

Ecology and the Biosphere

Chapter 50



Ecology - the study of the interactions between organisms and their environments



What factors govern the distribution of organisms?

The interactions between organisms and their environments determine their distributions and abundances

- Distribution = geographic range
- abundance=individuals per unit area
- environmental factors
 - abiotic - non-living chemical and physical factors
 - biotic - living factors like other organisms

Figure 50.1 Distribution and abundance of the red kangaroo in Australia, based on aerial surveys

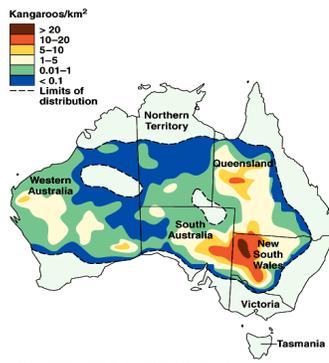


Figure 50.2 Sample questions at different levels of ecology



Examples of ecological questions:

- How do diving whales select their feeding areas?
- What processes recycle vital chemical elements, such as nitrogen, in a savanna ecosystem
- What factors influence the diversity of tree species that make up a particular forest

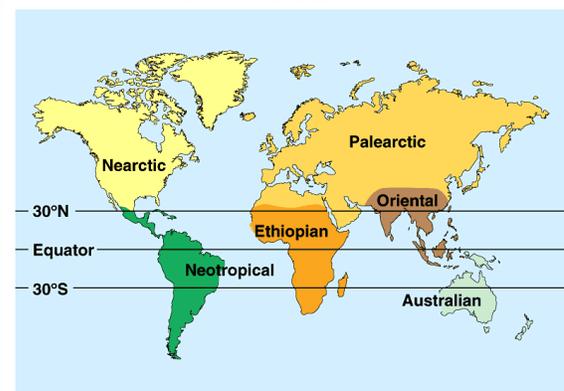
Factors affecting the distribution of organisms

- dispersal
- behavior and habitat selection
- biotic factors
- abiotic factors

Biogeography

- The study of past and present distributions of individual species
- continental drift and barriers contribute to distinctive floras and faunas of the Earth's major regions

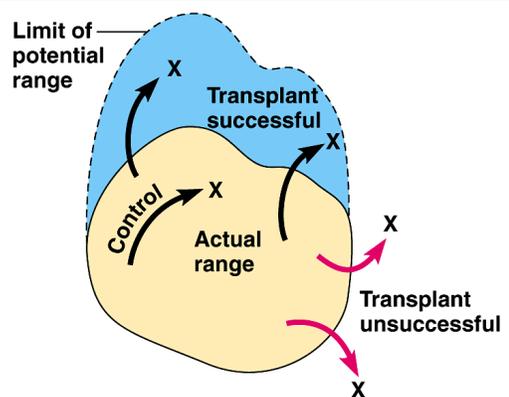
Figure 50.4 Biogeographic realms



Dispersal

- Example: Kangaroos may not be in North America because they historically had no way of getting there.
- To test this: species transplant experiments

Figure 50.6 Set of transplant experiments for a hypothetical species



- Transplant successful - distribution limited because of dispersal problems
 - inaccessible, not enough time to reach area, not recognized as suitable living space
- transplant unsuccessful - distribution limited by biotic or abiotic factors, I.e., for some reason cannot survive there.
- Why are experiments that involve transplanting species seldom conducted today?

Invasive species

- In modern times, normal restrictions on dispersal are lifted and invasive species can proliferate

Figure 50.7 Spread of the African honeybee in the Americas since 1956

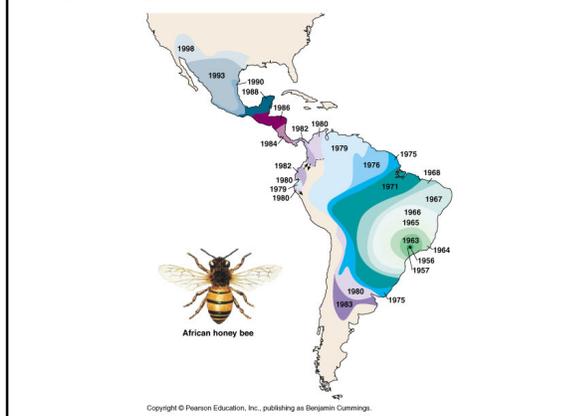
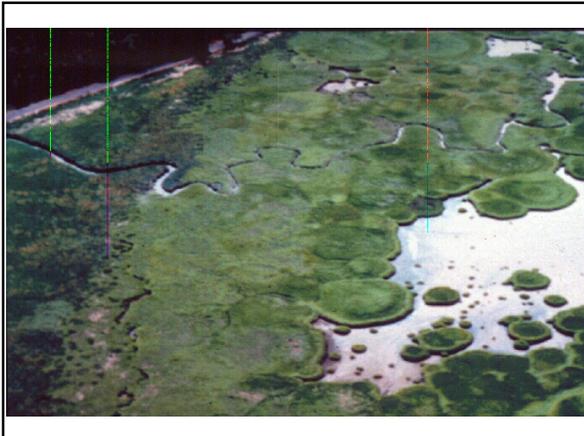
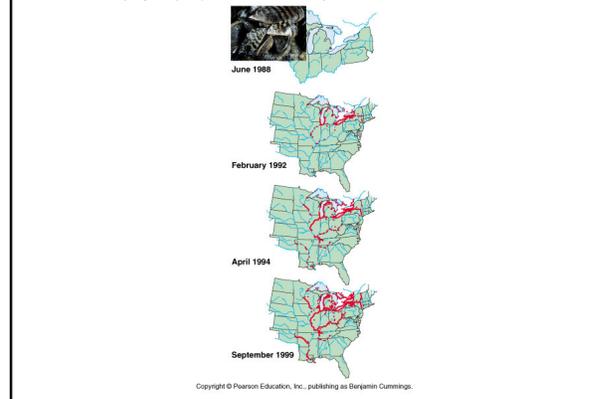


Figure 50.8 Expansion of the geographic range of the zebra mussel (*Dreissena polymorpha*) since its discovery near Detroit in 1988

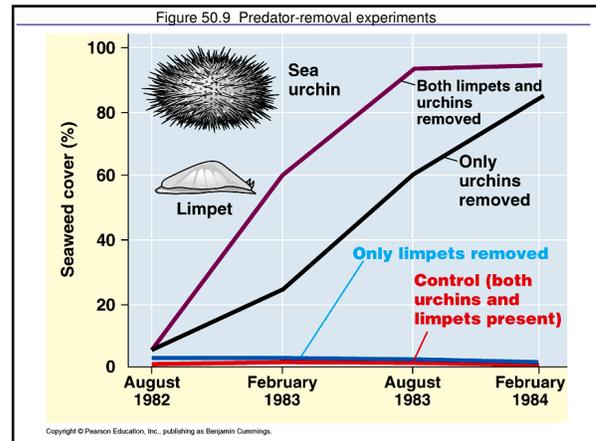


Willapa Bay

- *Spartina alterniflora*
- 10,000 to 25,000 acres affected
- Nearly 4000 solid acres

Biotic factors affect the distribution of organisms

- Competition
 - interspecific
 - intraspecific
- Predation
- Mutualism - species helping each other



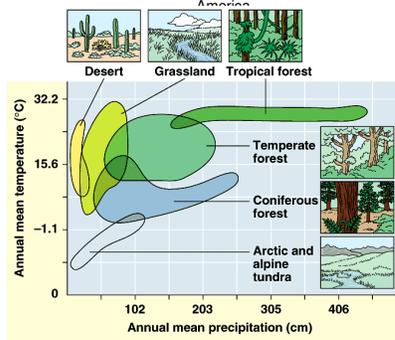
Limpet and urchin removal experiments

- Results show that the herbivores limit the distribution and abundance of seaweed
- limpets appear to be the main herbivores
- but why is there more seaweed when **both** limpets and urchins are removed?

Temperature and water are major climatic factors determining the distributions of organisms

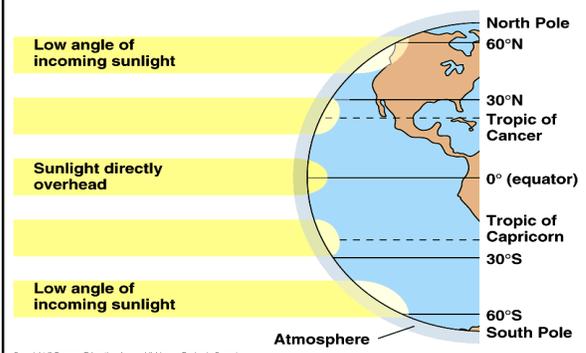
- Biome-a major type of ecosystem

Figure 50.10 A climograph for some major kinds of ecosystems (biomes) in North America



Which two factors influence the distribution of organisms, as shown in this climograph?

Global climate patterns



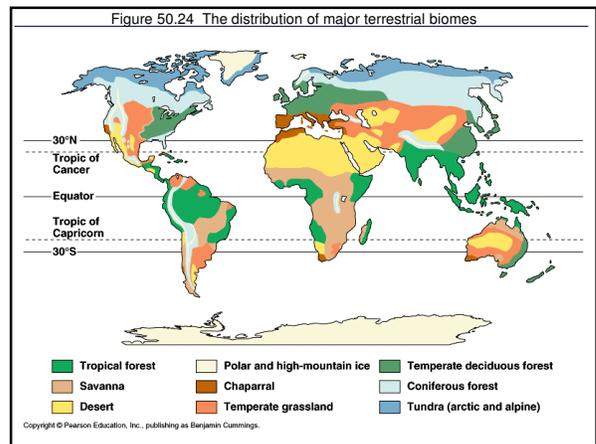
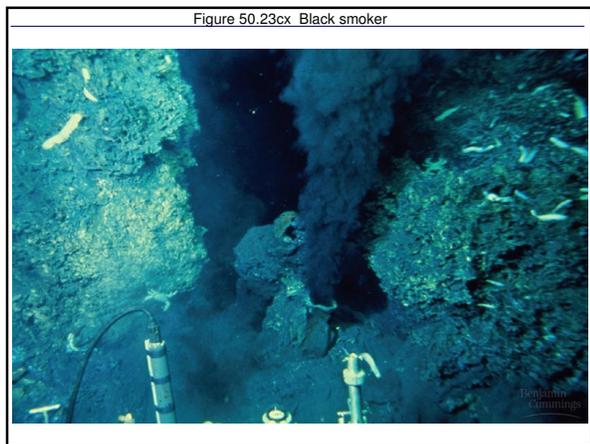
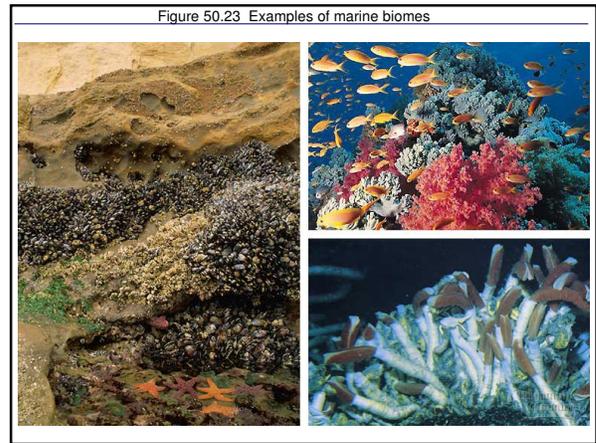
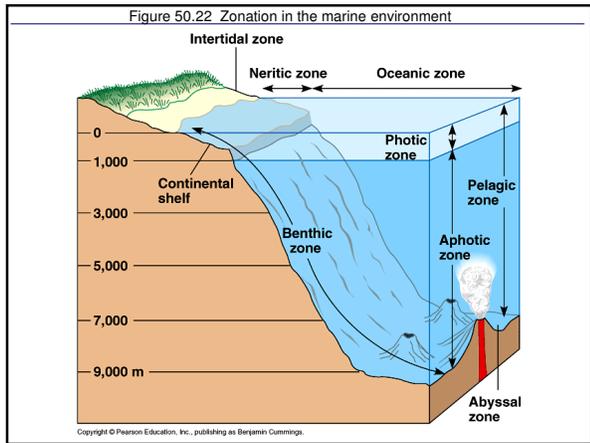
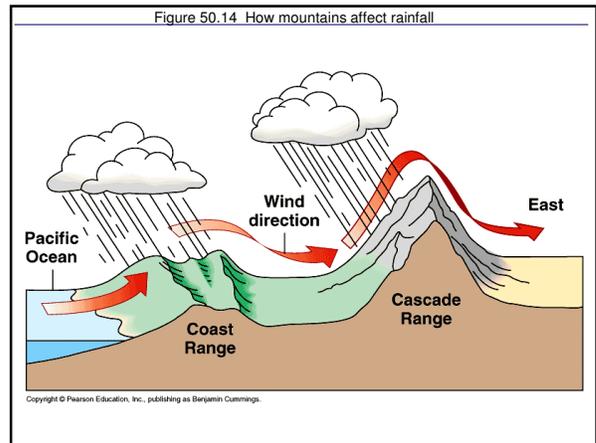
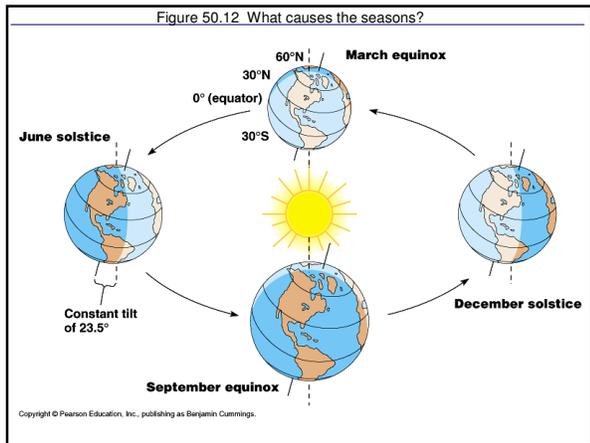
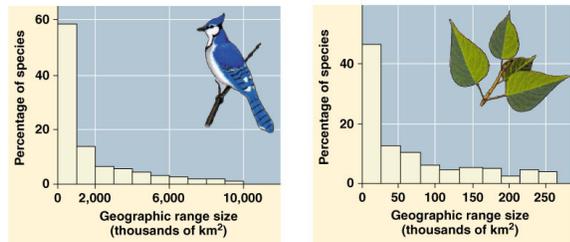
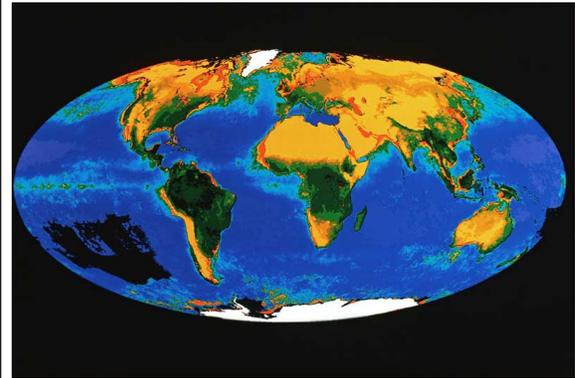


Figure 50.27 Most species have small geographic ranges



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Figure 50.x1 Patterns of distribution in the biosphere



- Wolf hunting behavior
<http://www.youtube.com/watch?v=2jXxtQRy47A&feature=fvrel>
- Wolves vs. grizzly
<http://www.youtube.com/watch?v=-pd7yTRnYzg&feature=fvrel>
- Step away from the bone
<http://brightcove.newscientist.com/services/player/bcpid1873822884?bctid=70820588001>

Historic and present ranges of gray wolves



Northern Rockies (Idaho, Montana)

- Wolves were eradicated from the region by the 1930s as part of an overall campaign to eliminate many of the native predators.
- With the adoption of the Endangered Species Act in 1973, wolves immigrated from Canada, by 1995, that population had grown to 60 - 70 wolves.
- 1995 and 1996 the US Fish and Wildlife Service captured 66 wolves from Canada and released them in central Idaho and Yellowstone National Park. Since that time, wolf numbers have increased to approximately 2,000 wolves in 2009,
- Idaho and Montana initiated hunting seasons which reduced the wolf population down to 1650 wolves by the end of 2009.



Lolo management area 10, 12

- Lolo Zone to a minimum of 20 to 30 wolves in three to five packs from a current estimated level of 60 to 80 wolves.
- 2010 survey estimated the population at 1,358 cow elk and 594 bull elk. The state's zone-wide objectives are 6,100 – 9,100 cow elk and 1,300 – 1,900 bull elk.

- Management activities would be intended to allow the elk population in the Lolo Elk Management Zone to increase while maintaining wolf populations that meet recovery objectives. This alternative includes monitoring both wolf and elk populations yearly to determine response to the implementation of management activities and adaptive changes in wolf removal based on yearly monitoring results.

USFW proposal

- 1) The basis of ungulate population or herd management objectives.
- 2) What data indicate that the ungulate herd is below management objectives.
- 3) What data indicate that wolves are a major cause of the unacceptable impact to the ungulate population.
- 4) Why wolf removal is a warranted solution to help restore the ungulate herd to management objectives.
- 5) The level and duration of wolf removal being proposed.
- 6) How ungulate population response to wolf removal will be measured and control actions adjusted for effectiveness.

3) What data indicate that wolves are a major cause of the unacceptable impact to the ungulate population.

- Historical elk population data
- Timing with wolf introduction and establishment
- Radiocollared calves and cow elk determine cause of death
- Model elk population growth

4) Why wolf removal is a warranted solution to help restore the ungulate herd to management objectives.

- Wolf predation is causing current declines
- Other strategies already employed: elk habitat improvement, winter feeding of elk, increased enforcement against poaching, and active predator control.

5) The level and duration of wolf removal being proposed.

- Percentage too high? Too low?
- Hunting not sufficient to achieve proposed percentage?
- 10 year duration