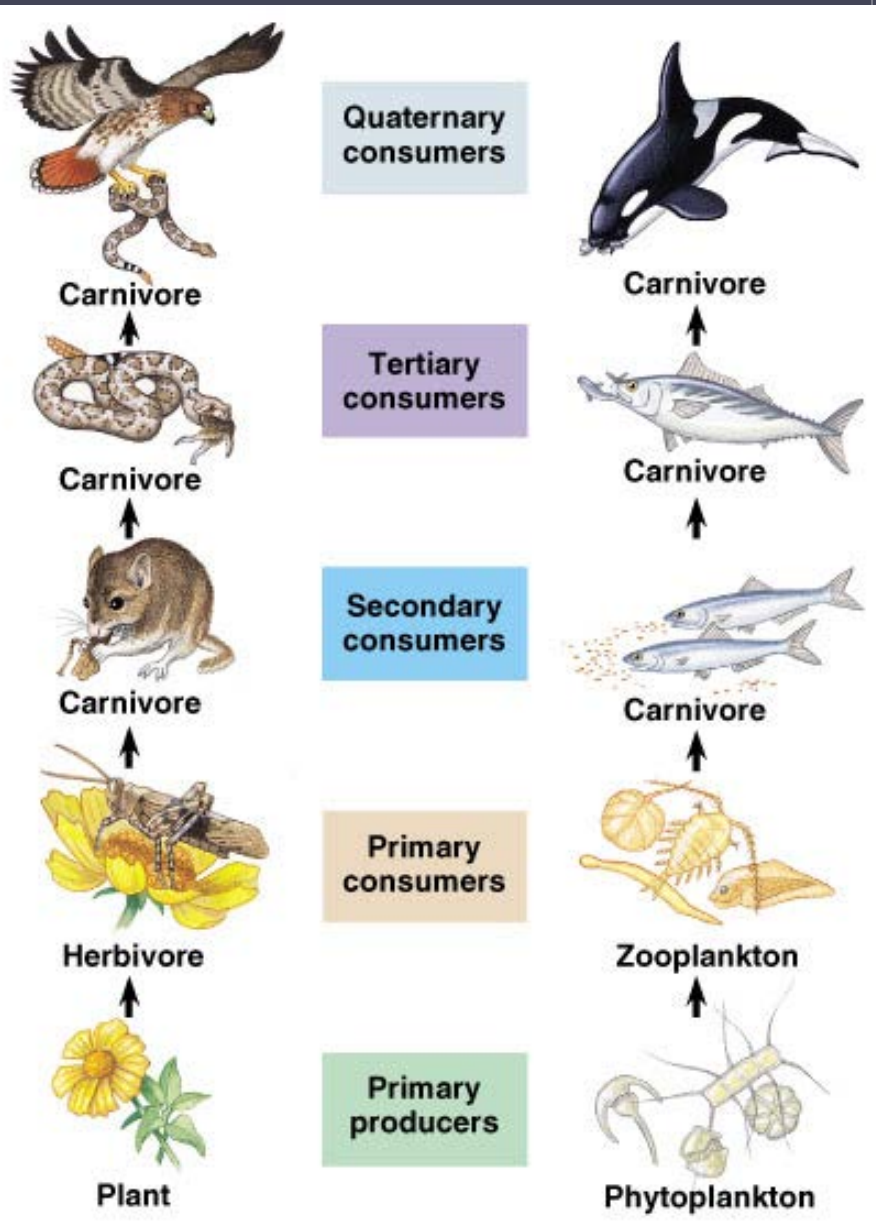
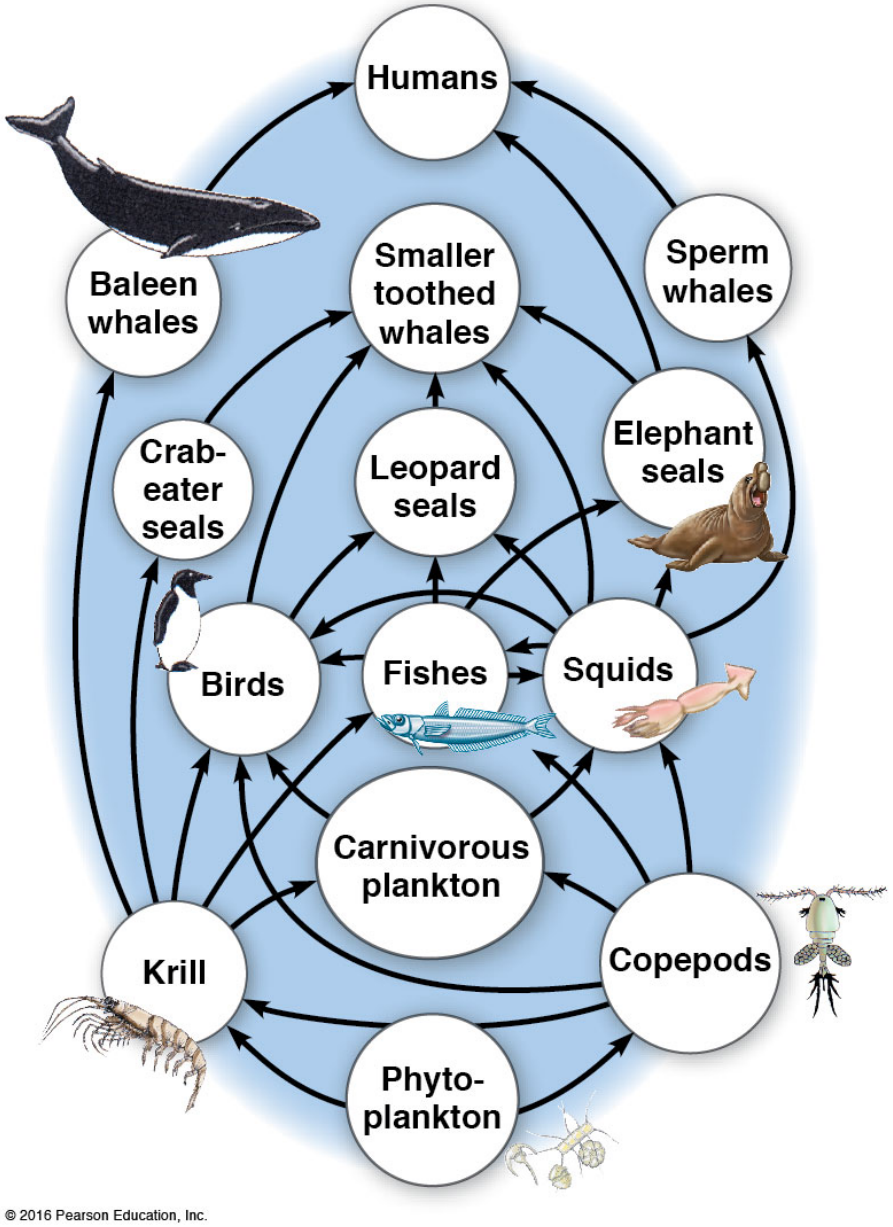


Fig. 53.10

- Two or more food chains linked together are called food webs.
- A given species may weave into the web at more than one trophic level.



- Dominant species: has the highest biomass or is the most abundant in the community
- Keystone species: exert control on community structure by their important ecological niches
  - Loss of sea otter → increase sea urchins, destruction of kelp forests
  - Grizzly bear (transfer nutrients from sea → land by salmon diet)
  - Prairie dogs (burrows, soil aeration, trim vegetation)

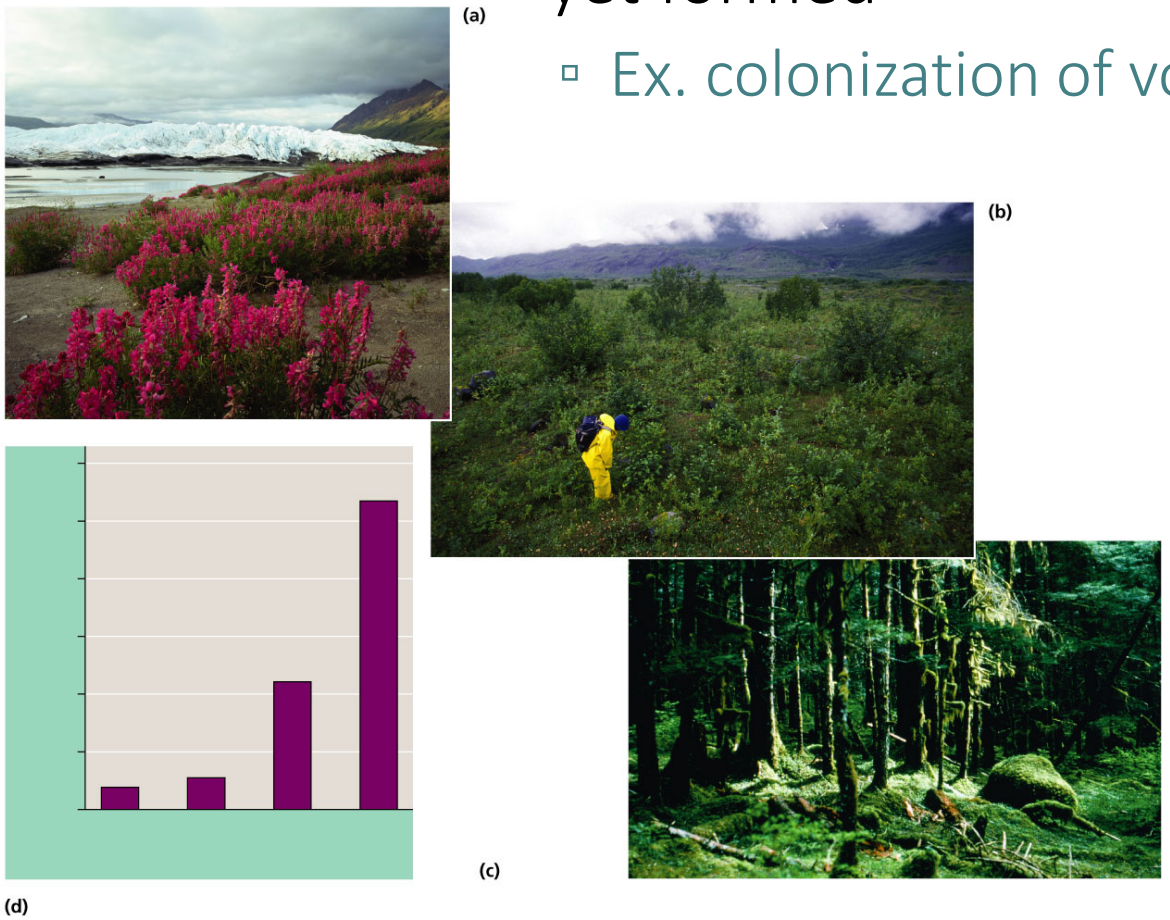
Disturbances influences species diversity and composition

- A disturbance changes a community by removing organisms or changing resource availability (fire, drought, flood, storm, human activity)

- Ecological succession: transitions in species composition in a certain area over ecological time

Primary Succession

- Plants & animals invade where soil has not yet formed
  - Ex. colonization of volcanic island or glacier



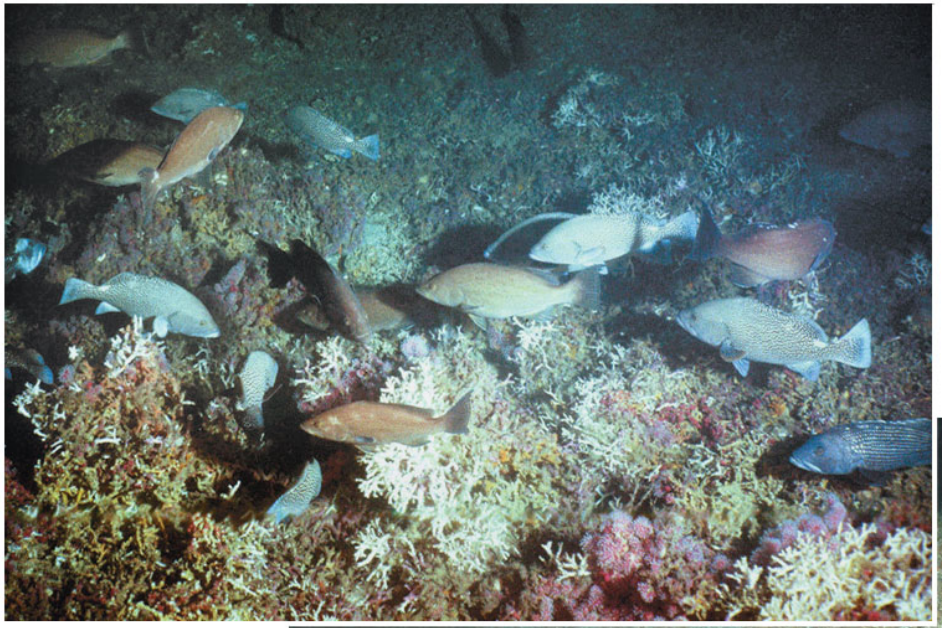
Secondary Succession

- Occurs when existing community is cleared by a disturbance that leaves soil intact
  - Ex. abandoned farm, forest fire

(a) Soon after fire. As this photo taken soon after the fire shows, the burn left a patchy landscape. Note the unburned trees in the distance.

(b) One year after fire. This photo of the same general area taken the following year indicates how rapidly the com-munity began to recover. A variety of herbaceous plants, different from those in the former forest, cover the ground.

Human Disturbance



◀ Before trawling

After ▶ trawling

Biogeographic Factors

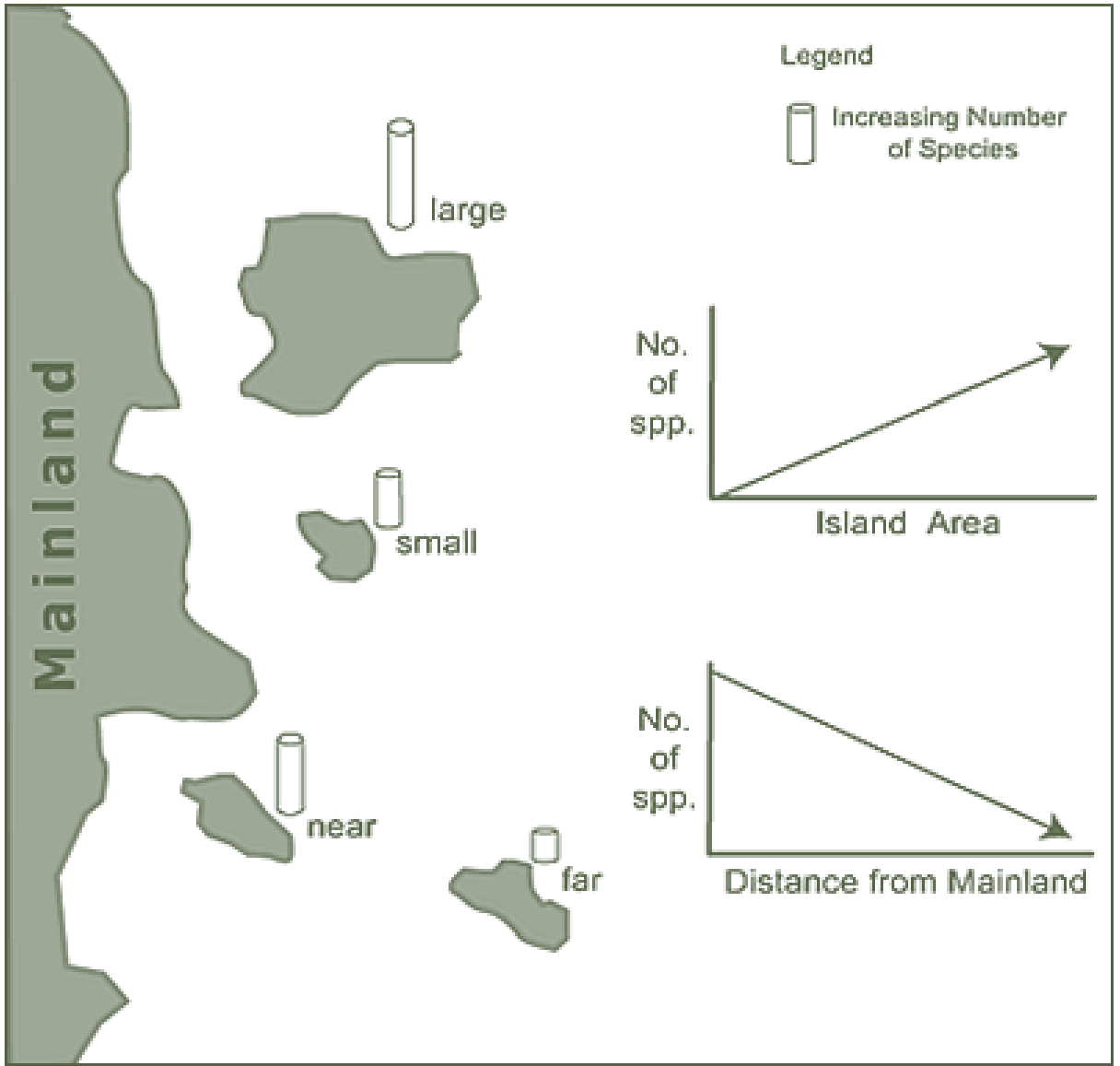
Important factors:

1. **Latitude**: species more diverse in tropics than poles
2. **Area**: larger areas more diverse

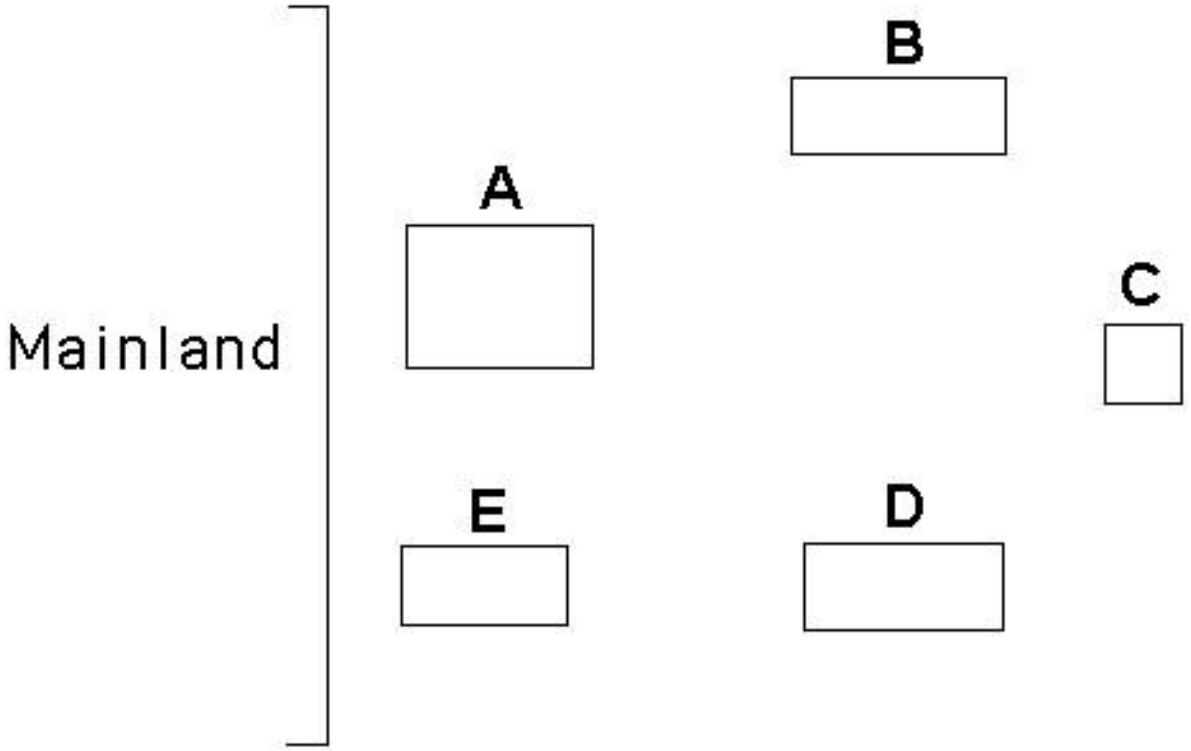
Biogeographic islands = natural labs for studying species diversity

- Influenced by size and distance
  - Larger islands → greater immigration, lower extinction
  - Far from mainland → immigration falls, extinction rates increase

Island Biogeography



1. Which island will have the highest immigration rates? Lowest immigration rate?
2. Which islands will have the highest extinction rate? Lowest extinction rate?



Pathogens alter community structure

- Pathogens = disease-causing microorganisms
- Introduction to new habitats → disastrous effects
- Eg. Chestnut blight fungus; White band disease (corals in Caribbean)
- Human activities transport pathogens