- Discussion Section 1
- Homework 1 - due **9/15** - open book/notes
- Today: Biomes (chapter 3 of your book)
- Thursday: Temperature and water constraints on ecosystems

First, go to
www.menti.com

The Biosphere

Definition: The zone of life on earth

- Btw the lithosphere ~ Earths surface crust
  troposphere ~ lowest layer in atm.

Lifeforms: Plants, animals, fungi, microbes

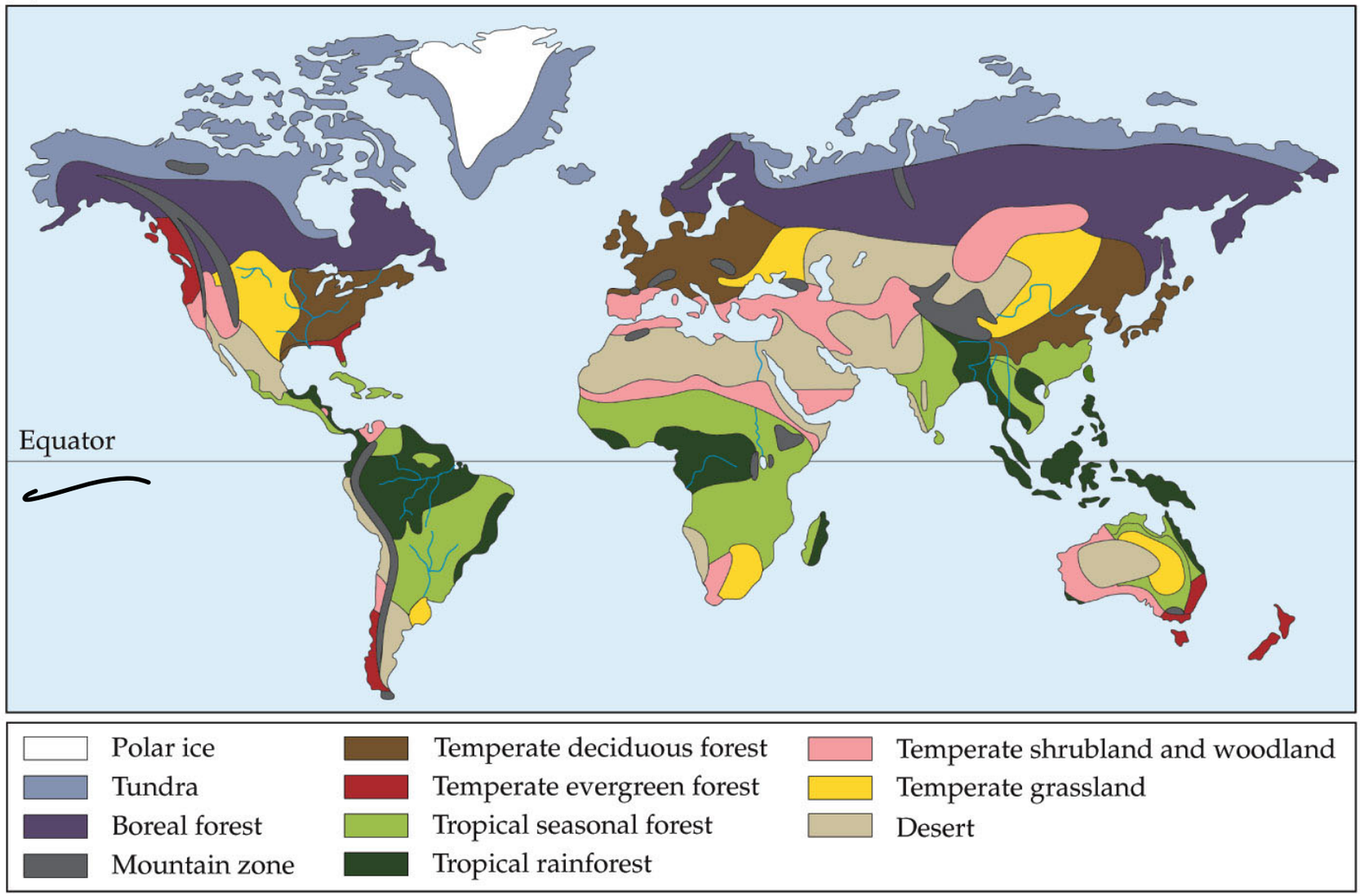
Deep Oceans → w/o sunlight

Autotrophs
/
Chemotrophs phototrophs

Heterotrophs

Deep biosphere → microbial

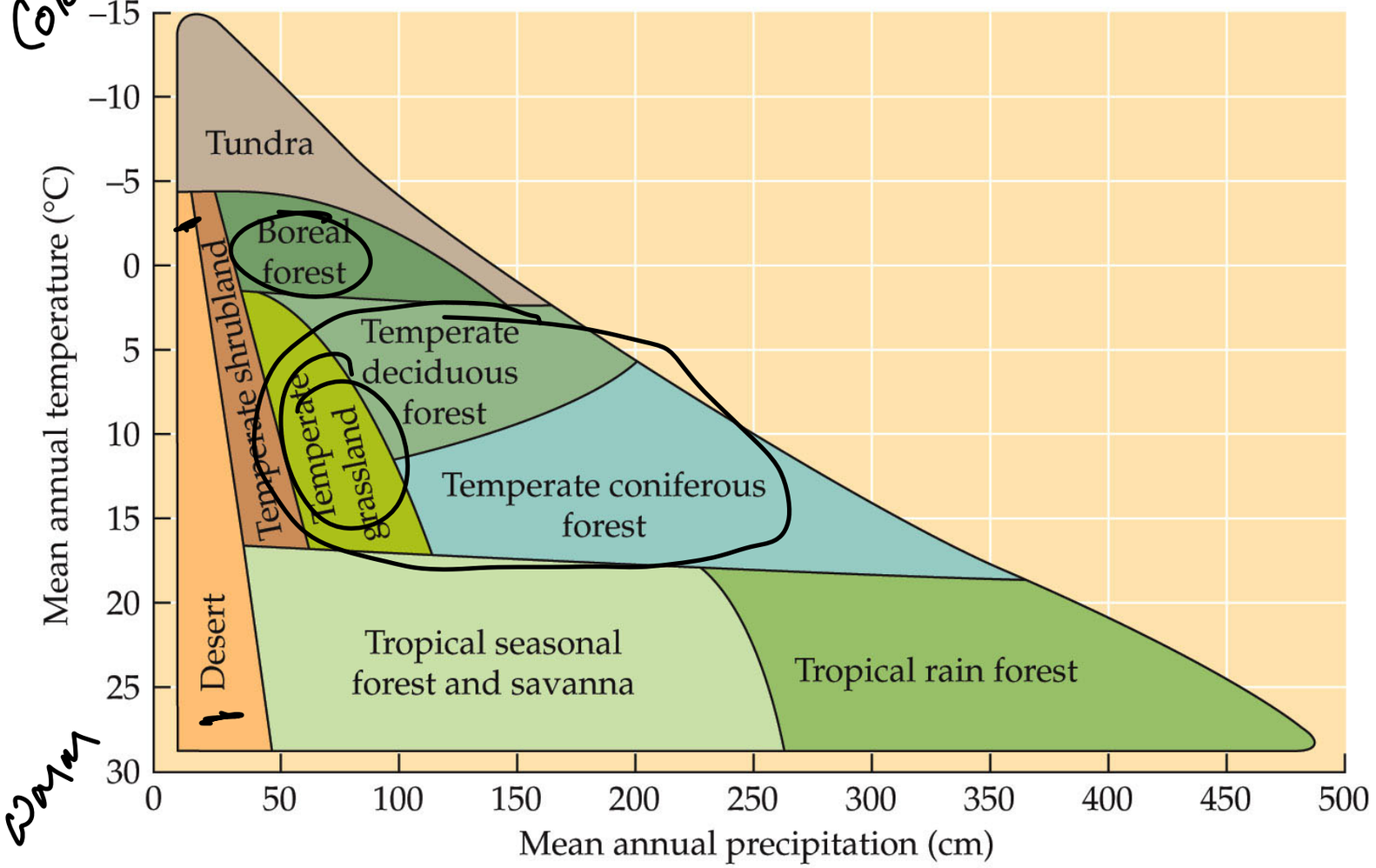
Terrestrial biomes → characterized by dominant vegetation
- good indicators of the physical environment



Terrestrial Biomes

Climatic zones: atmospheric and oceanic circulation patterns and the major determinants of the distribution of terrestrial biomes

Cold



Dry

Wet

Shaped by the physical environment

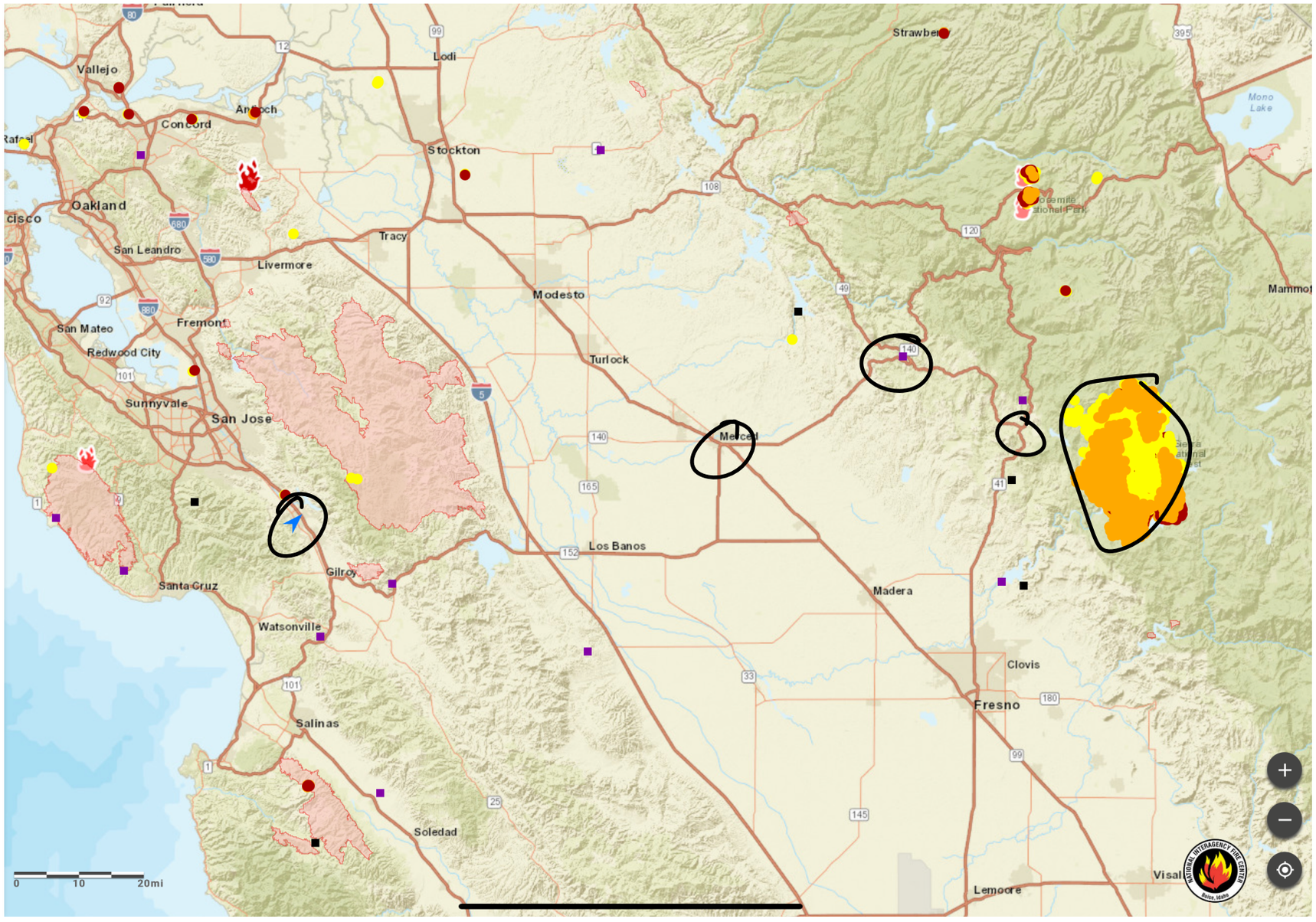
Types of selection pressures

- Aridity
- Temperature
- Solar radiation
- Grazing by animals
- Crowding by neighbors

Moist, seasonally warm/cool with fire

Temperature
Rainfall

Fire



The Global Extent and Determinants of Savanna and Forest as Alternative Biome States

A. Carla Staver,[1]* Sally Archibald,[2] Simon A. Levin[1]

Theoretically, fire–tree cover feedbacks can maintain savanna and forest as alternative stable states. However, the global extent of fire-driven discontinuities in tree cover is unknown, especially accounting for seasonality and soils. We use tree cover, climate, fire, and soils data sets to show that tree cover is globally discontinuous. Climate influences tree cover globally but, at intermediate rainfall (1000 to 2500 millimeters) with mild seasonality (less than 7 months), tree cover is bimodal, and only fire differentiates between savanna and forest. These may be alternative states over large areas, including parts of Amazonia and the Congo. Changes in biome distributions, whether at the cost of savanna (due to fragmentation) or forest (due to climate), will be neither smooth nor easily reversible.

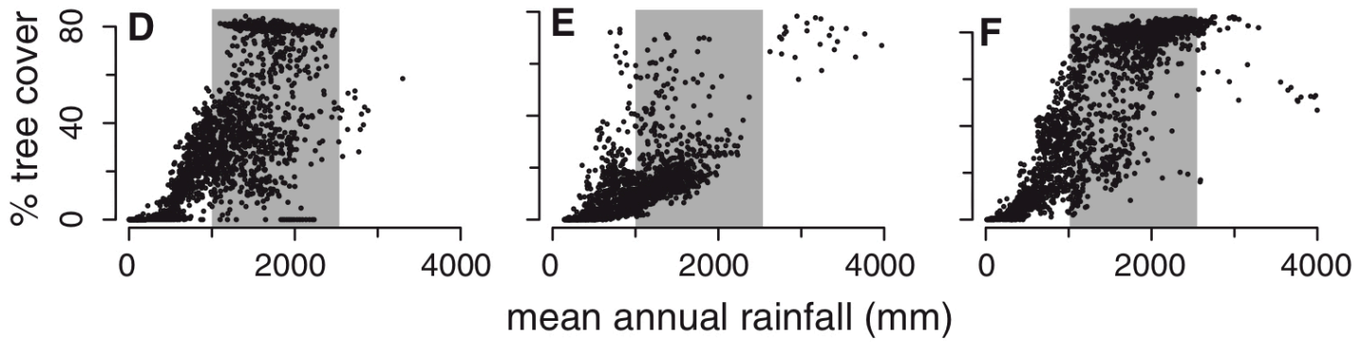


Fig. 1. Frequency distribution of tree cover (**A** to **C**) and relation of tree cover to mean annual rainfall (**D** to **F**). Gray zones denote intermediate rainfall [1000- to 2500-mm mean annual rainfall (MAR)].

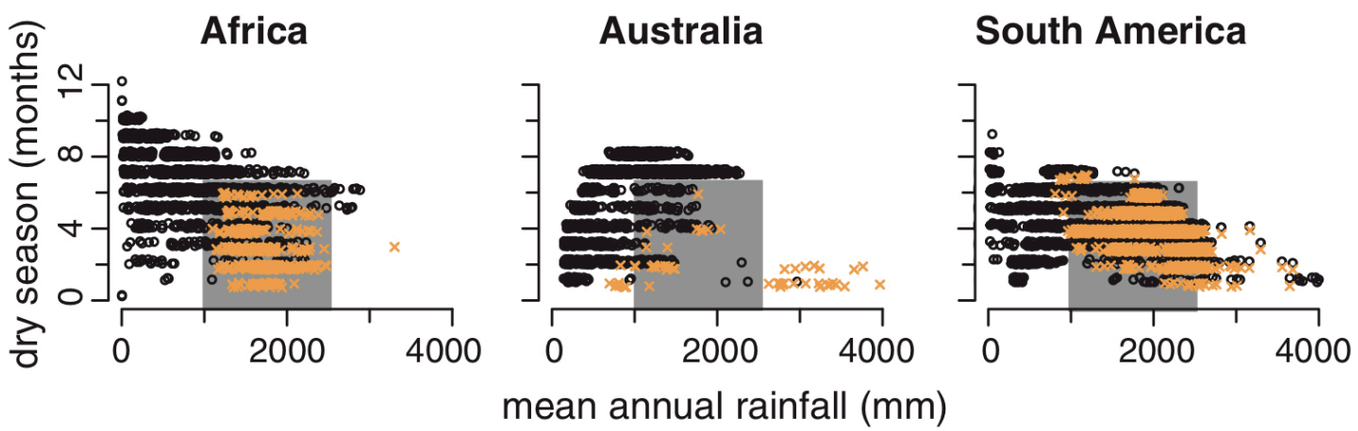


Fig. 2. Dry season length versus mean annual rainfall for areas with forest (>55% tree cover, yellow crosses) and savanna (≤55% tree cover, black circles). Gray zones denote intermediate rainfall (1000- to 2500-mm MAR) with mild seasonality (<7 months).

Mangroves

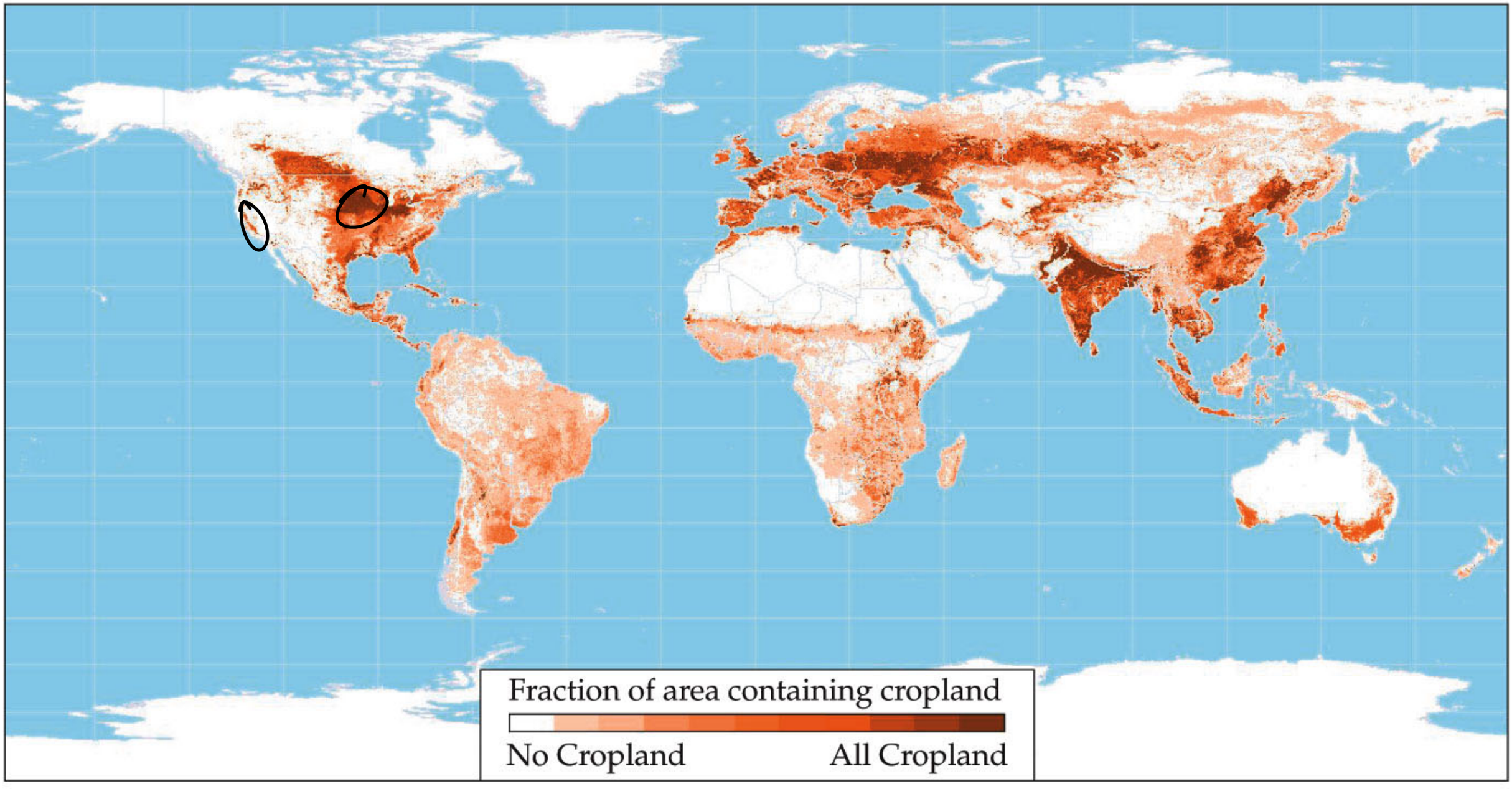
Australia

Not closely related to each other

Convergent evolution

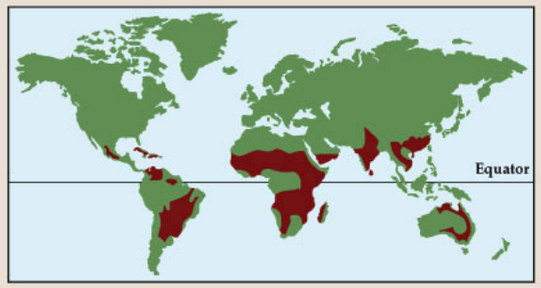
Belize (North America)

Effects of humans on landscapes

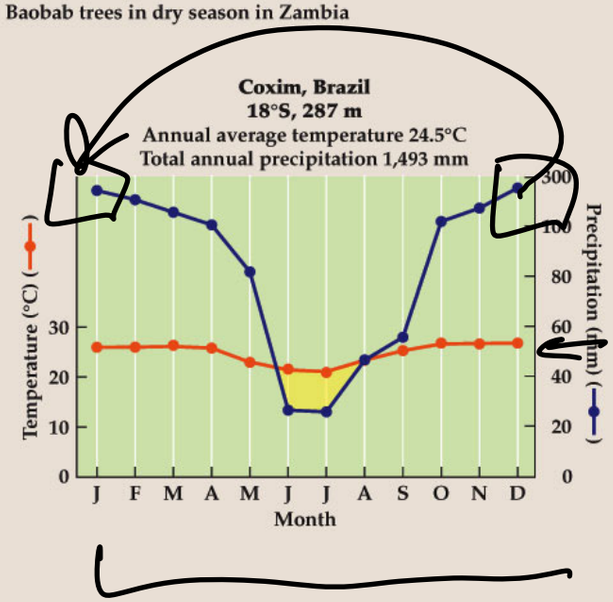


Tropical Seasonal Forests

Baobab trees in dry season in Zambia



Semi-evergreen forest of Pijio trees (*Cavanillesia platanifolia*) during the dry season, Cerro Blanco, Ecuador

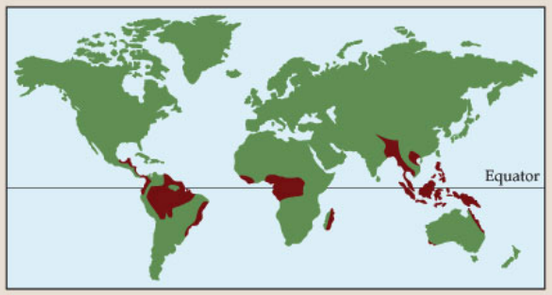


- Grassland/woodland savannas
- Fire adapted
- Wet/dry seasons
- Shorter trees
  - Deciduous
  - Evergreens
- grasses/shrubs

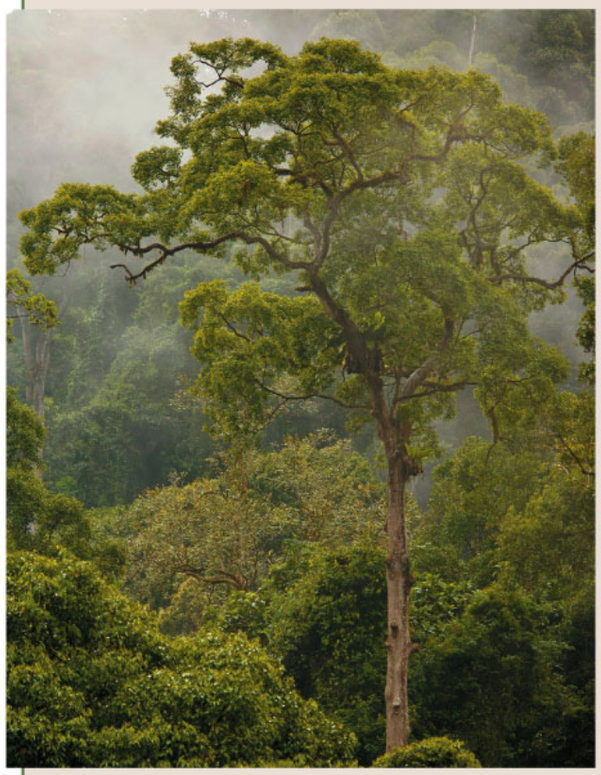
***ECOLOGY 2e*, Figure 3.B**

Tropical RainForests

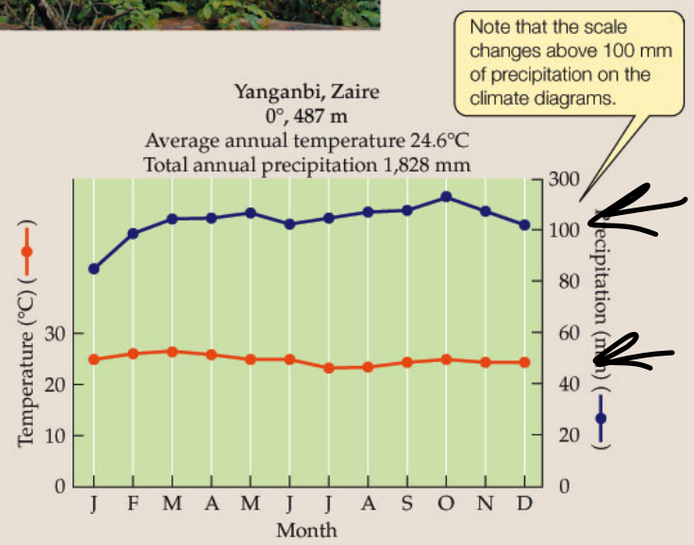
TROPICAL RAINFOREST



Lianas hanging down from canopy trees laden with epiphytes, above the well developed understory of smaller trees, shrubs, and forbs, Santa Elena Cloud Forest Reserve, Costa Rica



Emergent tree with epiphytes rises above the forest canopy, Borneo



***ECOLOGY 2e*, Figure 3.A**

> 200 cm annual precip.

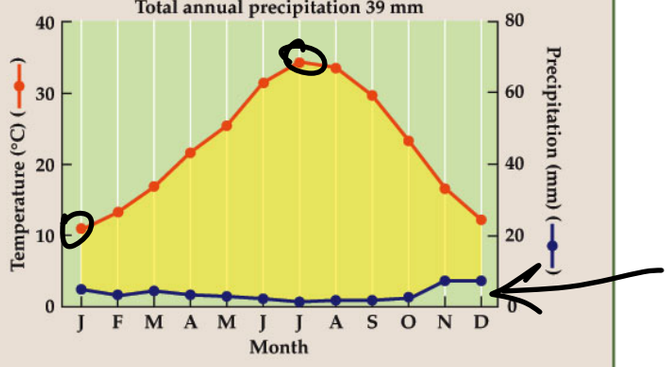
(Mexcod: 31 cm)

- little seasonality
- High biomass, high diversity
- Complex canopies
- Broad leaved evergreen and deciduous trees

Hot Deserts

Spring flowers in Goegap Nature Reserve, South Africa

Sonoran desert in bloom, Organ Pipe National Monument, Arizona



- sparse vegetation and animal populations
- Cacti in W. hemisphere
  Euphorbs in E. hemisphere
- Low abundance, high diversity still possible
- Bursts of activity after rainfall

***ECOLOGY 2e*, Figure 3.C**

North America

(A) Cactus

(B) Euphorb

Africa

***ECOLOGY 2e*, Figure 3.7**

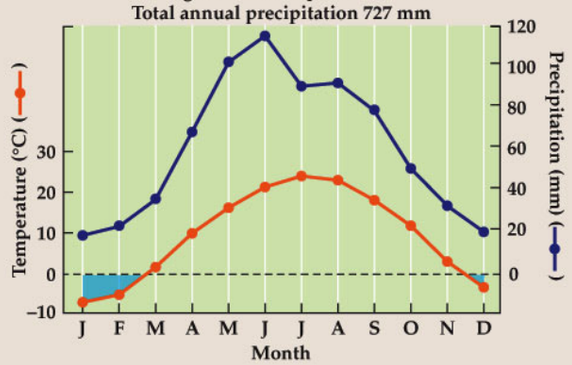
Cold Deserts

– Much less abundance and diversity : lichen

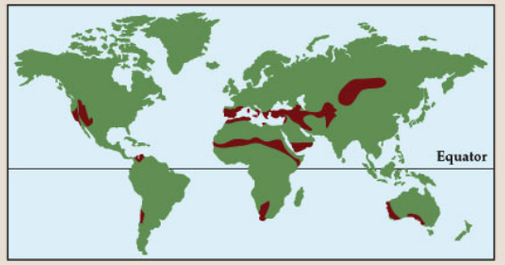
Temperate Grasslands

Sand Hills grasslands at Valentine National Wildlife Refuge, Nebraska, USA

Grassland with chamomile flowers, Altai Plateau, Russia

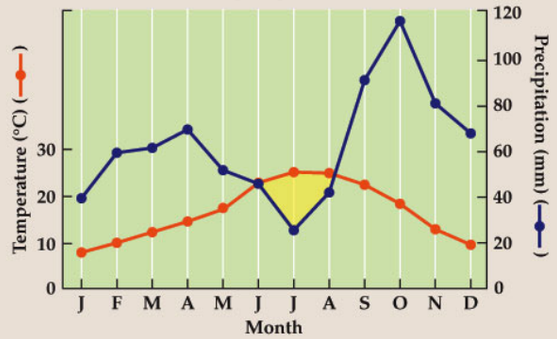


Temperate Shrublands & Woodlands



Shrubland on the coast of Western Australia

Fynbos landscape with everlastings (*Helichrysum* sp.), Cape Peninsula National Park, South Africa



***ECOLOGY 2e*, Figure 3.E**

Less than 1% of the European continent is considered ‘wild’

In comparison, 14% of the U.S. is federally protected wild land

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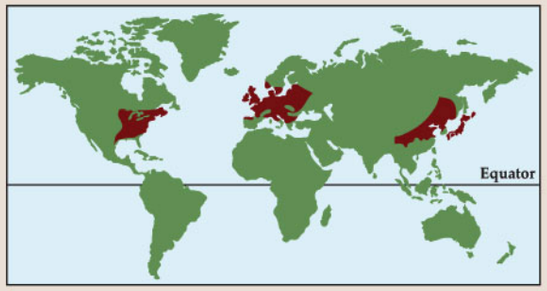
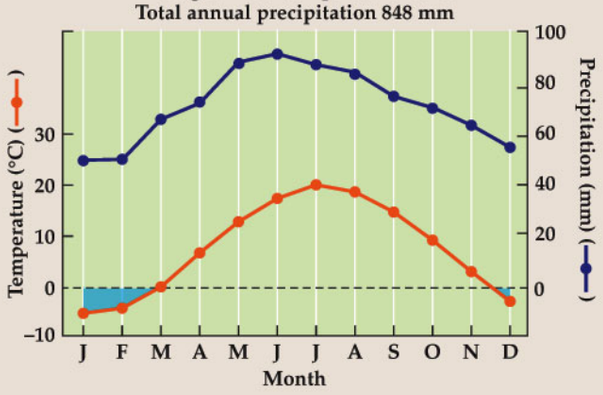
In comparison, 14% of the U.S. is federally protected wild land

Temperate Deciduous Forests

Autumn foliage prior to leaf fall, Great Smoky Mountains National Park, North Carolina, USA



Wellsboro, Pennsylvania, USA
41°N, 567 m
Average annual temperature 7.6°C
Total annual precipitation 848 mm

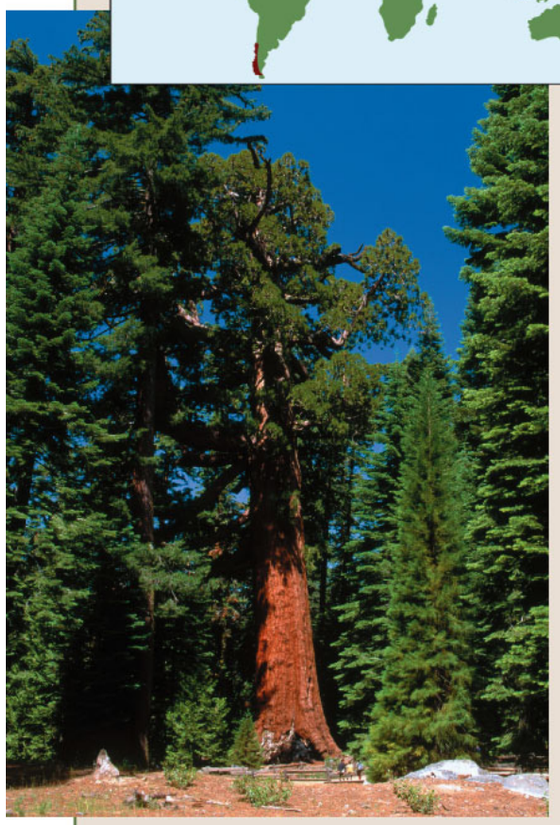


Beech forest in summer, Japan

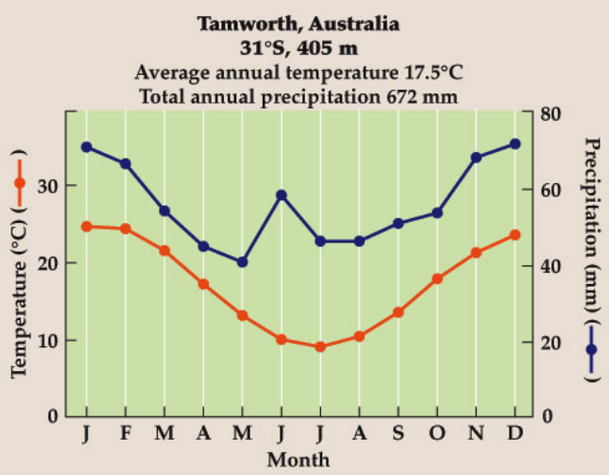
***ECOLOGY 2e*, Figure 3.F**

Temperate evergreen forests

Araucaria (monkey puzzle tree) forest, Lanin National Park, Argentina



Grove of giant sequoias (*Sequoiadendron giganteum*), with Douglas fir (*Pseudotsuga menziesii*), Mariposa Grove, Yosemite National Park, California

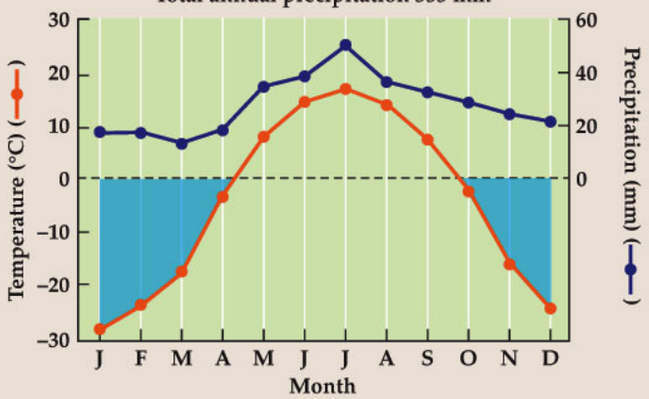


***ECOLOGY 2e*, Figure 3.G**

Boreal forests

Spruce trees in autumn, Denali National Park, Alaska

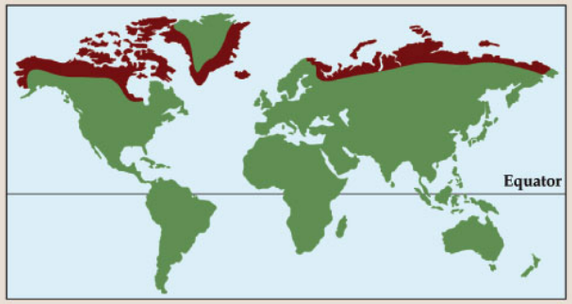
Fort Simpson, Northwest Territories, Canada
61°N, 169 m
Average annual temperature –4.6°C
Total annual precipitation 333 mm



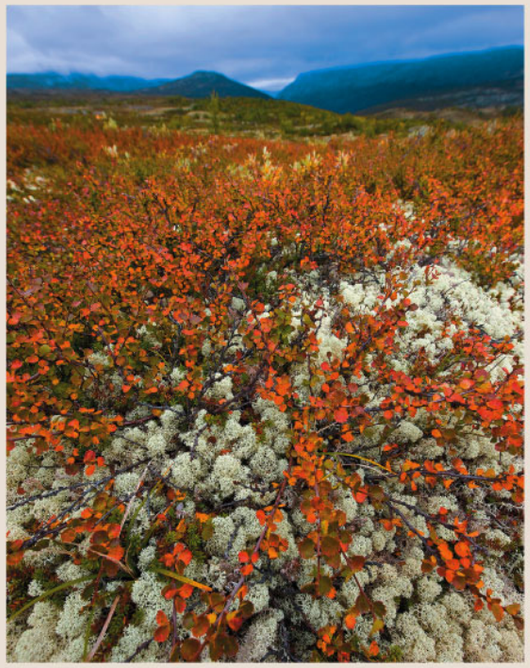
Spruce (*Picea abies*) and silver birch (*Betula verrucosa*) along the Kitkajoki River, Oulanka National Park, Finland

***ECOLOGY 2e*, Figure 3.H**

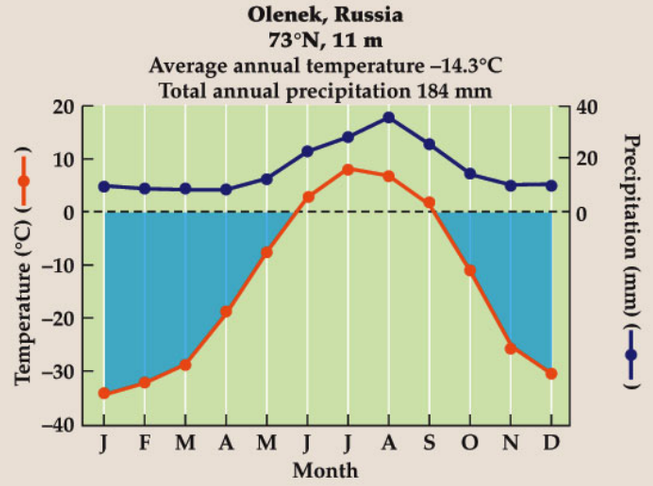
Tundra



Looking out to the Arctic plain at midnight from the northern edge of the Brooks Range, Alaska



Arctic tundra in early autumn color, Dovrefjell-Sunndalsfjella National Park, Norway



***ECOLOGY 2e*, Figure 3.I**