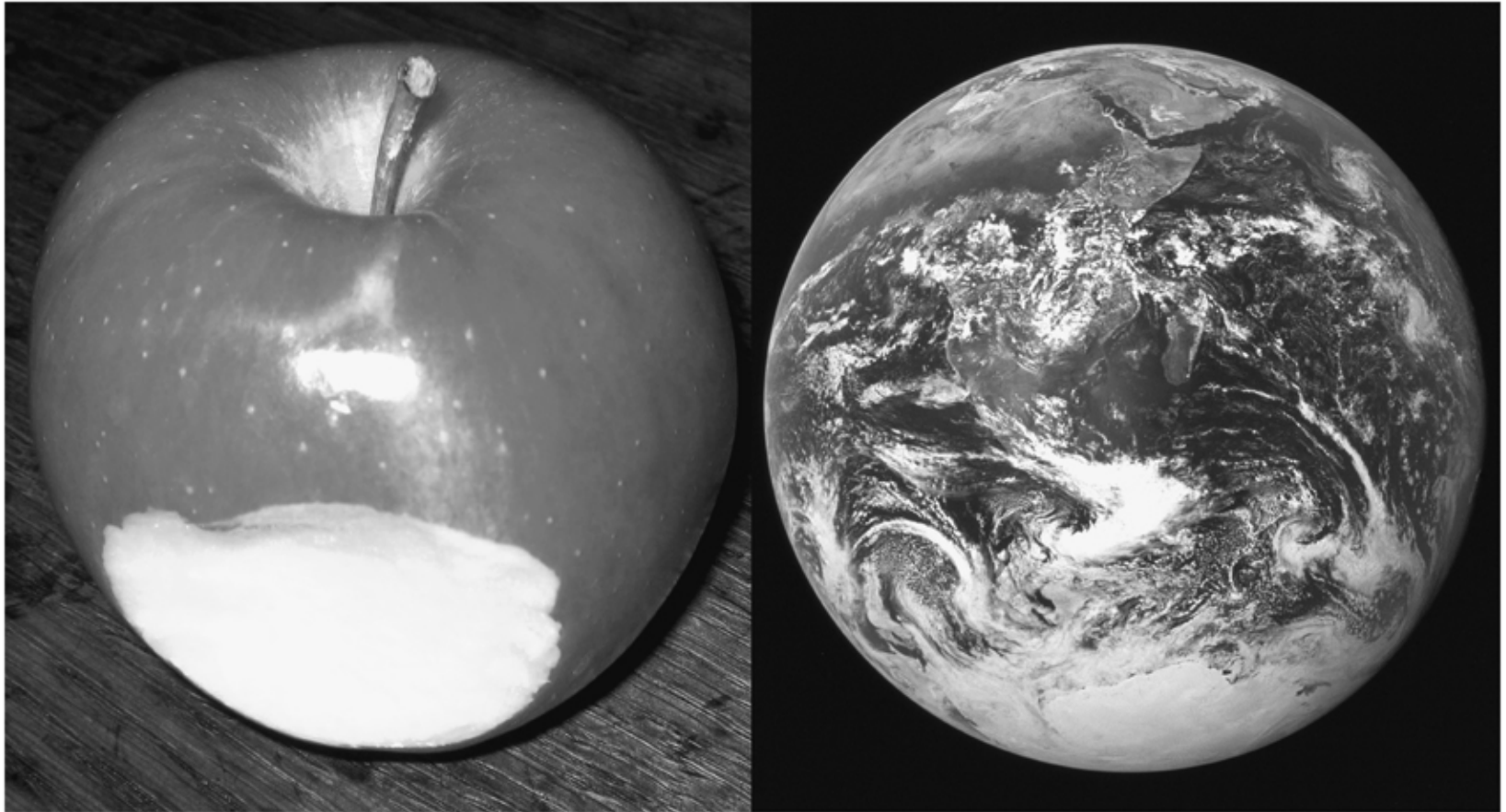
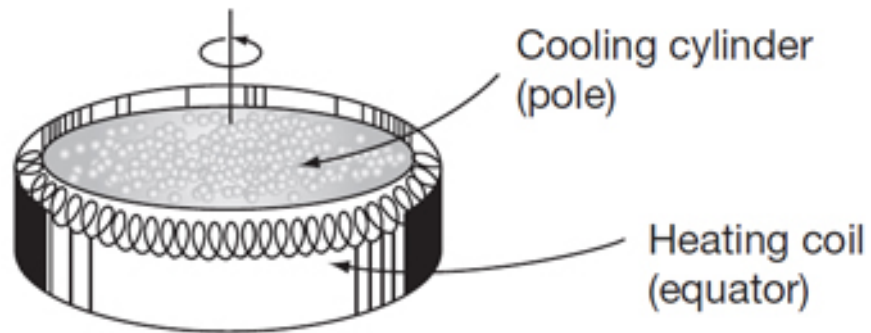


ES7-Geog7 Lecture 5

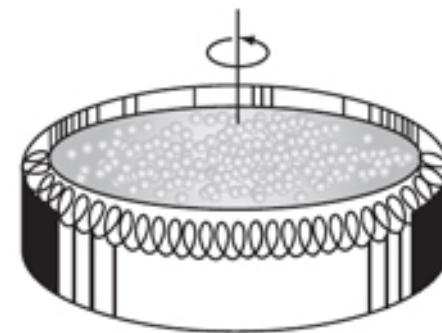
G. Leddy



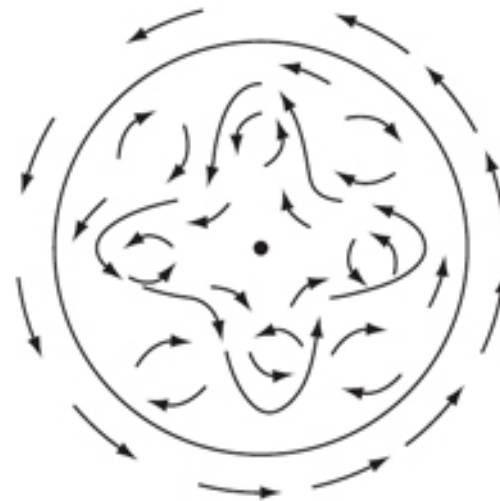
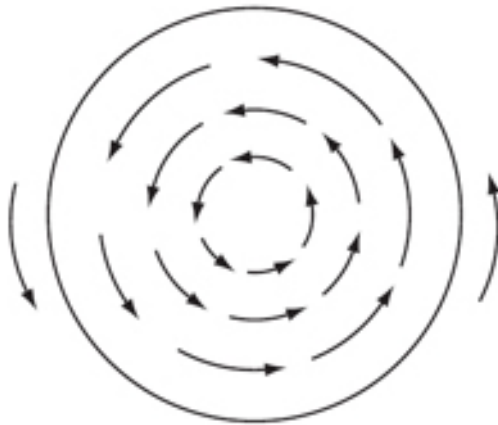
The skin of an apple is roughly equivalent to the Earth's biosphere in thickness.



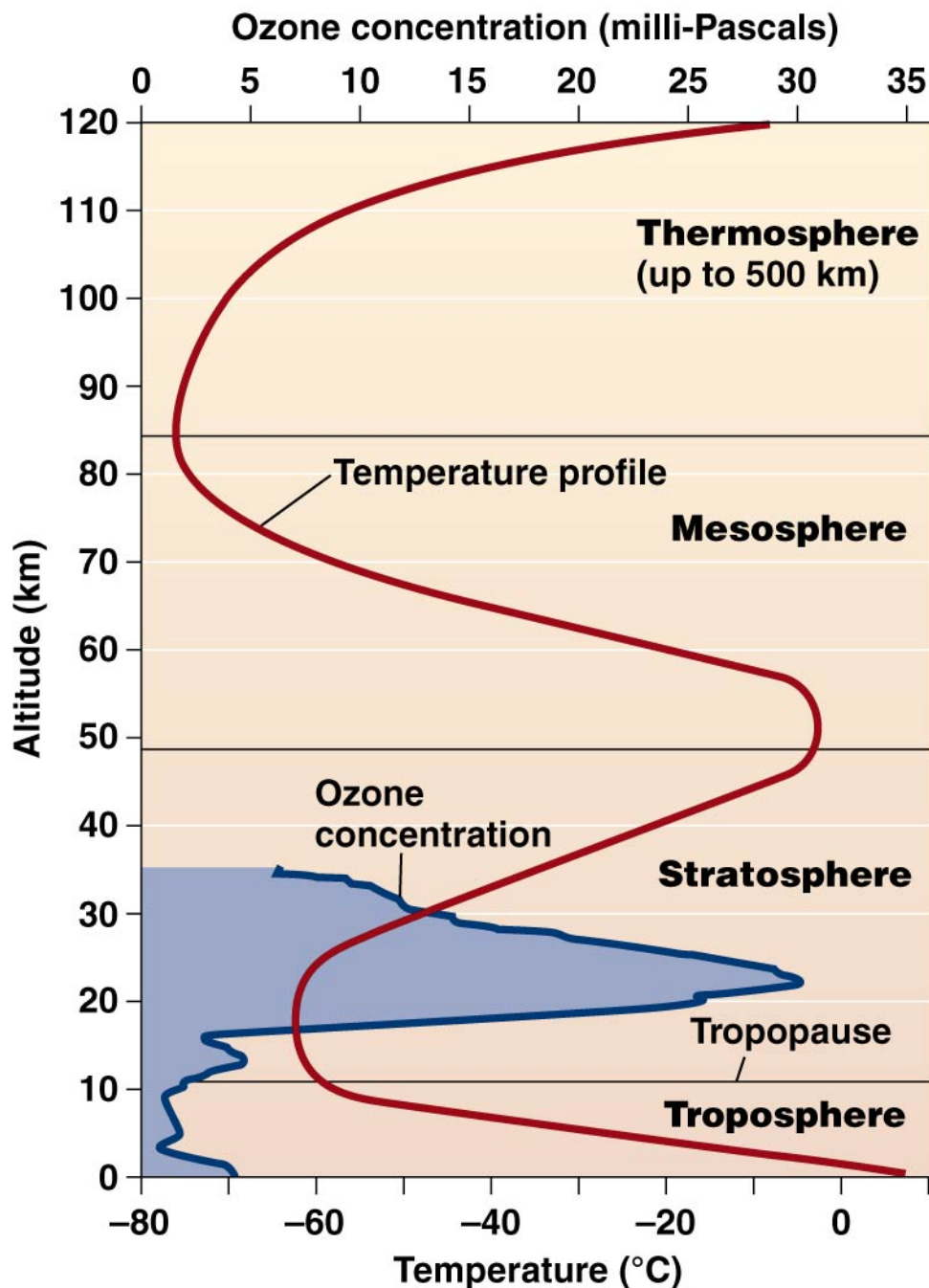
(a) Slow rotation



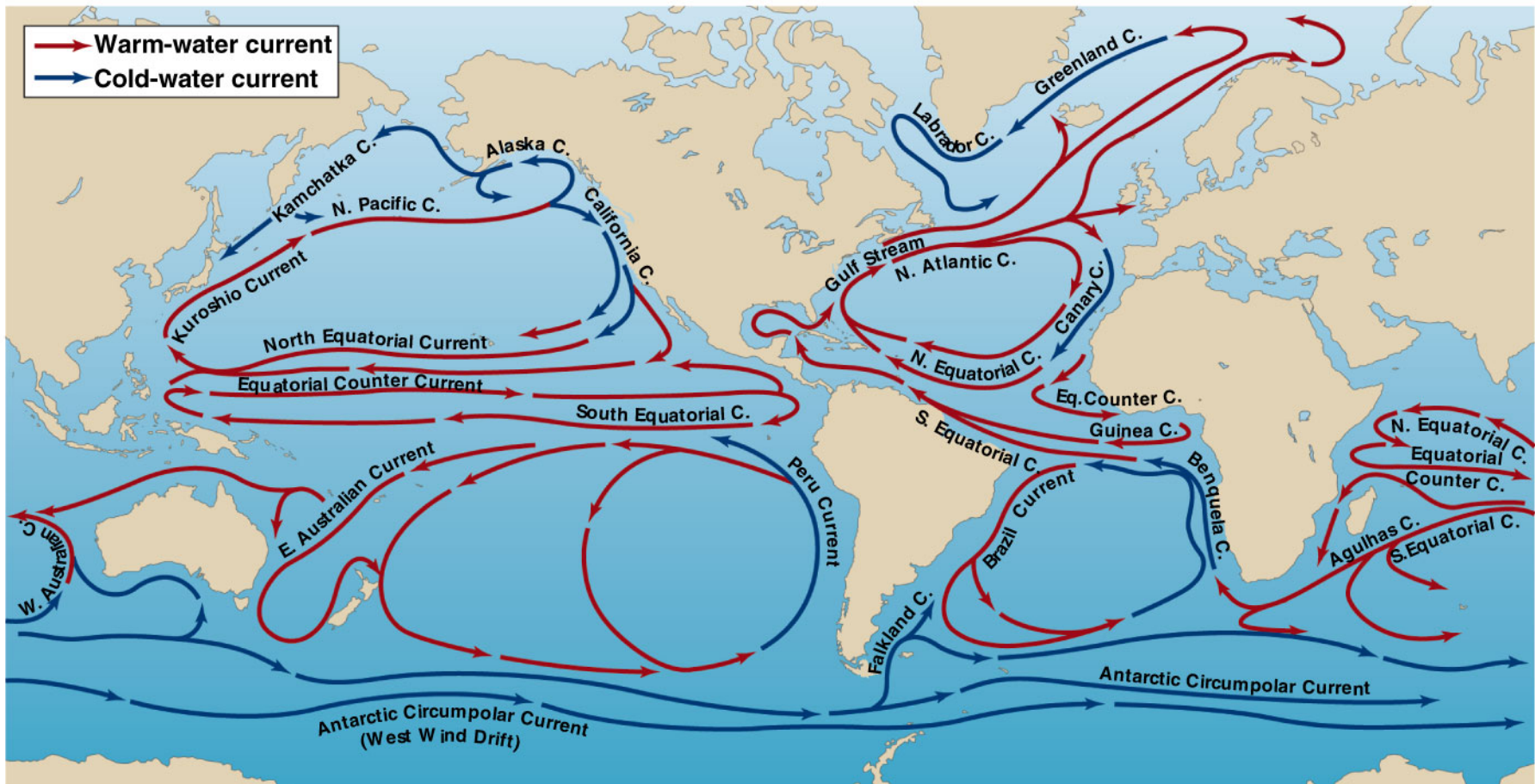
(b) Faster rotation



The rotation of the earth allows for eddies and circular patterns that distribute the solar radiation arriving to the Equator

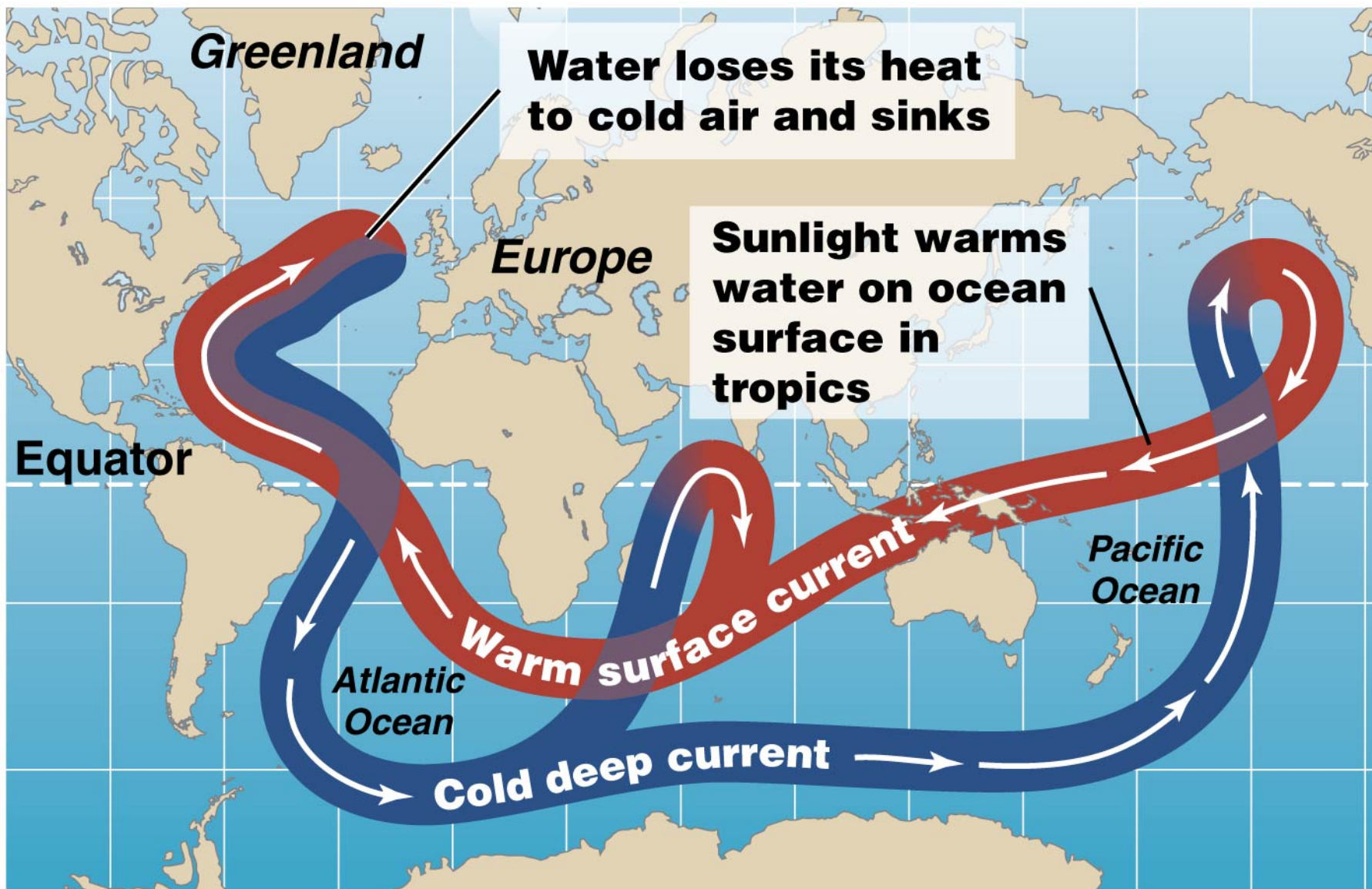


The earth's atmosphere can be compared to a layer cake. Almost 90% of the gases in the atmosphere are found in the first 20 kms in elevation above sea level. The troposphere contains the mix of gases in which 70% is Nitrogen, 28% is Oxygen, 1% Argon and the rest in trace gases that include CO₂.



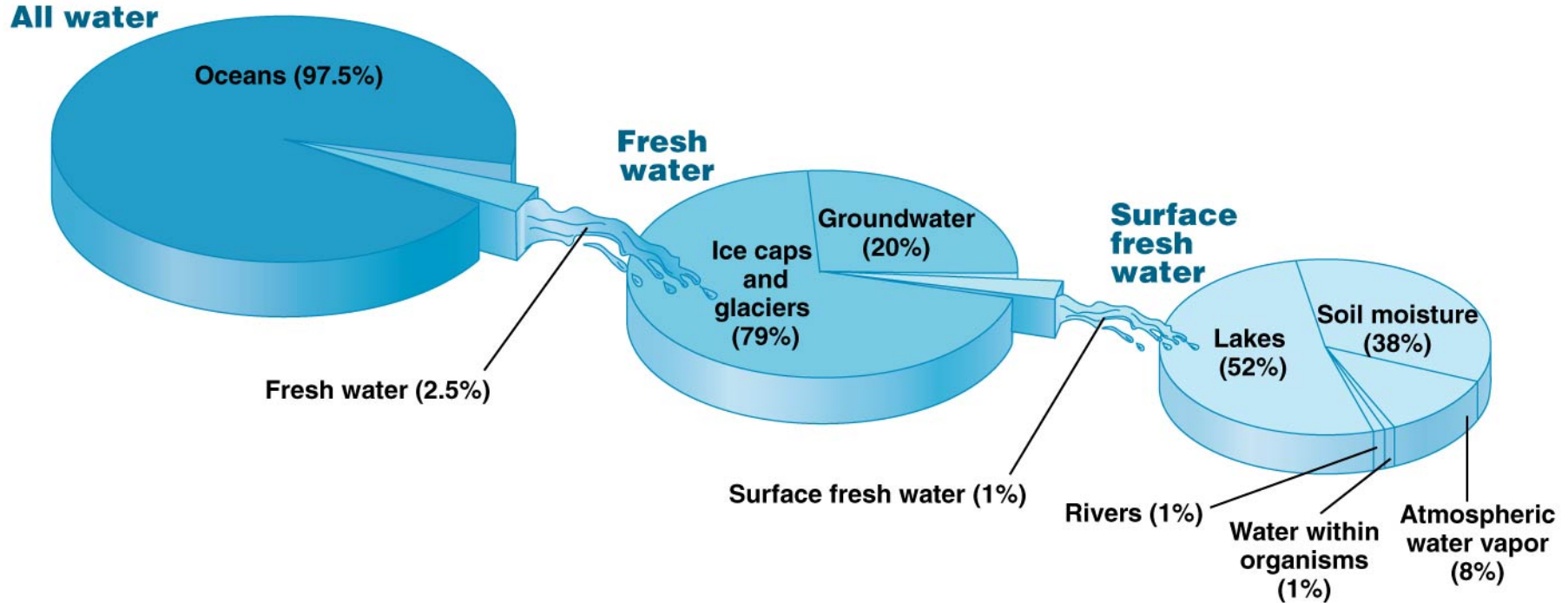
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Warm and cold ocean currents also distribute the solar radiation arriving differentially on earth.



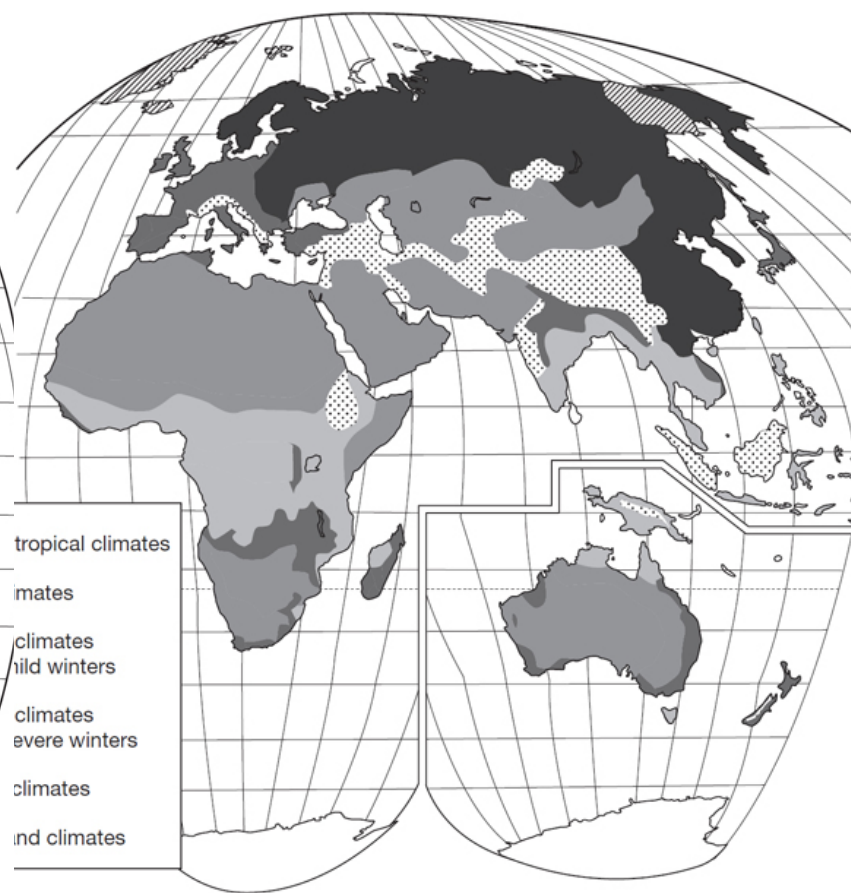
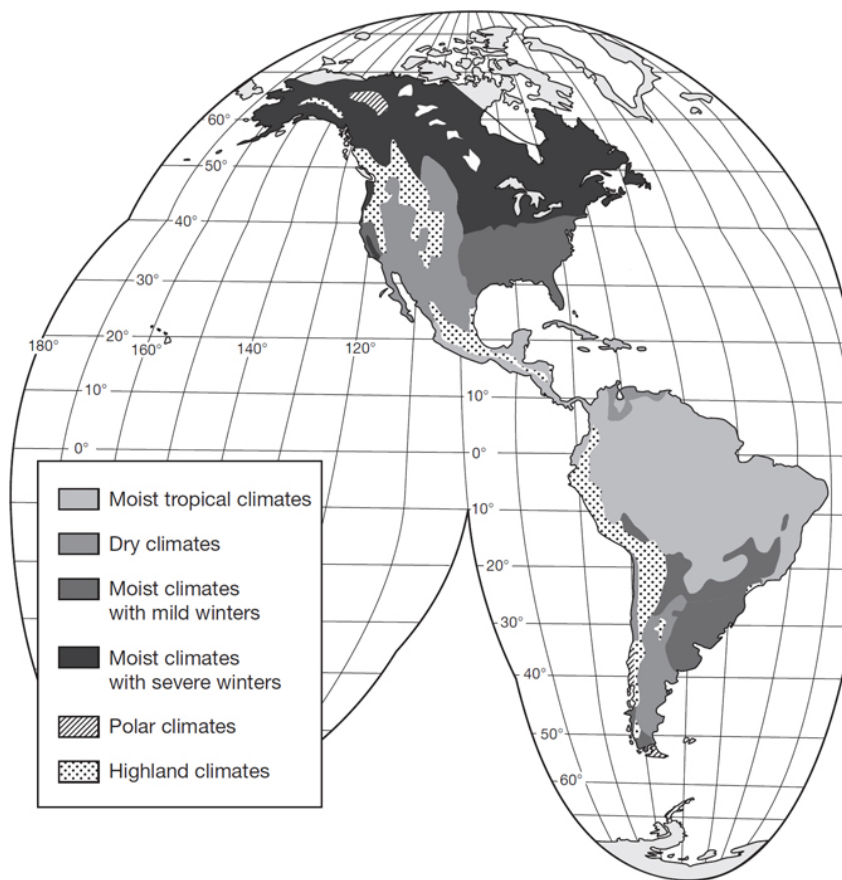
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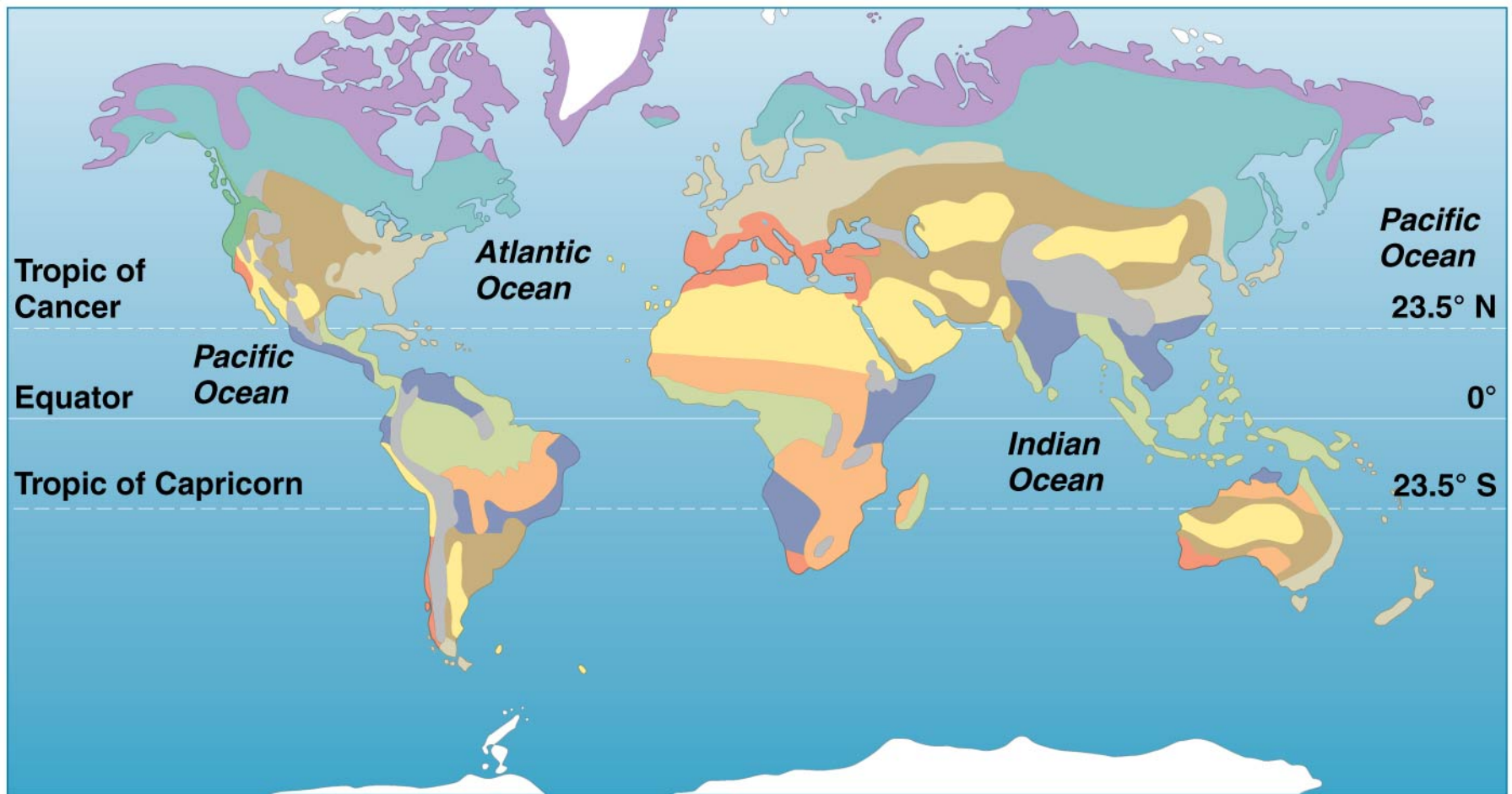
The thermohaline circulation has far reaching effects on Earth's climate.



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The actual amount of fresh water available to life forms is much smaller than the amount of water on Earth.

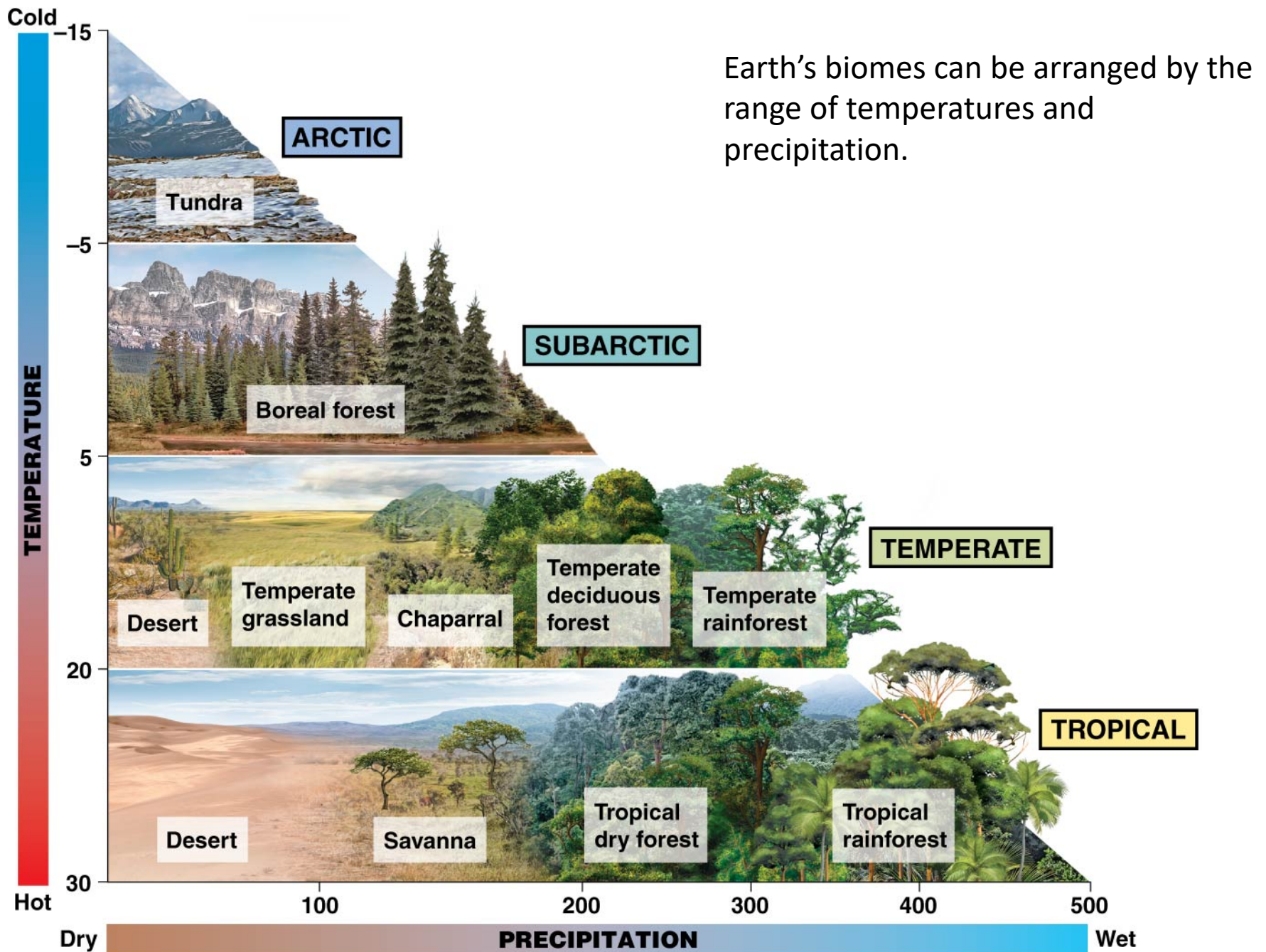


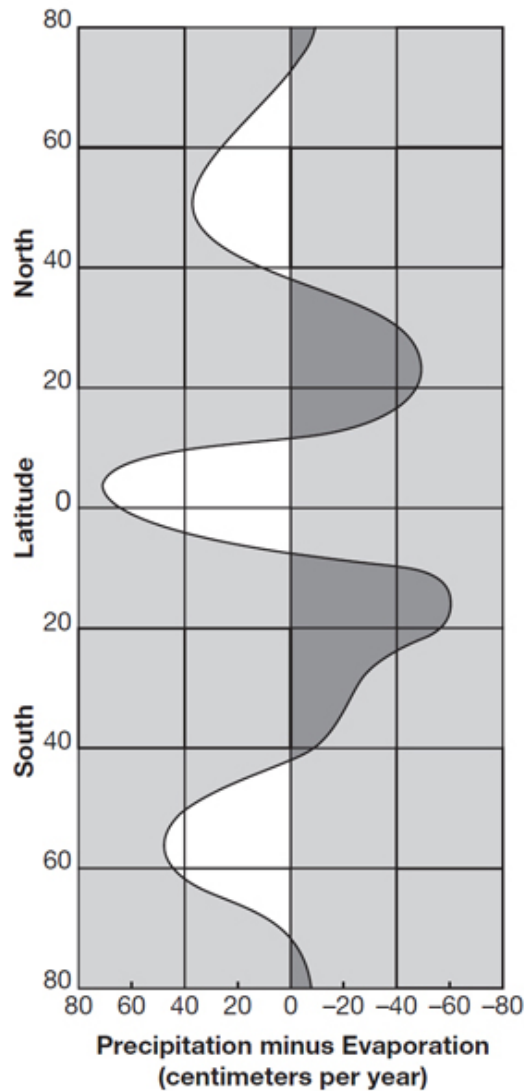


- | | | | |
|----------------------------|---------------------|---------------|---------------------|
| Temperate deciduous forest | Tropical rainforest | Desert | Chaparral |
| Temperate grassland | Tropical dry forest | Tundra | Mountainous regions |
| Temperate rainforest | Savanna | Boreal forest | Unvegetated regions |

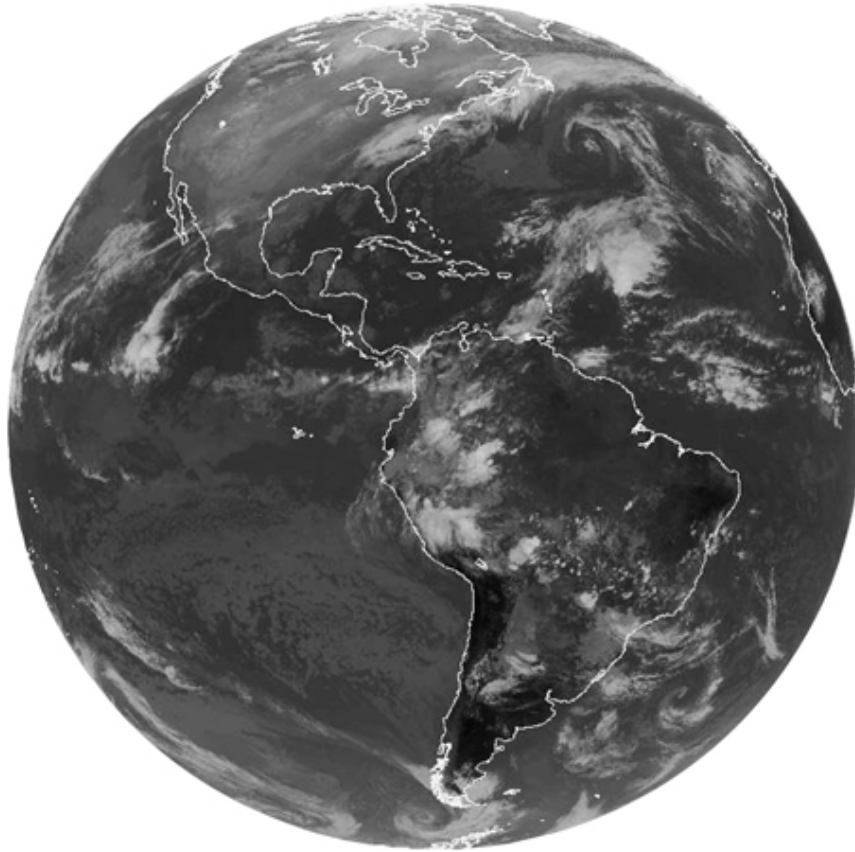
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Earth's Biomes

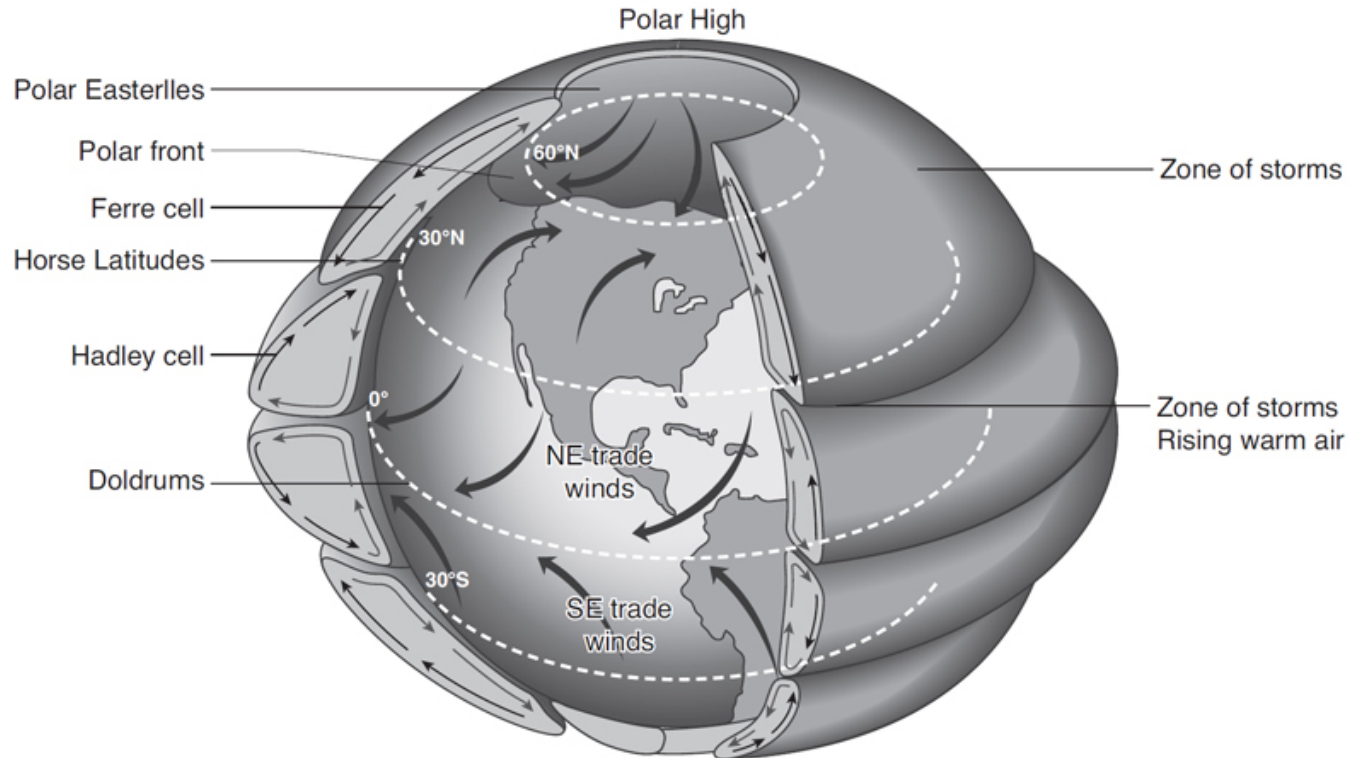




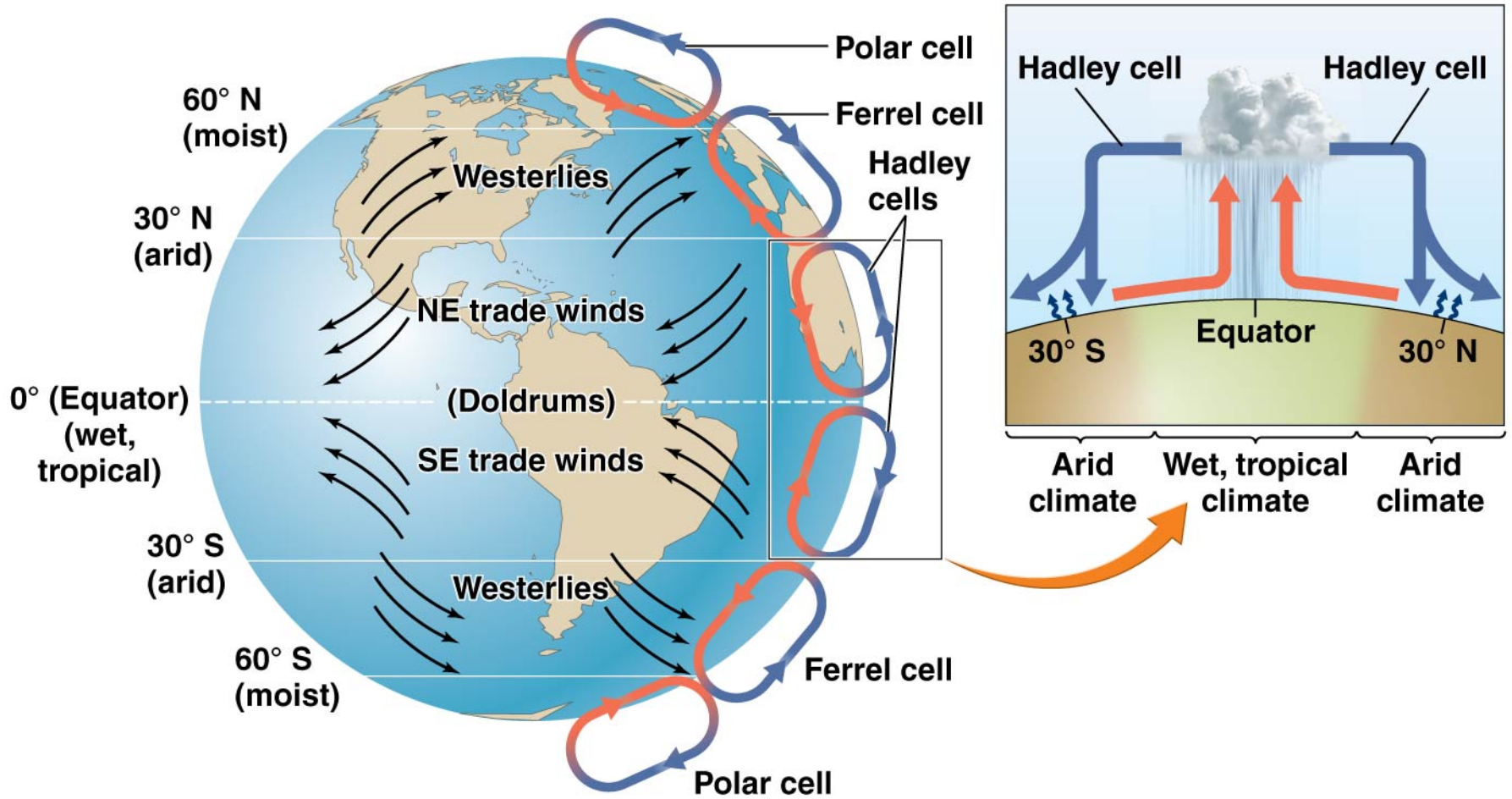
Precipitation on Earth is very uneven. Cool descending air at 30°N and 30°S Latitude makes for relative aridity. While the equatorial belt sees most of the precipitation as do 60°N and 60°S.

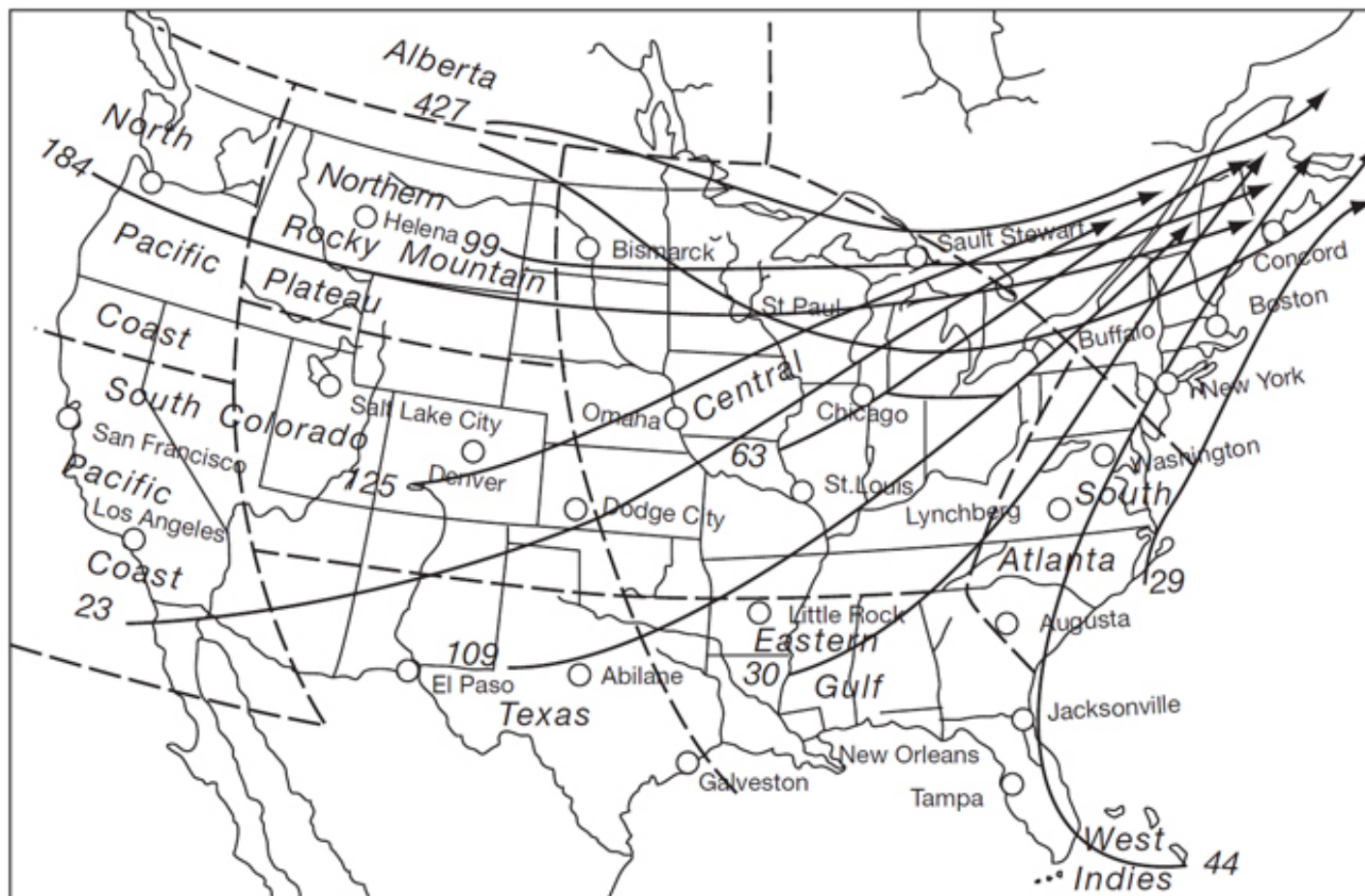


The Western hemisphere
seen from space. Note the
band of clouds at the
Equator.



The wind bands of the Earth show the very prominent “Hadley cells” that show the rising of moist warm air at the Equator and the descent of dry air at the 30°N/S latitude areas. The “dead air” at the Equator is known as the Doldrums. At 30°N/S they are called the Horse Latitudes.

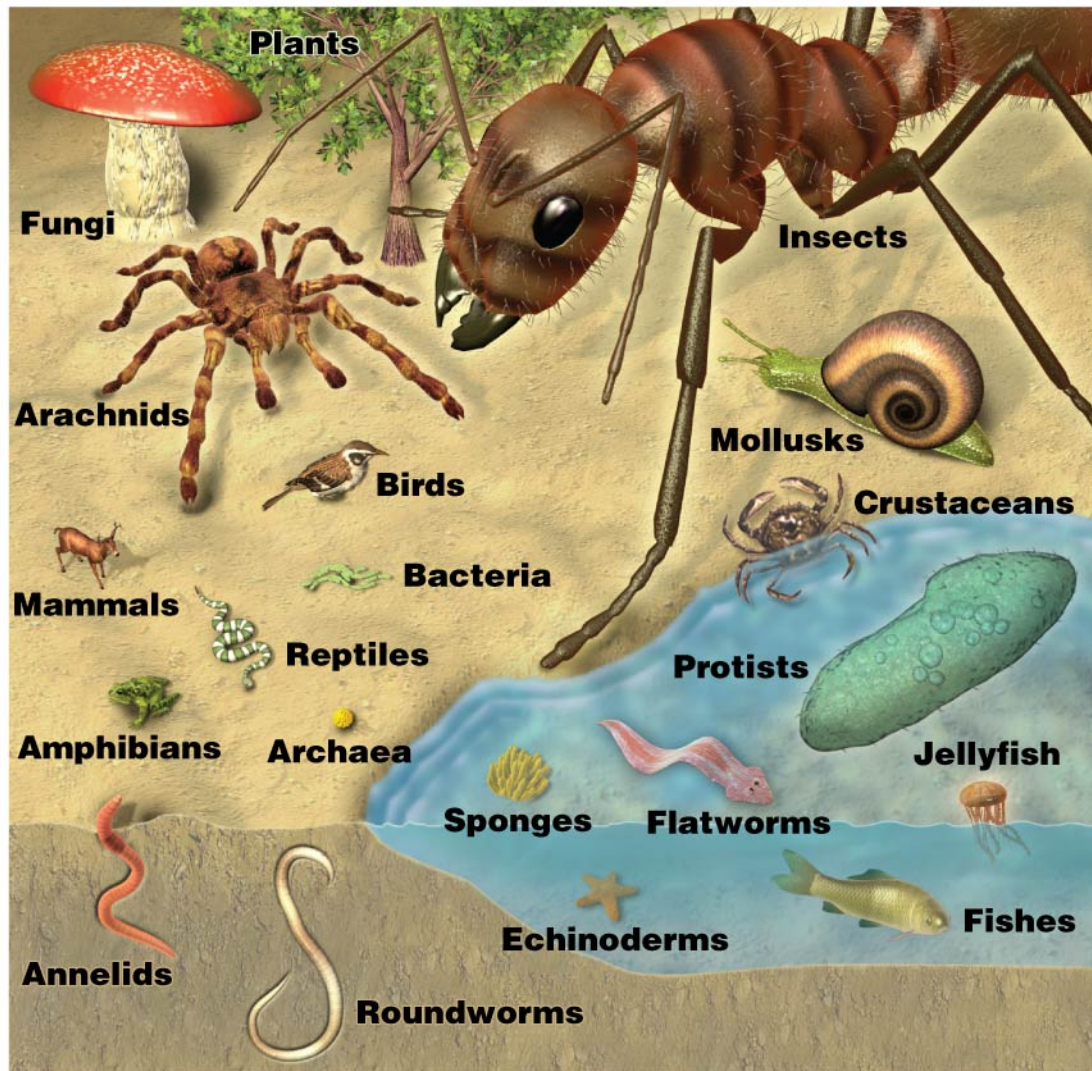




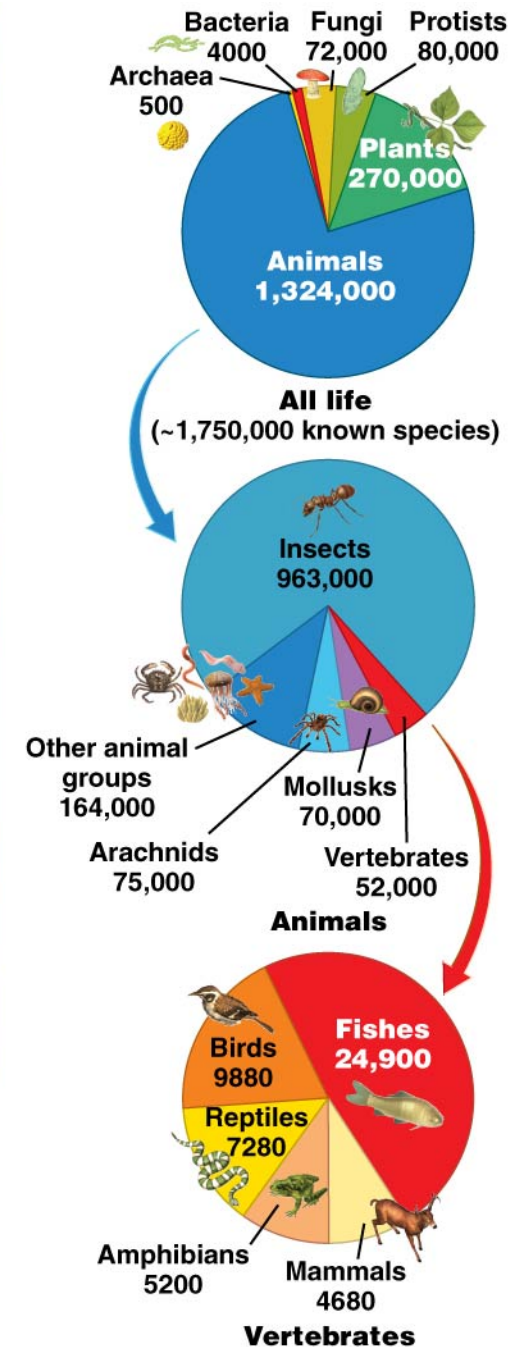
Storm tracks in the “lower 48 states” from West to East.

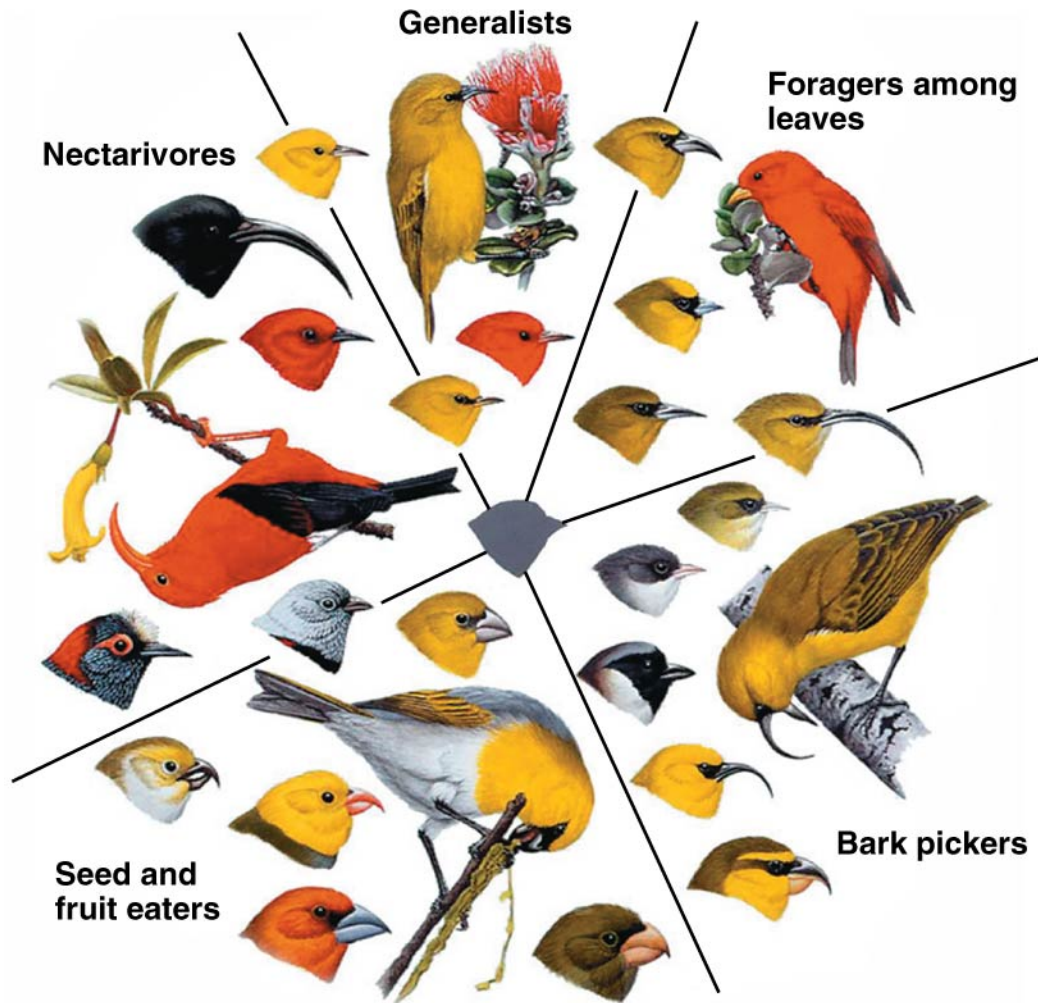


Jupiter, a gaseous giant, has very defined bands in its atmosphere.



Relative number of species on Earth



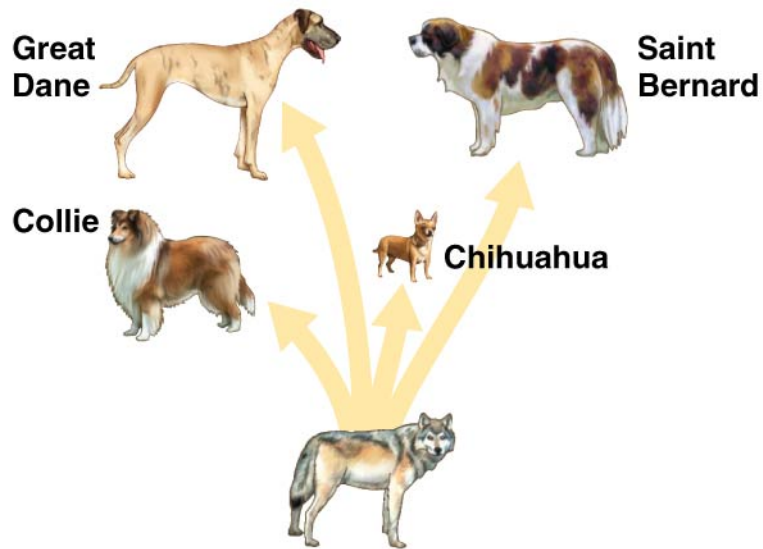


(a) Divergent evolution of Hawaiian honeycreepers

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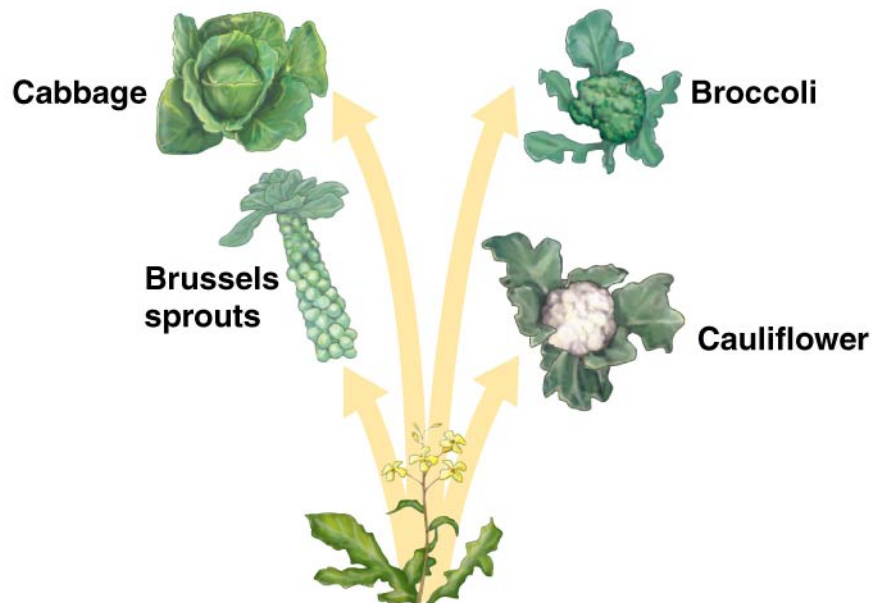


(b) Convergent evolution of cactus and spurge



(a) Ancestral wolf (*Canis lupus*) and derived dog breeds

Humans have created species through artificial selection. Darwin begins with this fact in order to discuss natural selection in his book, *The Origin of Species*.



(b) Ancestral *Brassica oleracea* and derived crops



Biosphere

The sum total of living things on Earth and the areas they inhabit



Community

A set of populations of different species living together in a particular area



Landscape

A geographic region including an array of ecosystems



Population

A group of individuals of a species that live in a particular area



Ecosystem

A functional system consisting of a community, its nonliving environment, and the interactions between them



Organism

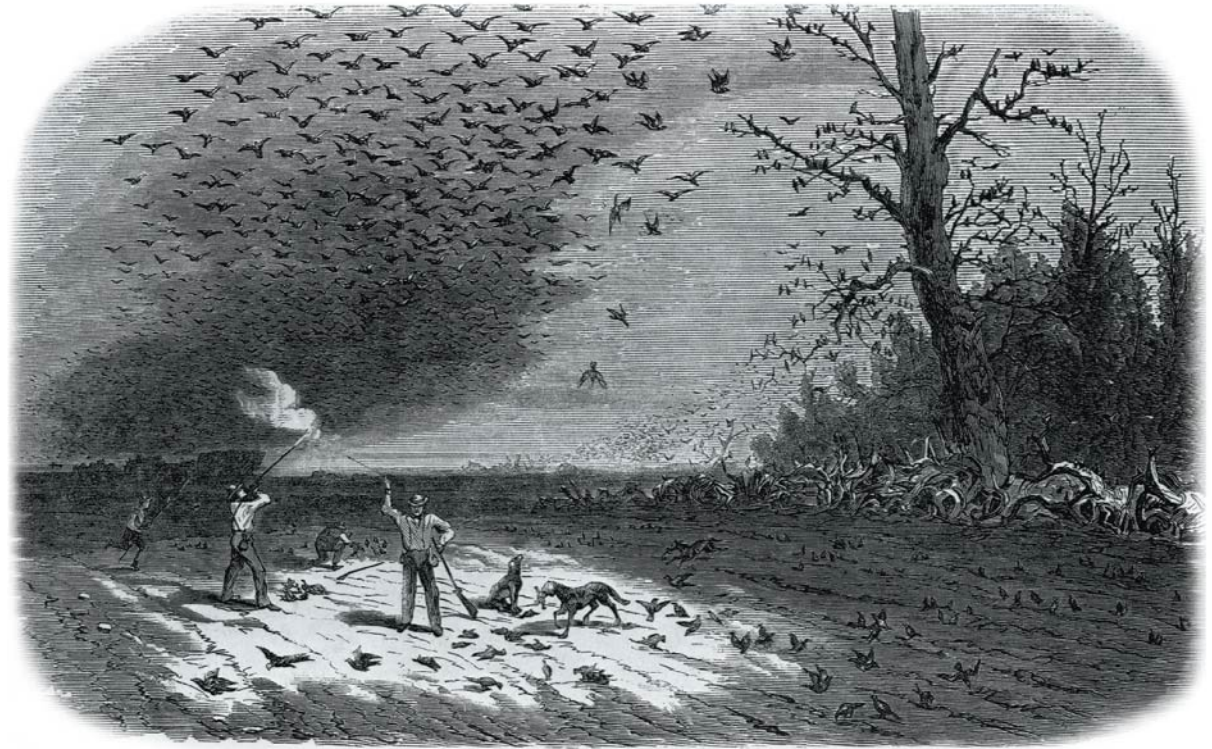
An individual living thing

The “nesting” of systems from organism to biosphere.



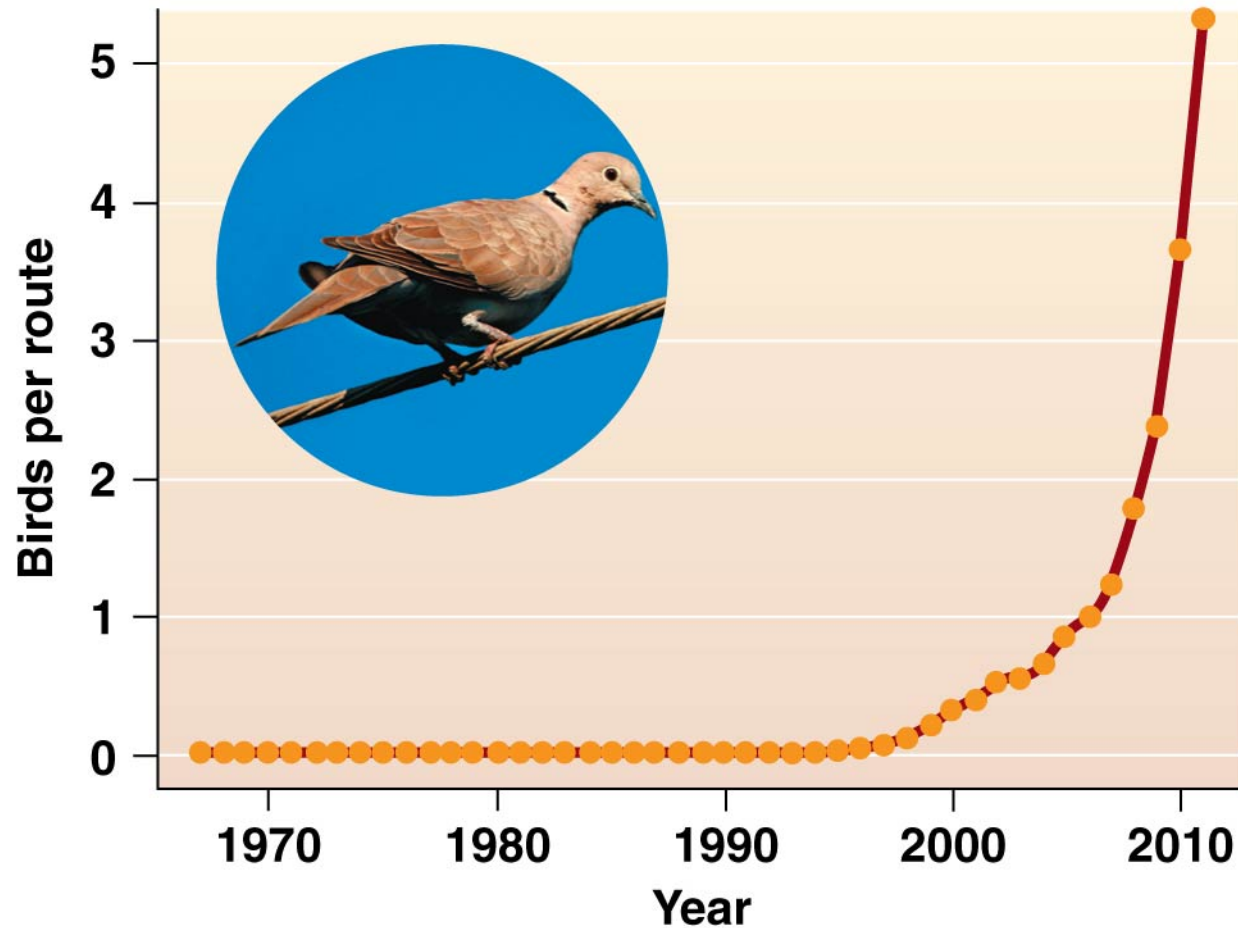
(a) Passenger pigeon

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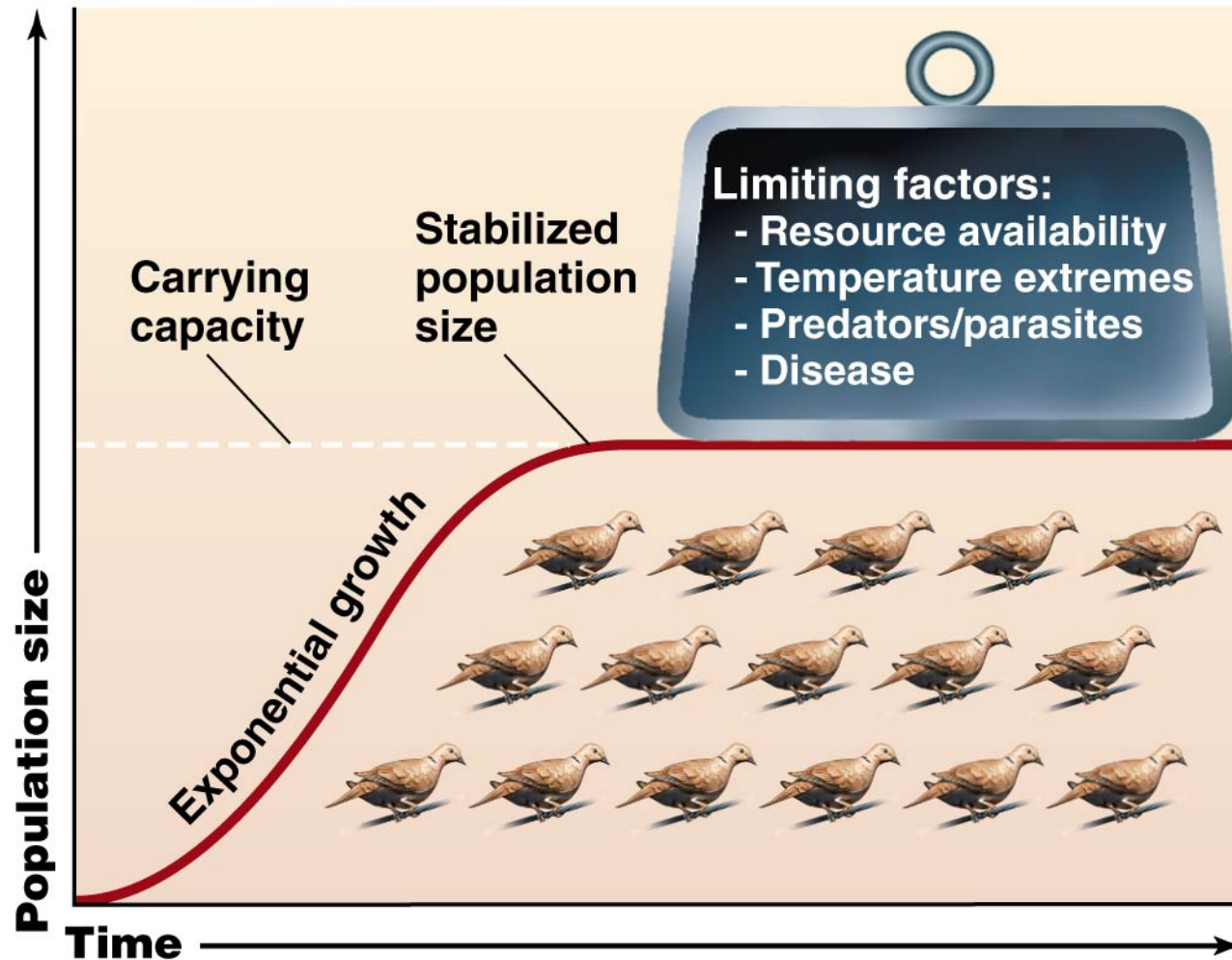
(b) 19th-century lithograph of pigeon hunting in Iowa

The extinction of the passenger pigeon by humans in North America.



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The exponential growth of the Eurasian dove population following its introduction in the US. This is characteristic of invasive species.

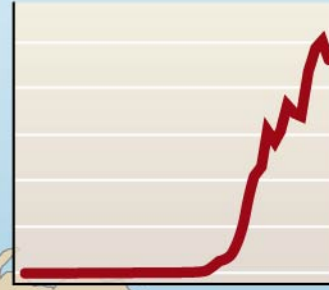


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The limiting factors that make for the “carrying capacity” of any ecosystem to support a population of organisms.

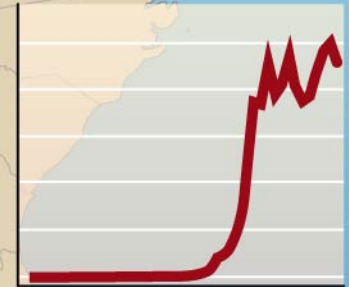


In the western U.S., the dove has arrived recently and is still undergoing exponential growth.



In the eastern U.S., the dove's population growth is slowing.

The dove is spreading north and west across the U.S.



In Florida, where the invasion began, the dove population has reached carrying capacity.

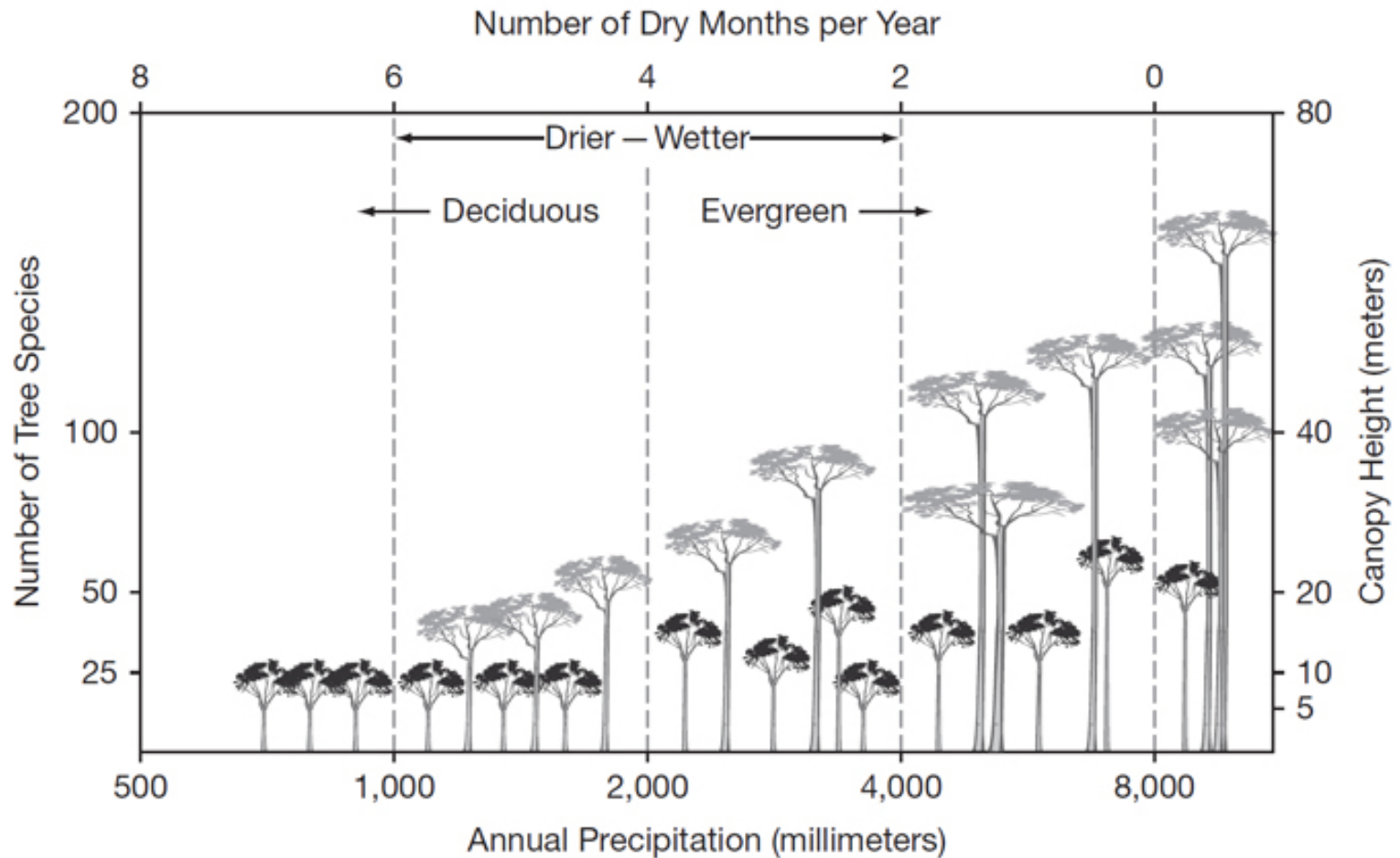


The snowy egret painted
by John James Audubon.

TABLE 5.1 NUMBER OF BIRD SPECIES AT DIFFERENT LATITUDES,
IN PLACES OF ROUGHLY SIMILAR AREA

Location	Number of bird species
Greenland	56
Labrador	81
Newfoundland	118
New York State	195
Guatemala	469
Colombia	1,525

As one moves toward the Equator away from the poles, biodiversity increases. Temperate climates have species abundance. Tropical climates have species variety.



Both the number of tree species and the height of the forest canopy are functions of wet and dry times of the year.



Old growth tropical rainforest in Indonesia.

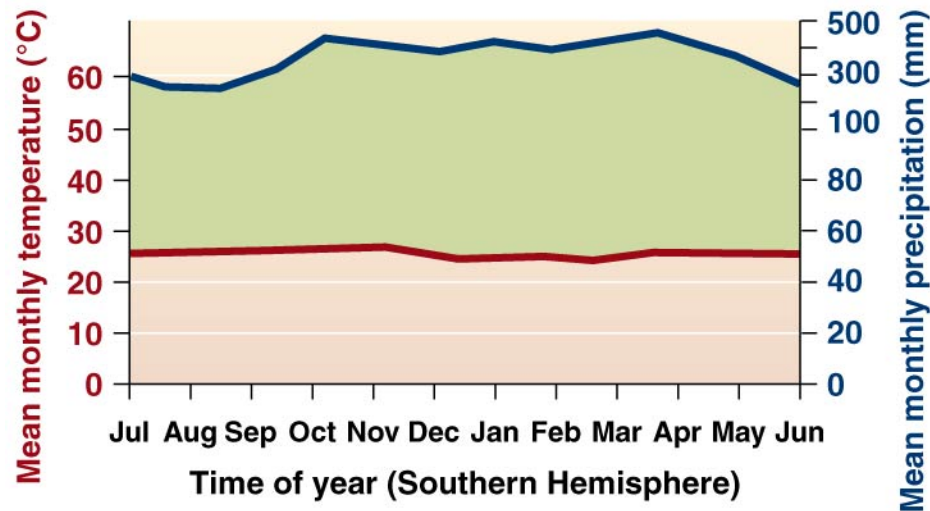


Coral reefs are in serious trouble. Bleaching is happening today to almost 90% of tropical reef forming corals.

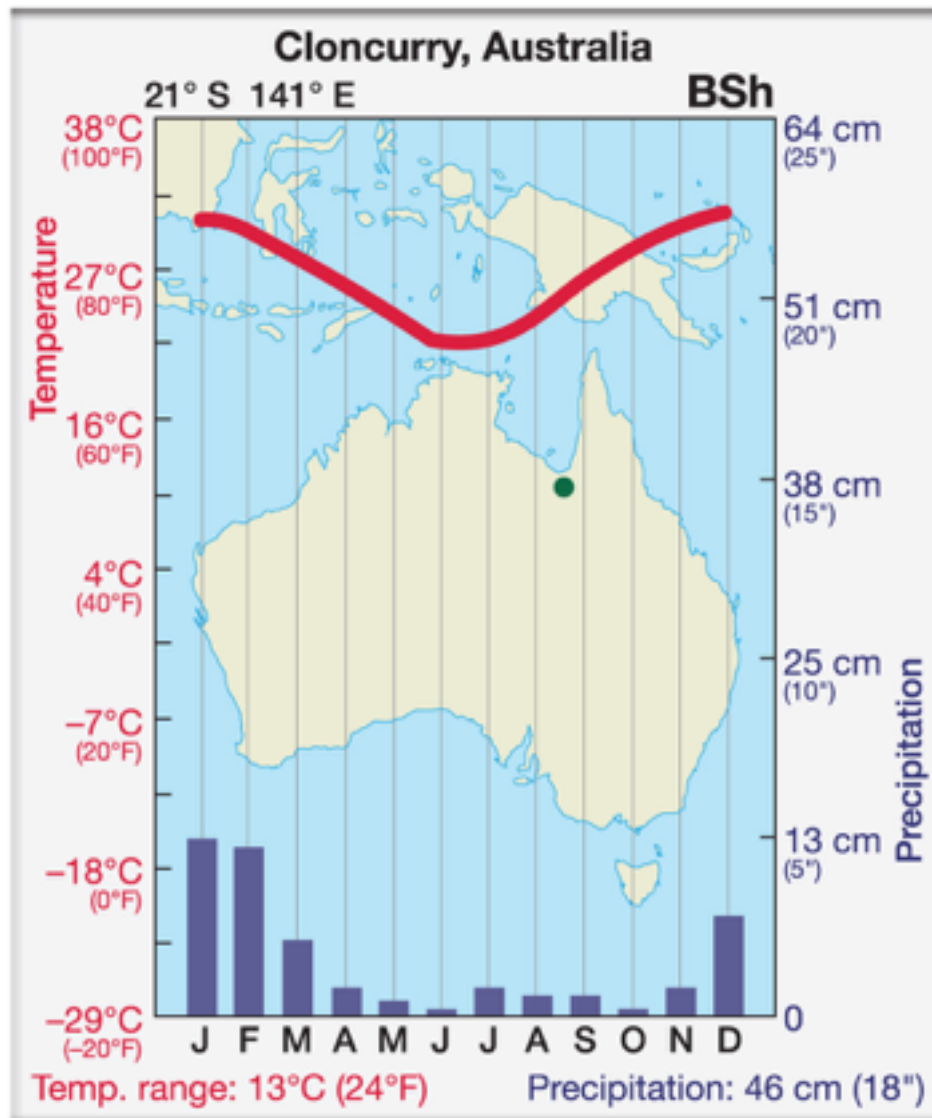


A simple climograph for an Indonesian rainforest. Note temperature and precipitation play a central role.

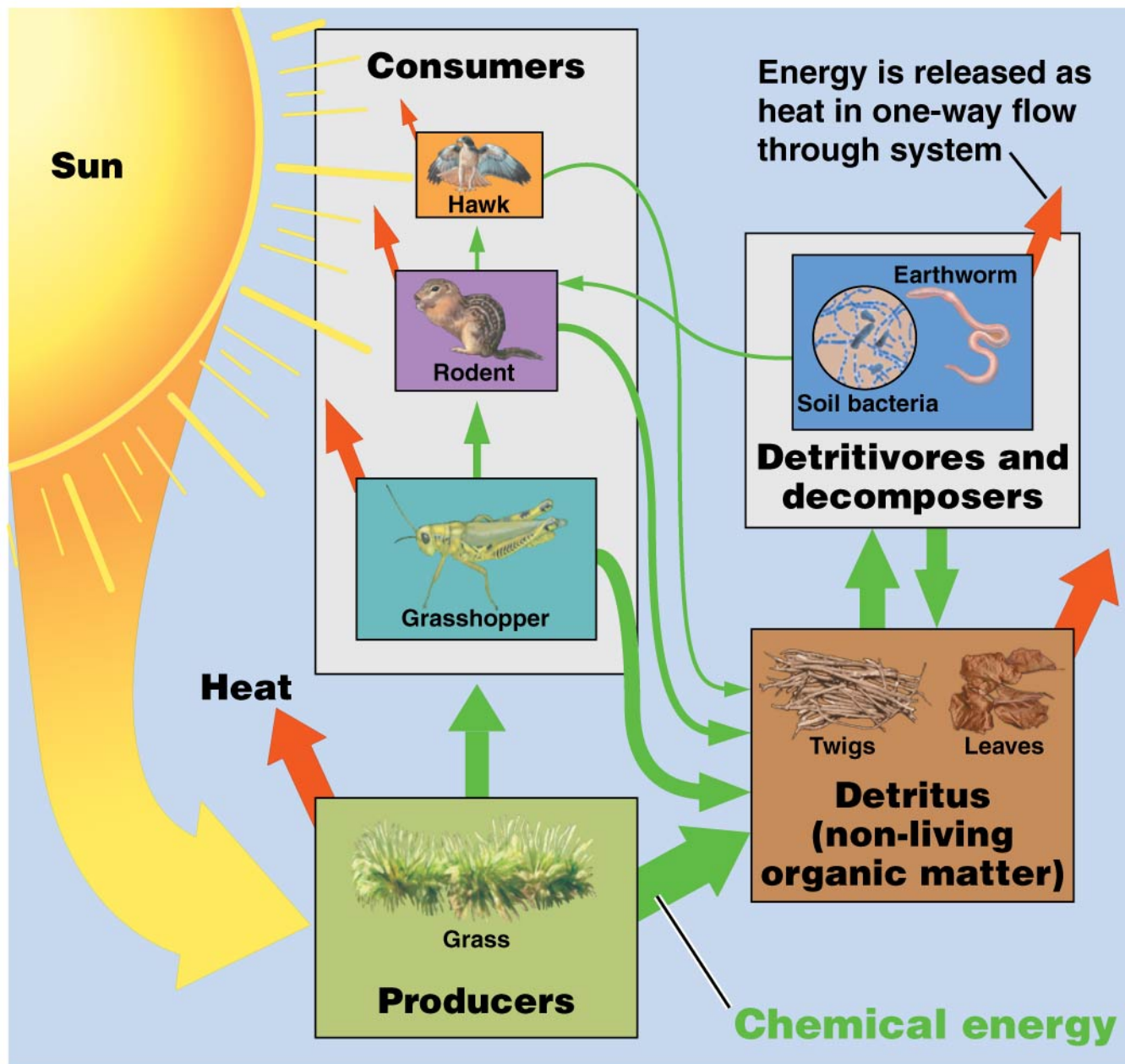
(a) Tropical rainforest



(b) Bogor, Java, Indonesia

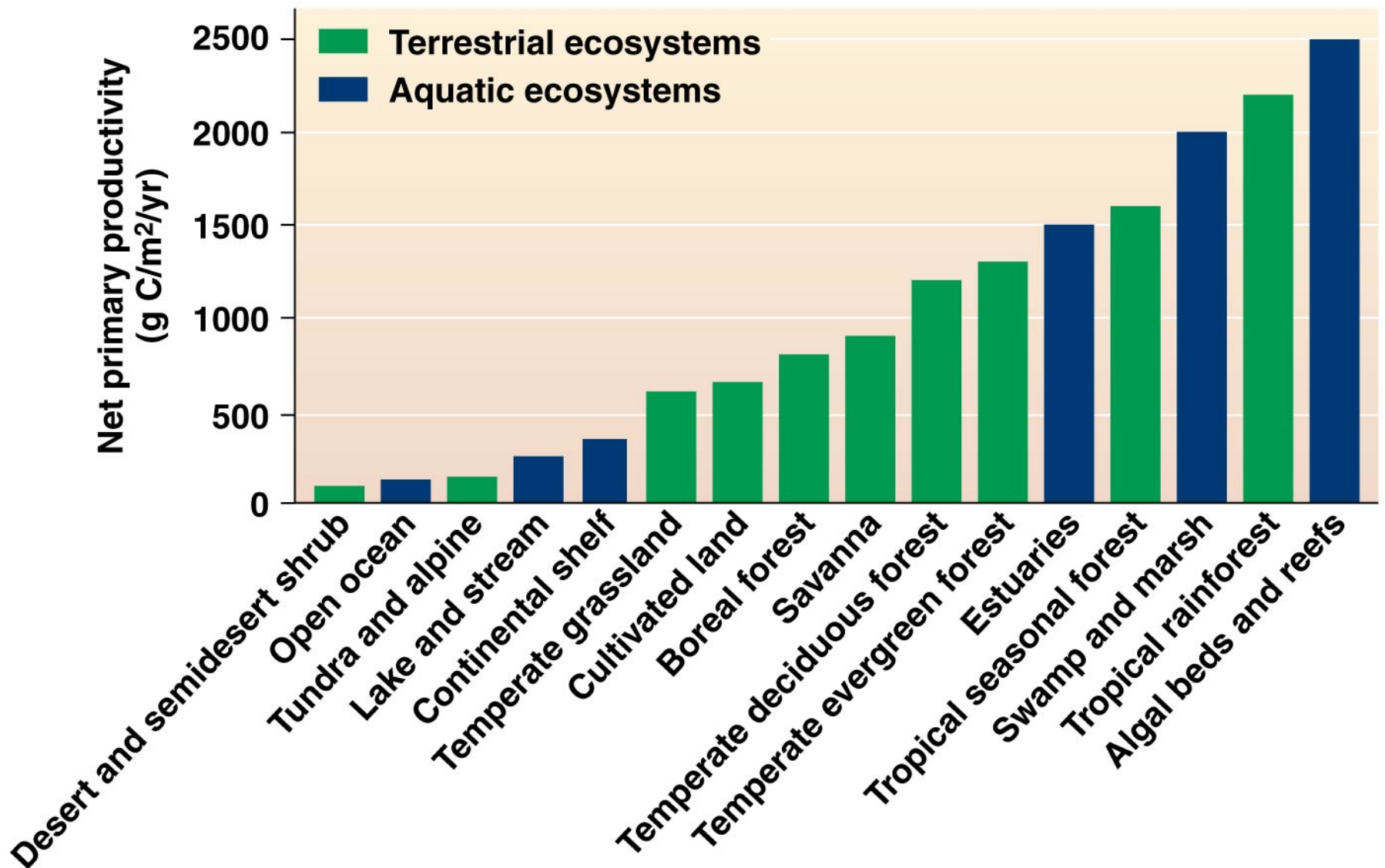


A more “proper” geographer’s climograph for an exact location in Australia. Note it includes exact coordinates (Lat/Lon) and a map as well as monthly and annual temperature and precipitation ranges.



The very base of all food chains starts with primary production. Only autotrophs (plants) get their energy directly from the sun through photosynthesis.

(a) Energy flowing through an ecosystem



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Net primary production is more prevalent on land than in water.
But the most productive are in fact algal beds and reefs.

TABLE 5.2 ECOSYSTEMS BEING MODIFIED BY HUMANS IN WAYS THAT RAISE COMMONS DILEMMAS.

Ecosystem type	Commons dilemmas and grand challenges	Questions about responses being attempted
Planet as a whole	Climate change Loss of biodiversity Global-scale economy, driven by demand from rich nations	Is global-scale governance feasible? Can development be made sustainable?
Critically damaged ecosystems	Severely polluted landscapes Seascapes and landscapes destroyed by overharvesting of fish and trees	How can outside assistance be provided? Can we sense limits before destruction becomes irreversible?
Protected areas (parks, coral reefs, biological preserves)	Ecosystems are being protected from human pressures, often by removing traditional human inhabitants	How do we insulate protected areas from human-caused changes? What should be the role of humans in these ecosystems?
Human settlements, including industrial landscapes	Ecosystems transformed by human activities Rapid population growth in cities in poor countries Changes in consumption of energy and materials	How do we recognize, enable, and manage rapid changes? How can social capability be built for communities being torn apart and reassembled by these changes?