Chapter 52: Introduction to Ecology and the Biosphere

Ecology

- oikos - home
- logos - to study
- Ecology - the study of interactions between organisms and the environment
- Answer important questions:
  - Where do organisms live?
  - Why do organisms live where they live?
  - What factors determine how many organisms live in one place?

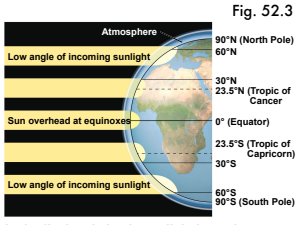
Climate

- Climate - long-term prevailing weather conditions in a particular area
- Major components: temperature, precipitation, sunlight, and wind
- Macroclimate - patterns on global, regional, and landscape level
- Microclimate - defined by fine-scale differences in the environment that affect light and wind patterns

Global Climate

- Determined by input of solar energy
- Sun's warming of the atmosphere, land, and water that causes temperature variations, cycles of air movements, and evaporation of water all determine latitudinal variations in climate

Fig. 52.3



Latitudinal variation in sunlight intensity

Global Air Circulation

- Water evaporates in the tropics, and warm, wet air masses flow from the tropics toward the poles
- Rising air masses release water
- Dry, descending air masses create arid climates (30 degrees north and south of the equator)
- Trade winds blow east to west in the tropics and westerlies blow from west to east in the temperate zones

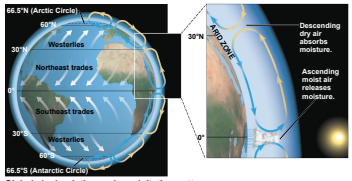


Fig. 52.3b
Global air circulation and precipitation patterns

Seasonality

- Variations of light and temperature increase steadily toward the poles
  - Impacted by tilt of the Earth at high latitudes

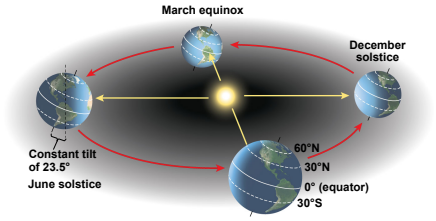


Fig. 52.4

Regional, Local, and Seasonal Effects

- Bodies of water
  - Ocean currents (ex. Gulf Stream)
  - Coastal zones (climate moderation)

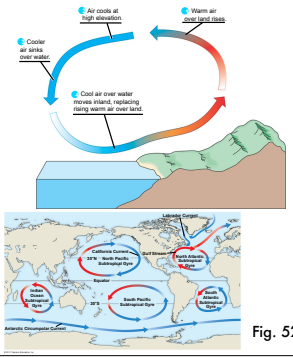


Fig. 52.5

Regional, Local, and Seasonal Effects

- Mountains
  - Effect amount of sunlight reaching an area
  - Effect rainfall
  - Temperature
  - Rain shadow

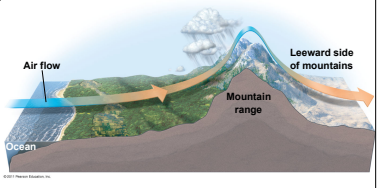


Fig. 52.6

Global Climate Change

- Greatly impact the biosphere
- May be able to predict impact by studying previous changes (ex. glaciers retreating)
- Species that have difficulty dispersing may have smaller ranges or become extinct

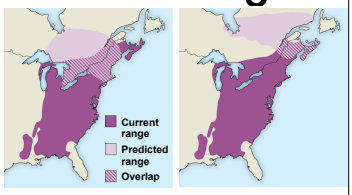


Fig. 52.7

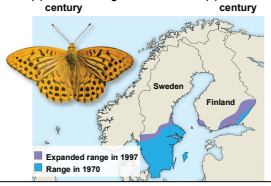


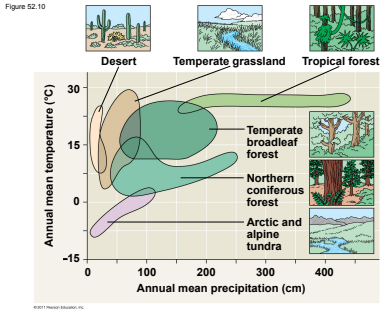
Fig. 52.8

Biomes

- Major types of ecological associations that occupy broad geographic regions in land and water
- Climate is key to determination
- Characterized by vegetation type (terrestrial biomes) and physical environment (aquatic biomes)

Climographs

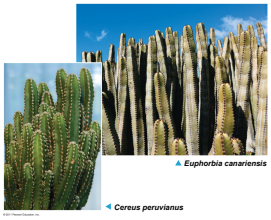
- Plot temperature and precipitation in a region
- Biomes are affected by the pattern of temperature and precipitation (not just the averages)



General Features of Terrestrial Biomes

- Usually grade into each other (no sharp boundaries)
- Ecotone - area of integration between biomes (may be wide or narrow)
- Vertical layering
  - Provides diverse habitats
- Convergent Evolution
  - Can arise in distant biomes

Fig. 52.11



Disturbance and Terrestrial Biomes

- Disturbance - event such as a storm, fire, or human activity that changes a community
- Fire suppression

Aquatic Biomes

- Largest part of the biosphere by area
- Freshwater vs. Marine
- Oceans
  - 75% of earth's surface
  - Evaporation of oceans provides most of the planet's rainfall
  - Temperature has major impact on climate and wind patterns
  - Algae and photosynthetic bacteria supply a substantial portion of the world's oxygen and consume carbon dioxide
- Freshwater - linked to soils and biotic components of the surrounding terrestrial biome

Zonation in Aquatic Biomes

- Many are stratified into zones or layers defined by light penetration, temperature, and depth
- Pelagic zone: made of the photic zone and aphotic zone
  - Deep aphotic zone is the the abyssal zone (2,000 to 6,000m)
- Benthic zone: organic and inorganic sediment at the bottom
  - Detritus - dead organic matter that falls from the productive surface

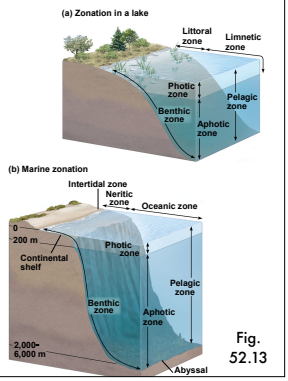


Fig. 52.13

Thermocline

- In oceans and most lakes this temperature boundary separates warm upper layer from cold deeper water
- Many lakes undergo semiannual mixing of the waters (turnover)
- Turnover mixes oxygenated water from the surface with nutrient-rich water from the bottom

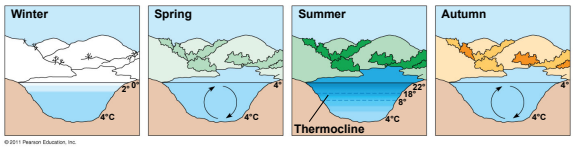


Fig. 52.14

Lakes

- Great size variation
- Oligotrophic lakes - nutrient poor and oxygen-rich
- Eutrophic lakes - nutrient rich and oxygen poor
- Littoral zone - shallow, well-lighted, close to shore
- Limnetic zone - deep water, small drifting animals (zooplankton) that graze on phytoplankton

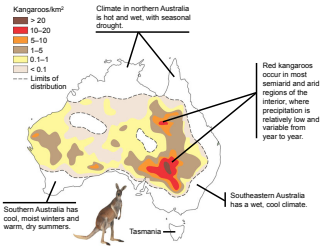
An oligotrophic lake in Grand Teton National Park, Wyoming

A eutrophic lake in the Okavango Delta, Botswana

Fig. 52.16

Distribution of Species

- Result of ecological and evolutionary relationships through time
- Events in ecological time can lead to evolution



- Red Kangaroo
- Abiotic factors
- Biotic Factors

Factors Limiting Distribution

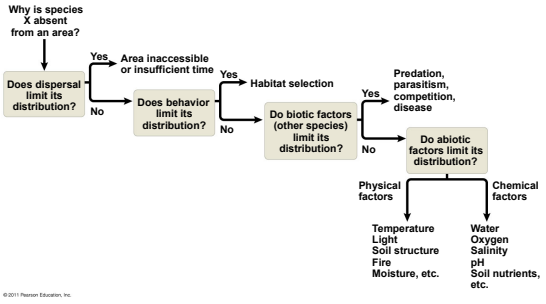
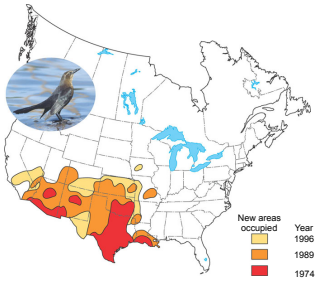


Fig. 52.18

Dispersal and Distribution

- Dispersal - movement of individuals away from centers of high population density or from area of origin



Natural Range Expansion and Adaptive Radiation

- Natural range expansions show influence of dispersal on distribution (ex. cattle egrets)
- Adaptive radiation happens in rare cases of long-distance dispersal (ex. Hawaiian silverswords)

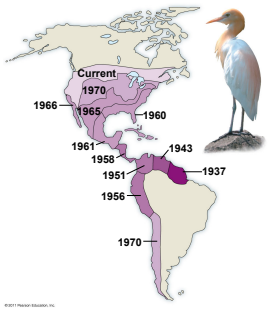


Fig. 52.19

Species Transplants

- Organisms intentionally or accidentally relocated from their original distribution
- If successful, it indicates that the species potential range is larger than current range.

Biotic Factors

- Impact distribution
- Predation, herbivory, competition

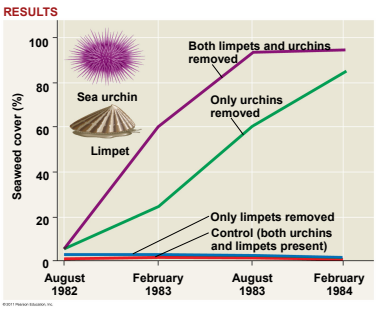


Fig. 52.20

Abiotic Factors

- Also impact distribution
- Temperature, water, sunlight, salinity, wind, rock and soil

Fig 52.21