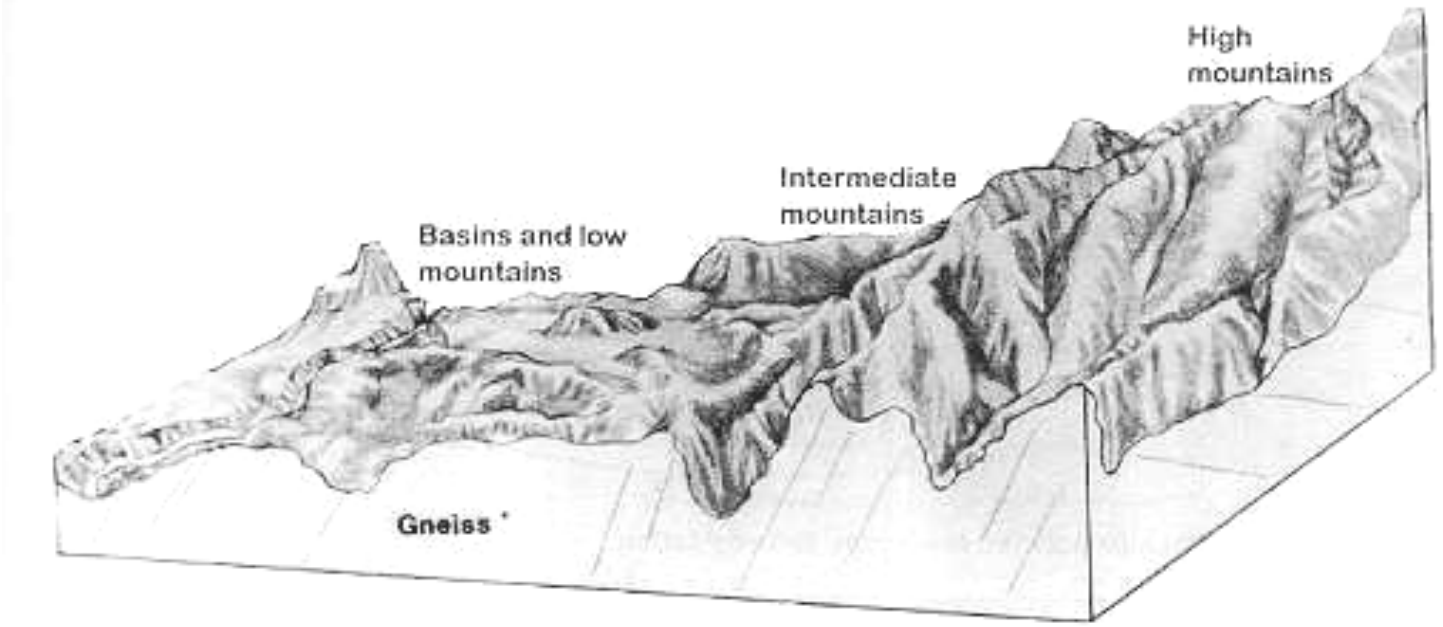


Figure 9. Topography of mountain soil systems illustrating the sharp ridges and steep slopes, broad basins, and high mountain topography.

Ecology – Climate & Topography

Introduction to the evaluation of the relationships of the physical environment and organisms

Climatic Factors

- Let us consider the abiotic features that qualify as climatic factors
  - Temperature
  - Precipitation
  - Incident Solar Radiation
  - Wind Patterns
- This combination of factors often determines the major types of vegetation in a given region

Major Vegetation Formations

- The most common method of classifying the different major climatic/vegetative zones is by Biome designation
- Most biomes are defined by both dominant vegetation *and* prevailing climatic conditions (or at least they should be)
- Let us look at biome distribution (*please note there are several different classification schemes for biomes*)

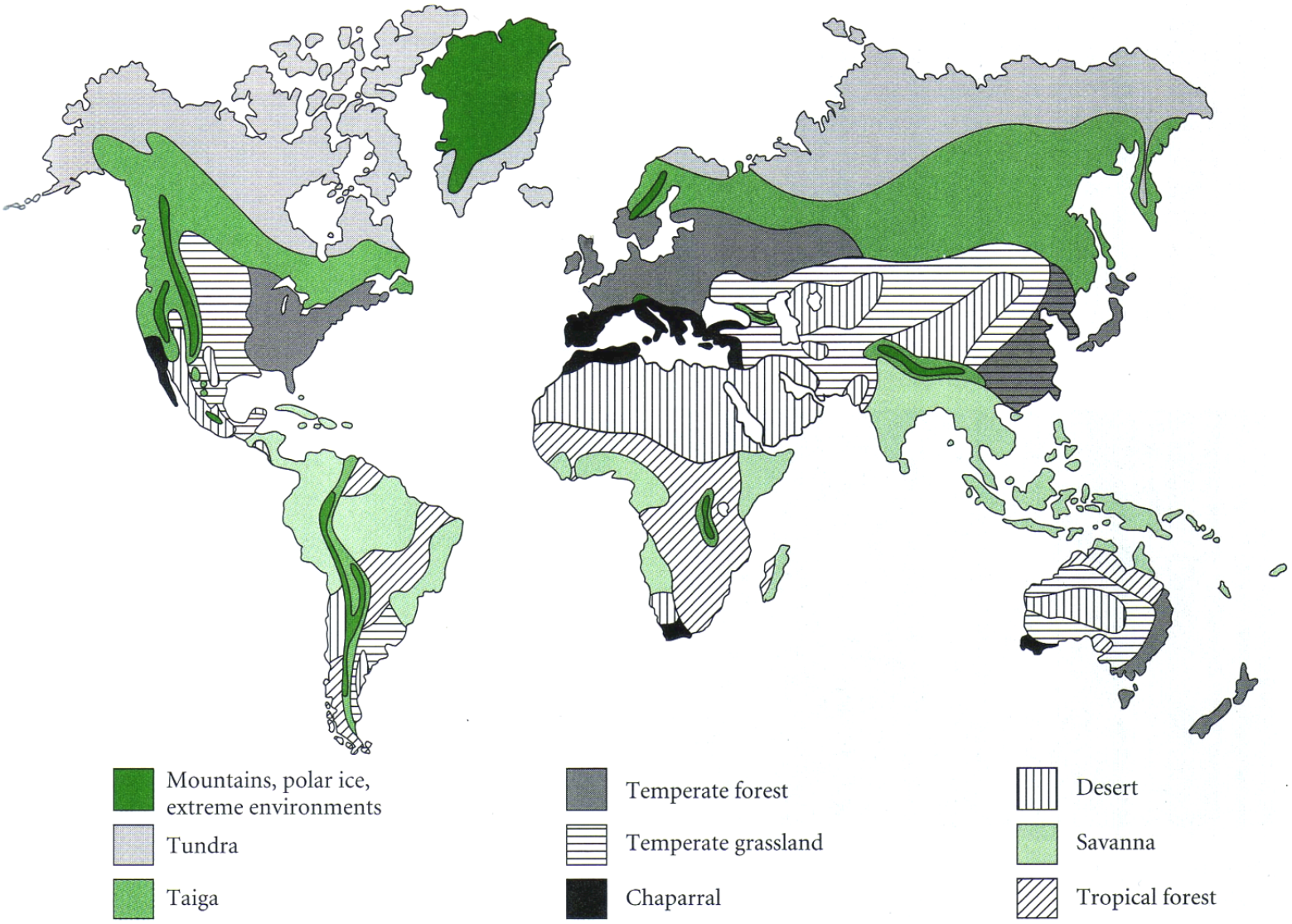


FIGURE 8-28 The major biomes of the world.

Look at a graphic representation of the major determining factors

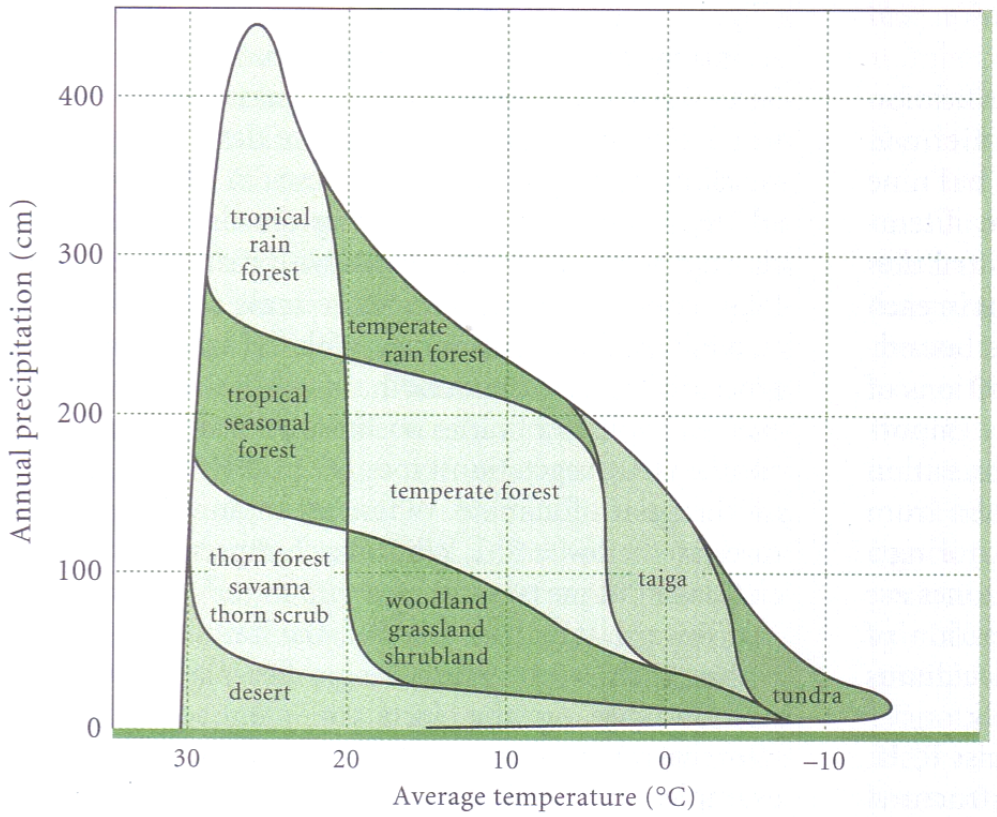
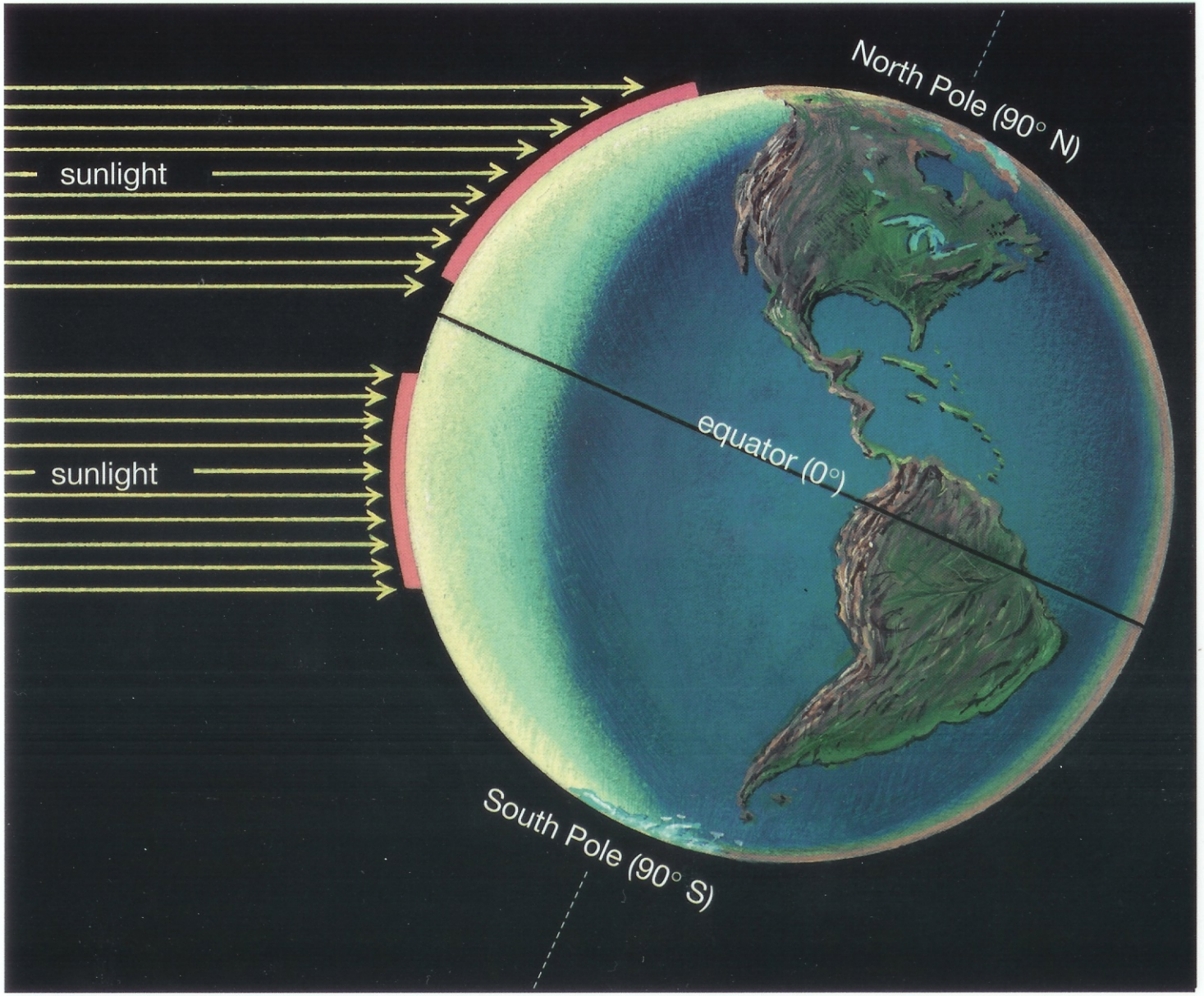
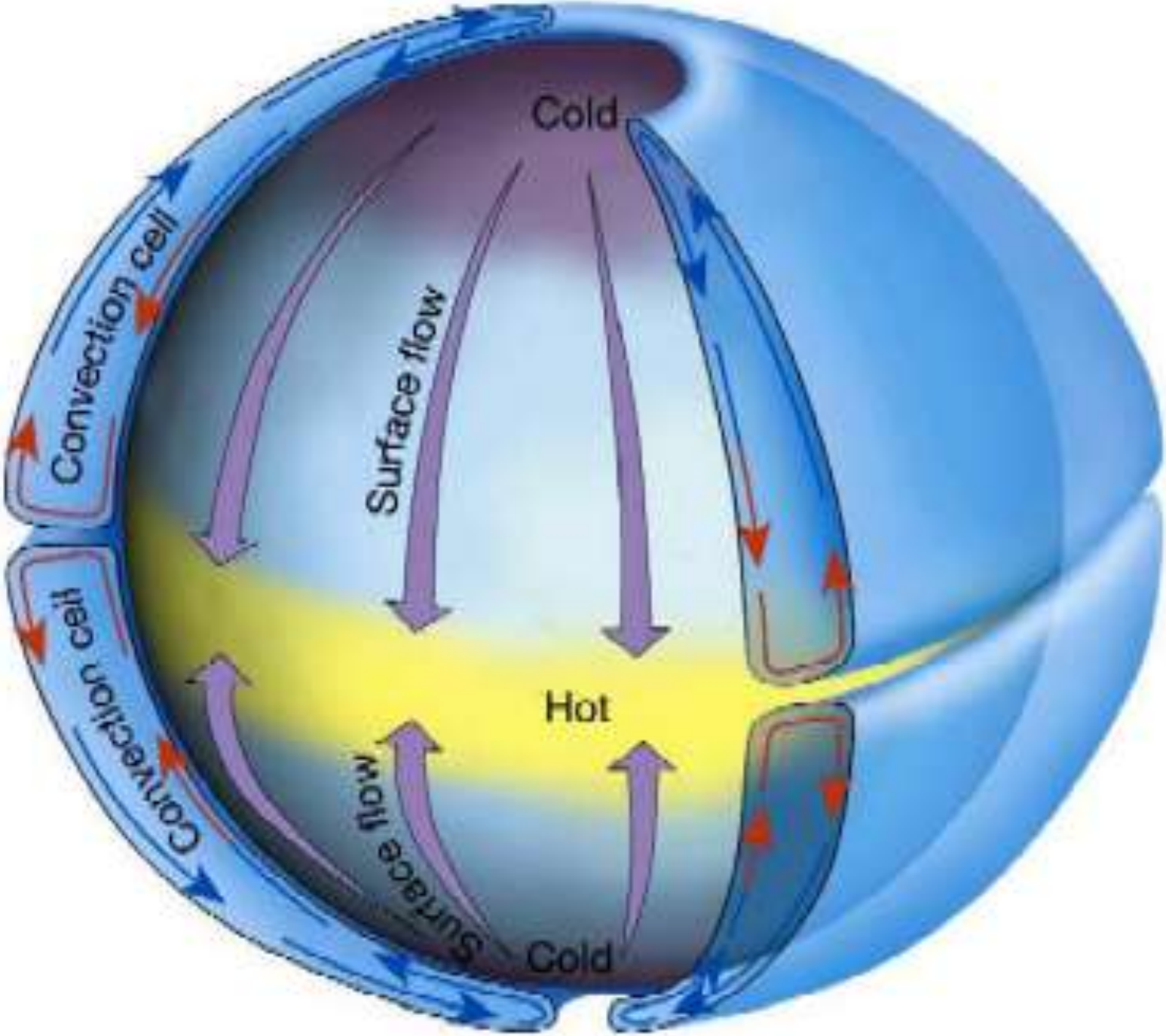


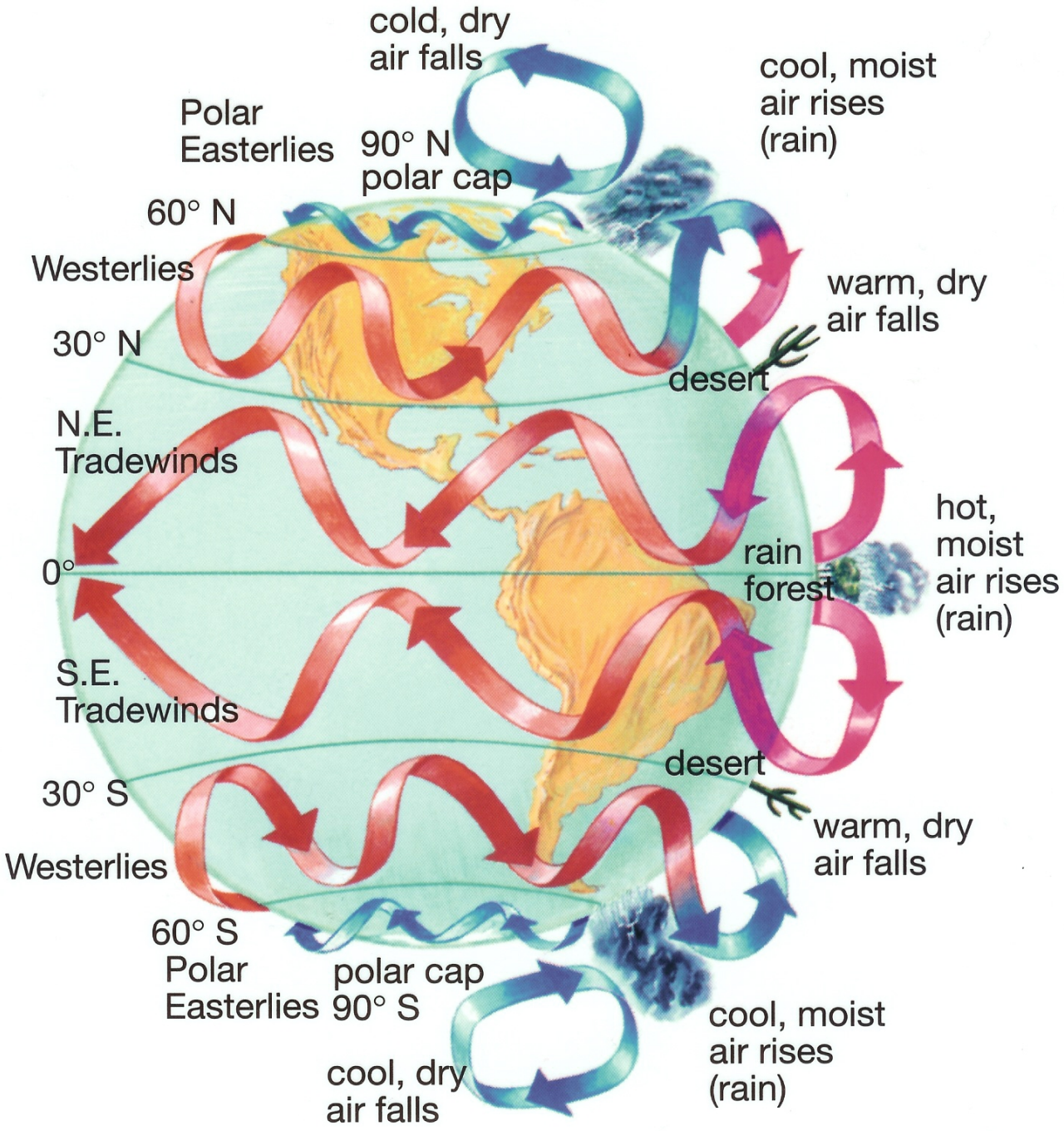
FIGURE 8-27 Whittaker's classification of vegetation types superimposed upon the range of terrestrial climates. In climates intermediate between those of forested and desert regions, fire, soil, and climate seasonality determine whether woodland, grassland, or shrubland develops. (*From Whittaker 1975.*)

Factors influencing climate

- Look a bit closer at some of the factors influencing the distribution of physical and therefore biological features on the surface of the earth
- Certainly of primary importance is the pattern of air circulation - even on a local scale air flow patterns may dramatically influence conditions
- But let us consider the global scale

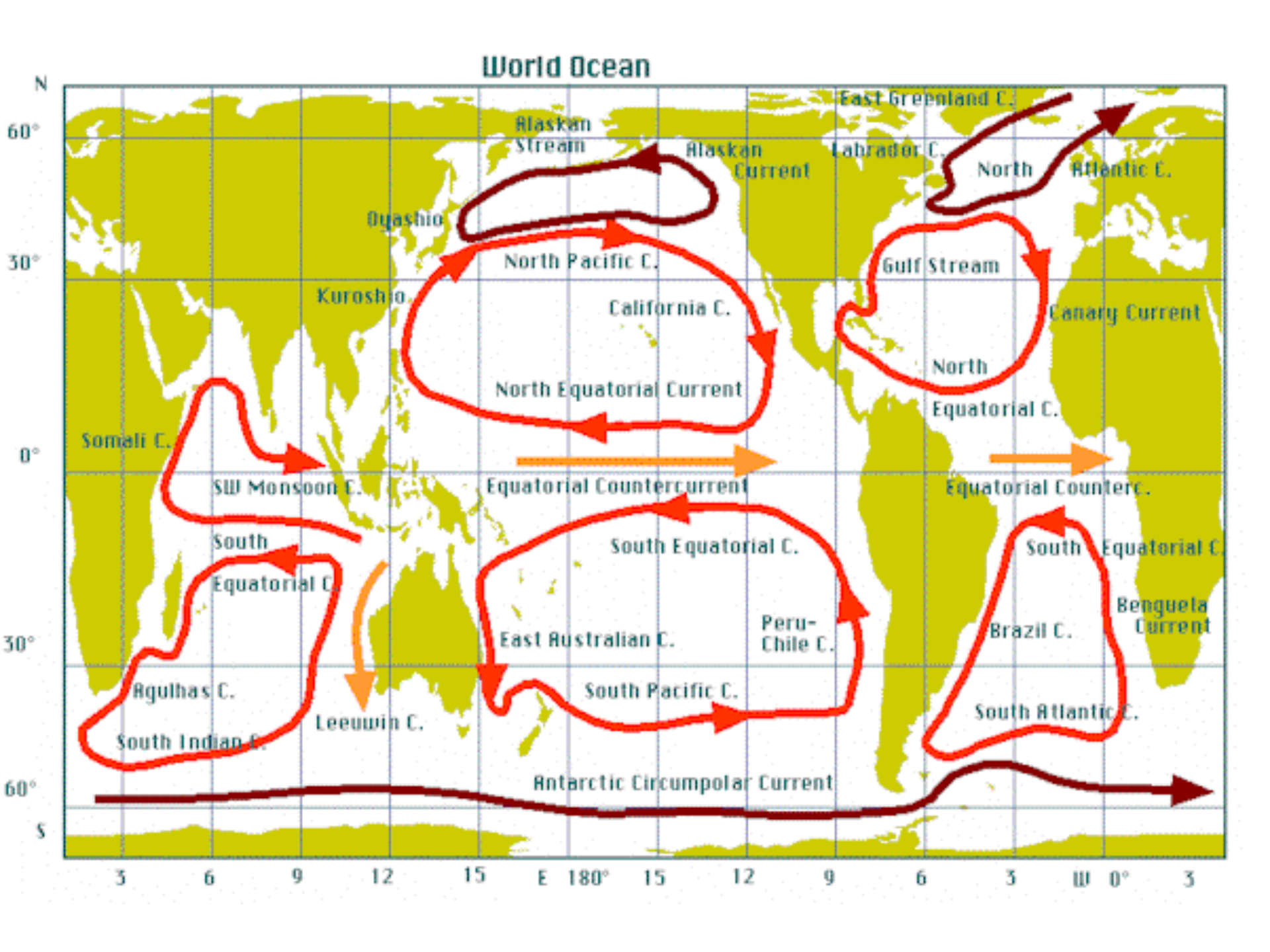

North Pole (90° N)
sunlight
sunlight
equator (0°)
South Pole (90° S)


Cold
Convection cell
Surface flow
Hot
Convection cell
Surface flow
Cold


cold, dry
air falls
cool, moist
air rises
(rain)
Polar
Easterlies
90° N
polar cap
60° N
Westerlies
warm, dry
air falls
30° N
desert
N.E.
Tradewinds
hot,
moist
air rises
(rain)
rain
forest
0°
S.E.
Tradewinds
desert
30° S
warm, dry
air falls
Westerlies
60° S
Polar
Easterlies
polar cap
90° S
cool, moist
air rises
(rain)
cool, dry
air falls

Oceanic Circulation

- The permanent currents of the world oceans are the result of three primary factors:
  - Wind circulation patterns transfer energy to surface waters and create much of the driving force
  - Uneven distribution of potential energy due cooling or evaporation yielding uneven distribution in mass in the ocean
  - And, clearly, the distribution of landmasses


World Ocean
N
60°
30°
0°
30°
60°
S
East Greenland C.
Alaskan Stream
Alaskan Current
Labrador C.
North Atlantic C.
Oyashio
North Pacific C.
Gulf Stream
Kuroshio
California C.
Canary Current
North Equatorial Current
North Equatorial C.
Somali C.
SW Monsoon C.
Equatorial Countercurrent
Equatorial Counterc.
South Equatorial C.
South Equatorial C.
South Equatorial C.
Benguela Current
Peru-Chile C.
East Australian C.
Brazil C.
Agulhas C.
South Pacific C.
Leeuwin C.
South Atlantic C.
South Indian C.
Antarctic Circumpolar Current
3
6
9
12
15
E
180°
15
12
9
6
3
W
0°
3

But, what else, on a Global Scale…

- We know the variation in solar radiation
- We also know the pattern of global wind patterns
- And, we know the major circulation patterns of the worlds oceans
- Therefore, we should be able to accurately predict climatic conditions on earth with great precision – right?

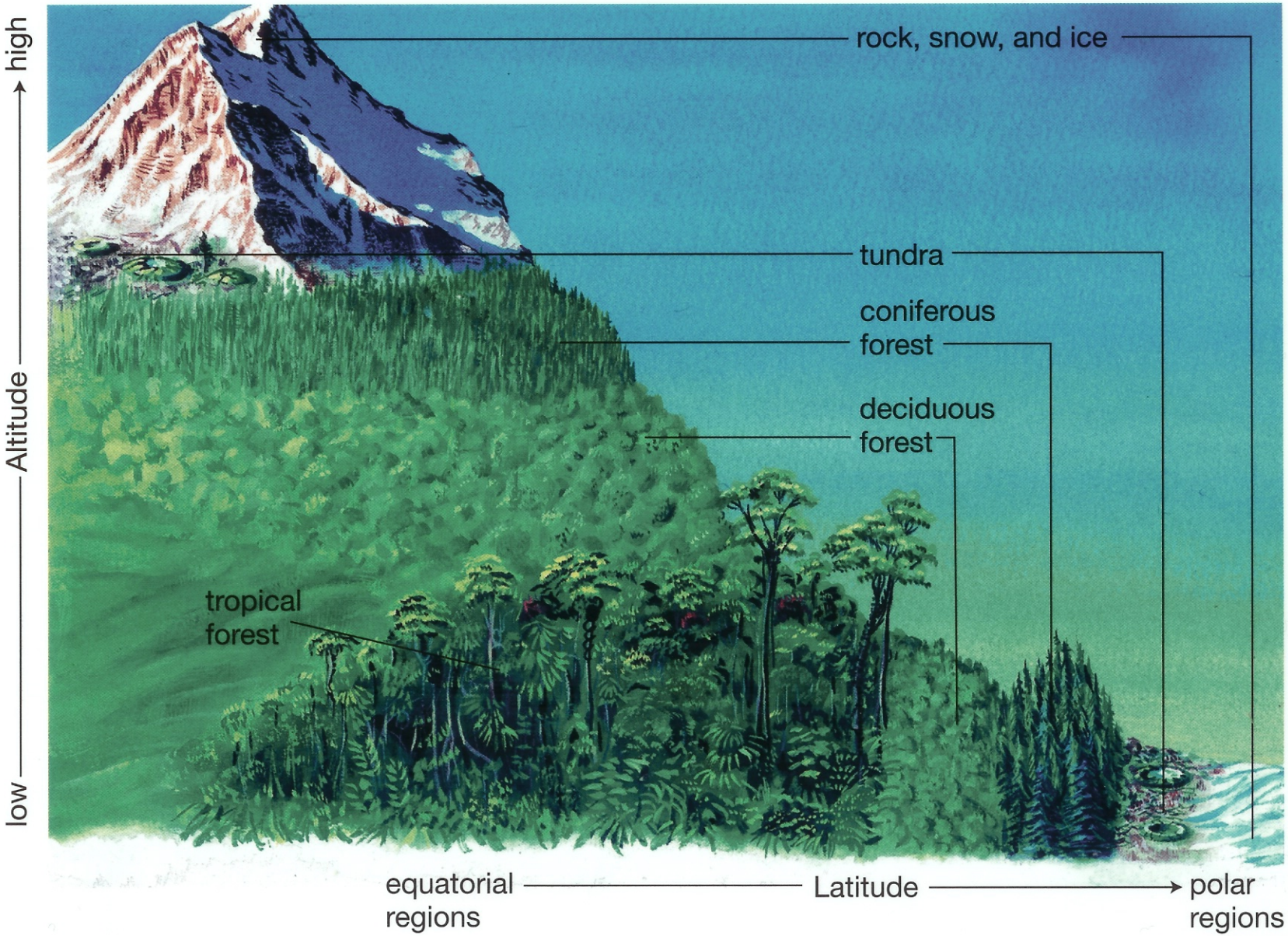
However, the world is not flat

- With the season, geographic location and knowledge of wind patterns, we have some very important information
- But, we cannot *a priori* define climatic conditions on a local scale without additional data
- We need to consider the role of topography in determination of local conditions (and substrate – in a minute)

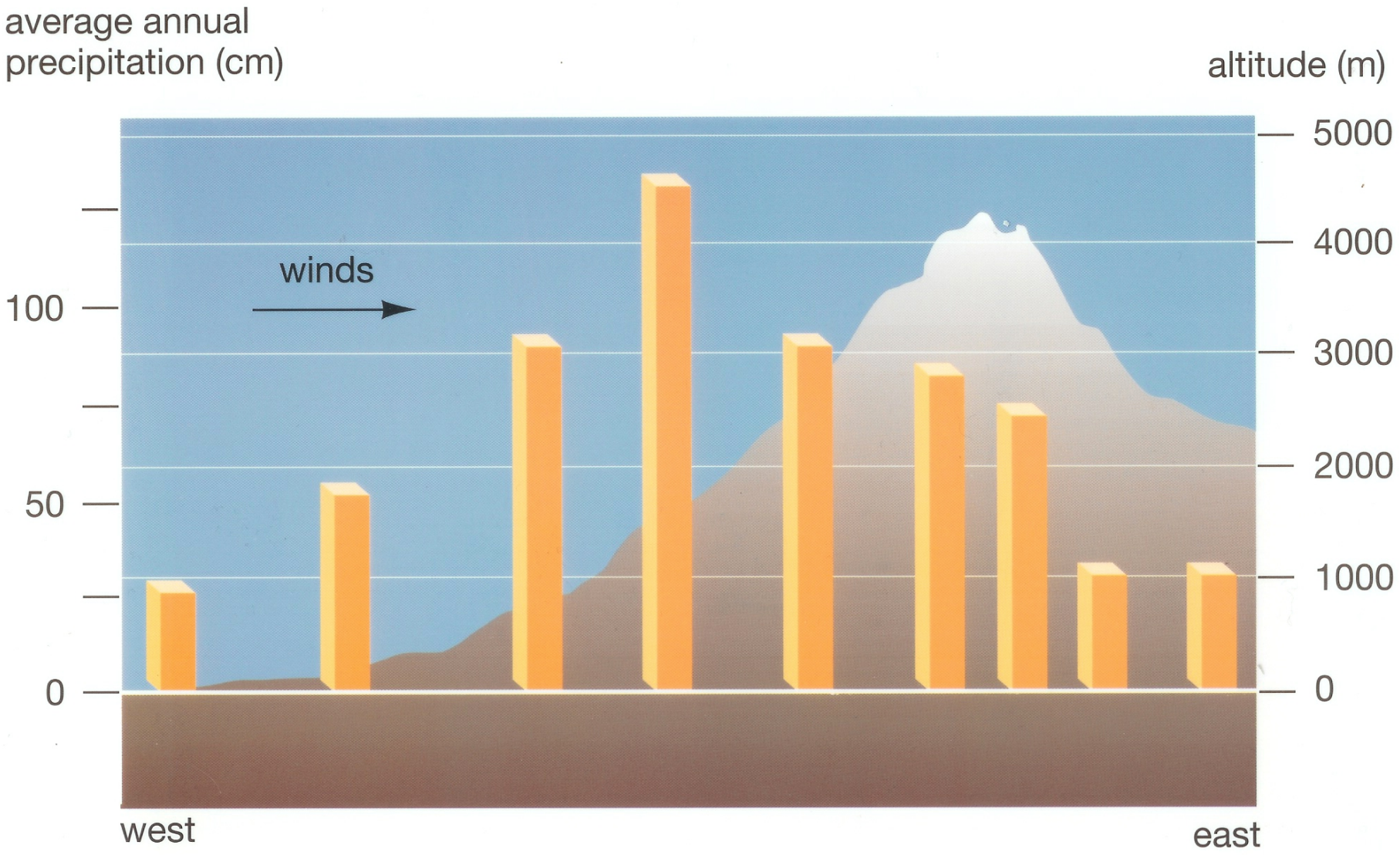
Topographical Effects

- Really, there are three major effects topographical features exert on local communities
- **Slope** – both in terms of anchoring in or on the substrate and the amount of available water
- **Exposure** – by this we mean north or south facing slopes (and others)
- **Elevational** effects – overall height of land

Effects of Elevation on Temperature



The Rain Shadow of the Sierra Nevada



Now, the effects of substrate type

- The underlying bedrock significantly influences community development, generally on a local scale, but sometimes in general ways
- It is not only consideration of the type of parent rock, but also the maturity or depositional nature of the substrate
- That is, particle size and type, e.g.

Particle type	Size
Clay	<0.002 mm
Silt	0.002-0.05 mm
Sand	0.05-2.0 mm

What is the water-holding capacity of the different particle sizes in this diagram?

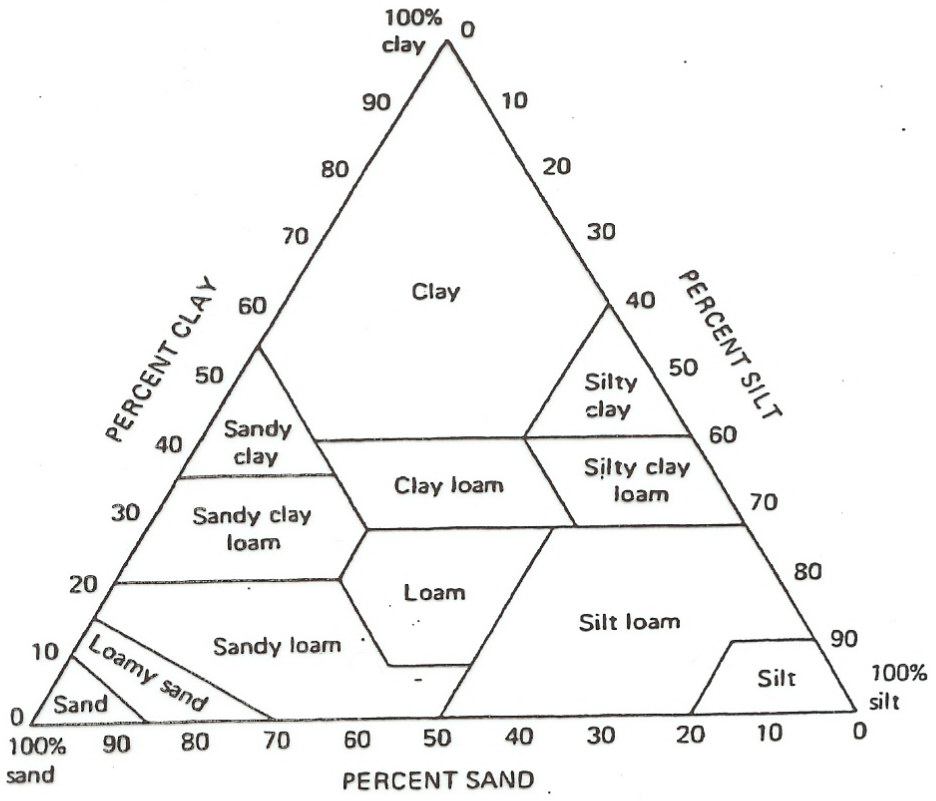


Figure 1. Particle size distribution

Something more detailed than biomes?

- Both the ecoregion designation and the ecological province delineation exhibit similar patterns of regions
- This is the most accurate way to define the various types of ecosystems and communities.
- This is not to be overly critical of the concept of biomes, but this contains much more information regarding the biota