The biomes of the world

There are many terrestrial biomes on Earth

Climograph for North American Biomes
Tundra

~ 7% of the terrestrial biosphere

Two types of tundra

• Arctic
  
  Climate & Location

Soils

Not Found in S. Hemisphere
Dominant Soil Order is: Gelisol

Gelisol
Presence of permafrost or soil temperature of 0°C or less within 2 meters of the surface; formed through the process of gleization.

Wet conditions slow decay allowing organic matter to accumulate and organic acids to be released. Organic acids react with iron to give a black/bluish-gray color.

Permafrost

Patterned Ground
Patterned Ground

Vegetation

Productivity is low (ca. 103 g C m⁻² yr⁻¹)
2% of total terrestrial productivity on Earth

Arctic tundra

Animals

Year round –

Winter –

Migrants –

Essentially no reptiles & amphibians

Why???
May have large oscillations in population size

Brown Lemmings

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Changes in Latitude
Changes in Altitude

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Alpine tundra
Communities similar to arctic tundra
However:
Human Impacts

Boreal Forest

~15% of terrestrial biosphere

• Boreal Forest
  Climate & Location

Soils
Spodosols are a common soil order

Spodosol

Light gray, whitish surface horizon on top of black or reddish B horizon; high in extractable iron and aluminum; formed through process of podzolization.

Soil solution of organic acids enhance leaching of iron and aluminum from the topsoil creating a sublayer composed of sand (white to gray in color). Leached materials deposited deeper in the soil forming the spodic horizon.

Boreal Forest

Vegetation

Productivity is low (ca. 216 g C m\(^{-2}\) yr\(^{-1}\))
8% of total terrestrial NPP on Earth

Sunken Stomate
Lectures 11-13

**Boreal Forest**

*Animals*
- Herbivores –
- Predators –

Sunken Stomate
Human Impacts

Temperate Deciduous Forest

~11% of terrestrial biosphere

Temperate Deciduous Forest

Climate & Location

Soils
Alfisols, Inceptisols, & Ultisols are common soil orders

**Alfisols**
Shallow penetration of humus; translocation of clay; well-developed horizons.

*Leaching of clays from the topsoil and into the subsoil.*

**Inceptisols** are young soils that are weakly developed.

**Ultisols** are older soils that have been intensely leached creating cation poor, acidic, and clay & iron enriched subsoils.

Temperate Deciduous Forest

**Vegetation**

Productivity is high (ca. 638 g C m⁻² yr⁻¹)
17% of total terrestrial productivity on Earth

Temperate Deciduous Forest

**Animals**
Greater variety

Characteristic mammals

Many birds & insects
Adapted to seasonality

Amphibians & reptiles are present
Temperate forests have been strongly influenced by human activities.
Tropical Forests

~23% of terrestrial biosphere

Climate & Location

Three Types

- Tropical Thorn Forest
  Pronounced dry season; thorny shrubs & trees; found in S. America, S. Africa, & India; little rainfall

- Tropical Deciduous Forest
  Distinct wet & dry seasons; found in Central America, S. America, India, & Asia
Tropical Rain Forests

Climate & Location

Tropical Rain Forest Soils

Oxisols are a common soil order

Oxisol
Highly weathered soils with nearly featureless profile; red, yellow or gray; rich in kaolinite, iron oxides, and often humus; in tropics and subtropics.
The Forest Floor in Two Different Biomes

From Smil 2001 Cycles of Life pg 56

Tropical Rain Forests

Vegetation

Highest productivity (ca. 911 g C m⁻² yr⁻¹)
36% of total terrestrial productivity on Earth

If you consider all types of tropical forests,
then they account for 49% !!!
Tropical Rain Forests

Animals
The Challenge of Research in the Canopy

Deforestation in Rondonia State, Brazil

1975 1986 1992

Deforestation in Brazilian Amazonia

Deforestation in the Brazilian Amazon, 1988-2010

State of Maryland per year
Worldwide Tropical Deforestation

- Tropical deforestation rates, 2000-2005

  - ~15,000 per year
  - State of Montana

State of Montana

Grassland

- ~7% of terrestrial biosphere
Grasslands

Climate & Location
Many names depending on location:

Amount of rainfall effects the height of the grass

wet (75 cm) =\rightarrow (40 cm) =\rightarrow (25 cm)
Tall (2m) Short (0.5 m) Bunch grass

Temperate Grassland Soils

- Thick mat of roots & rhizomes
- High organic matter => 19.2 kg C m$^{-2}$
- Dominant soil order = Mollisols

Mollisol
Surface horizons dark brown to black with soft consistency; rich in bases; soils of semi-humid regions; prone to the process of calcification.

Characteristically form under grass in climates with strong seasonal dry periods.

Fairly high in organic matter.
Grasslands

Vegetation

Productivity is low (ca. 266 g C m$^2$ yr$^{-1}$)
4% of total terrestrial productivity on Earth

Animals
Lectures 11-13

Changes in the range of Bison

Deserts

~20% of terrestrial biosphere
Deserts & arid lands

Climate & Location

Desert Soils

Caliche

Aridisols are a common soil order

Aridisol

Develop in very dry environments; low in organic matter; high in base content; prone to the process of salinization.

Often accumulate calcium carbonate, gypsum, salt, & other easily leached minerals in the subsoil.
**Deserts**

*Vegetation*

Adaptations to conserve water

Lowest productivity ca. 95 g C m\(^{-2}\) yr\(^{-1}\)  
5% of total terrestrial productivity on Earth

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**Saguaro Cactus**  
**Desert in Bloom**

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**Ocotillo**
Creosote Bush
(growing for ca. 11,000 years?)

Prosopis juliflora (honey mesquite)

Deserts

Animals

Adaptations to conserve moisture & keep cool
Extreme environments, such as deserts, often contain examples of *convergent evolution.*

*Convergent Evolution* -
Convergent Evolution

- Sahara Fennec
- American Kit fox
- Saharan Jerboa
- Kangaroo rat
- Namib Sidewinder
- American Sidewinder