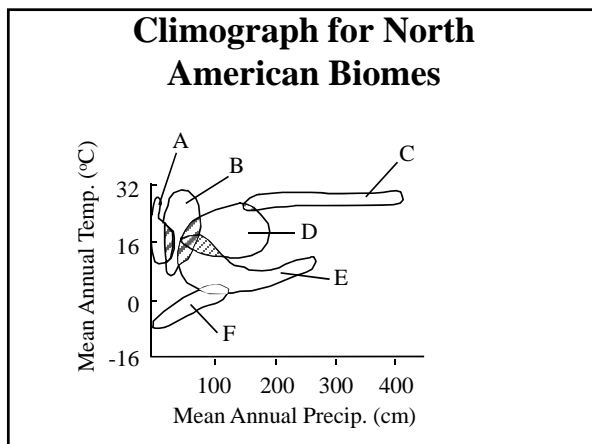


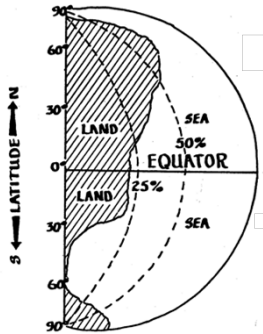
Biomes

Biome -

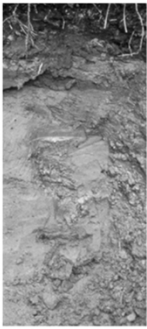
There are many terrestrial biomes on Earth



Not Found in S. Hemisphere



Dominant Soil Order is: Gelisol



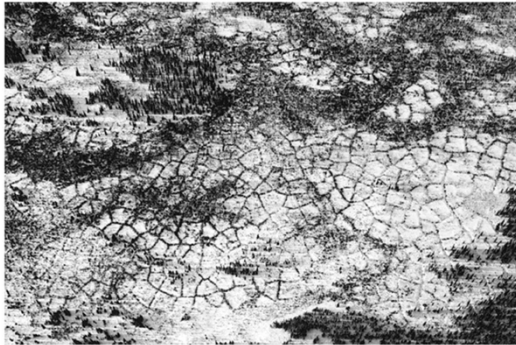
Gelisol

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.



Patterned Ground



Arctic tundra

Vegetation

Productivity is low (ca. $103 \text{ g C m}^{-2} \text{ yr}^{-1}$)
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

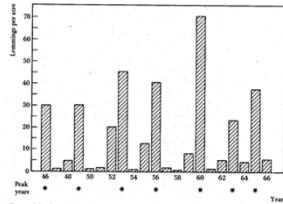


Figure 2.7 Population densities in summer of brown lemming (*Lemmus sibiricus*) at Point Barrow, Alaska. (After Schultz 1969)

Changes in Latitude Changes in Altitude

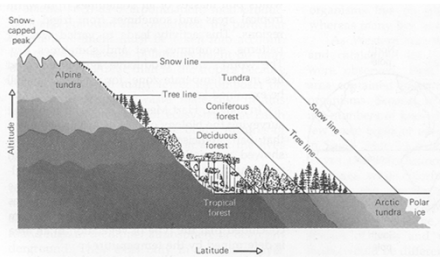


Figure 7-3 Vegetation changes with latitude and altitude. Temperature, which affects vegetation, falls as one travels up a mountain or away from the Equator, so that if there is plenty of moisture, vegetation is similar at high altitudes and at high latitudes as shown here.

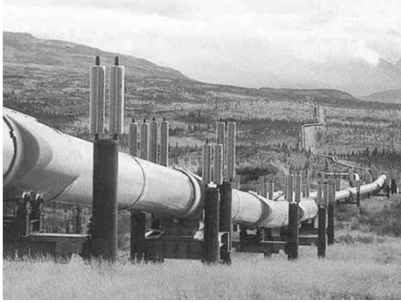
Alpine tundra

Communities similar to arctic tundra

However:



Human Impacts



Boreal Forest

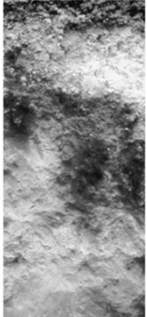


~15% of terrestrial biosphere

- Boreal Forest
Climate & Location

Soils

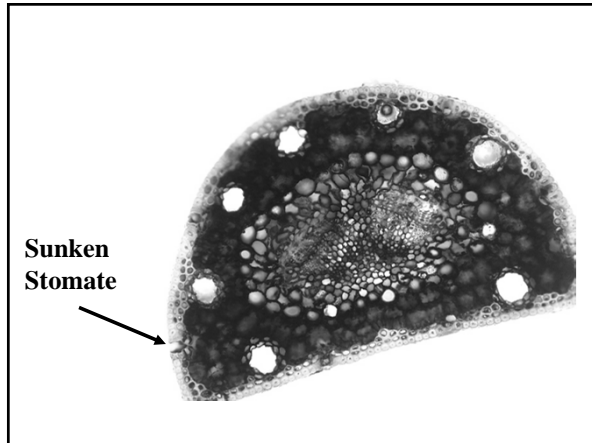
Spodosols are a common soil order



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.



Sunken Stomate

Boreal Forest

Animals



Boreal Forest

Animals

herbivores –

predators -



Boreal Forest

Animals

summer - abundant biting insects, migrant birds which nest (owls, redwings, thrushes, warblers)

few reptiles & amphibians



Human Impacts



Temperate Deciduous Forest

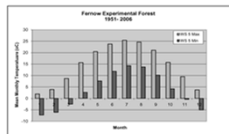
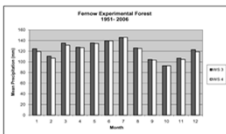


~11% of terrestrial biosphere

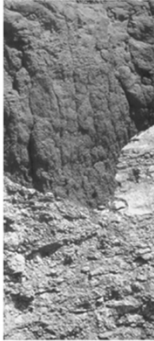
Temperate Deciduous Forest

Climate & Location

Soils



**Alfisols, Inceptisols, & Ultisols
are a common soil orders**



Alfisol

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. $638 \text{ g C m}^{-2} \text{ yr}^{-1}$)
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

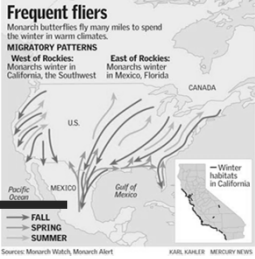
Monarch Butterflies



Frequent fliers
Monarch butterflies fly many miles to spend the winter in warm climates.


MIGRATORY PATTERNS

West of Rockies:	East of Rockies:
Monarchs winter in California, the Southwest	Monarchs winter in Mexico, Florida




Sources: Monarch Watch, Monarch Alert
KARL KAHLER MERRILL NEWS


“Light sleeper”




True Hibernator



Gray Tree Frog



Unfrozen

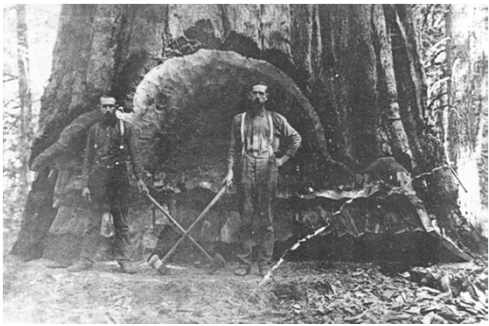


Frozen

Temperate forests have been strongly influenced by human activities.



**Nicholas County, WV
ca. 1920**



Tropical Forests



~23% of terrestrial biosphere

Tropical Forests

Climate & Location

Three Types

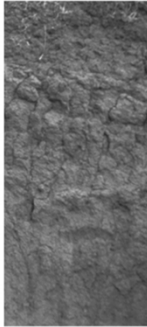
- Tropical Thorn Forest
Pronounced dry season; thorny shrubs & trees; found in S. America, S. Africa, & India; little rainfall
- Tropical Deciduous Forest
Distinct wet & dry seasons; found in Central America, S. America, India, & Asia

Tropical Rain Forests

Climate & Location

Tropical Rain Forest Soils

Oxisols are a common soil order



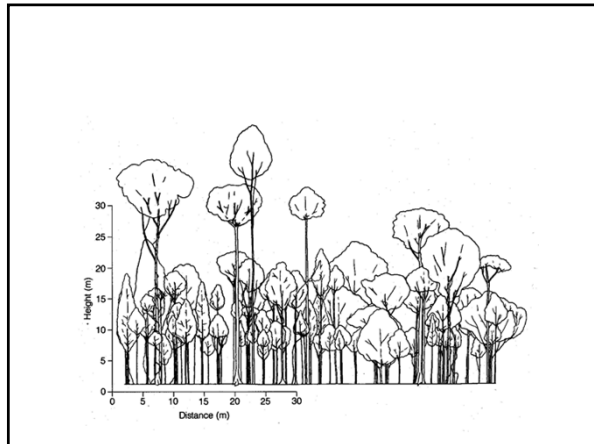
Oxisol

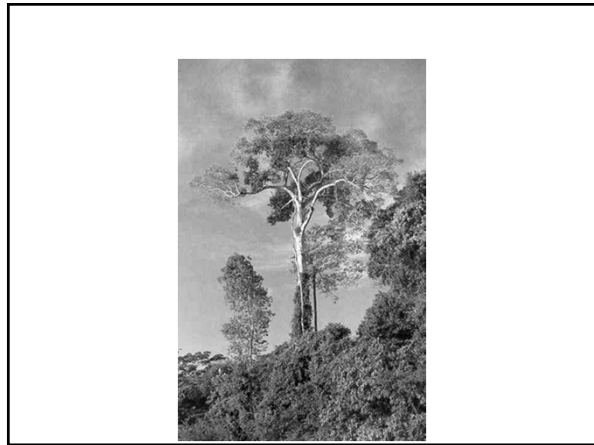
Highly weathered soils with nearly featureless profile; red, yellow or gray; rich in kaolinite, iron oxides, and often humus; in tropics and subtropics.

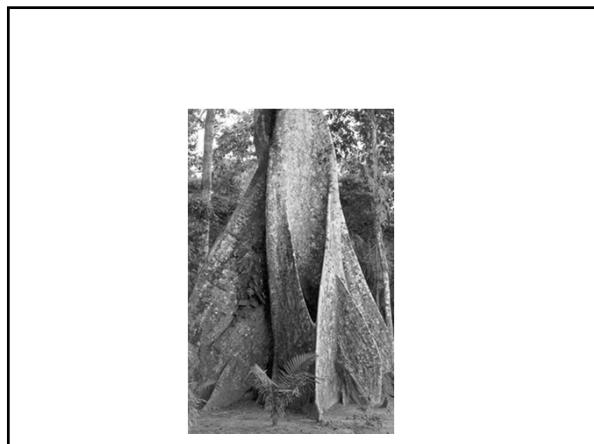
Tropical Rain Forests

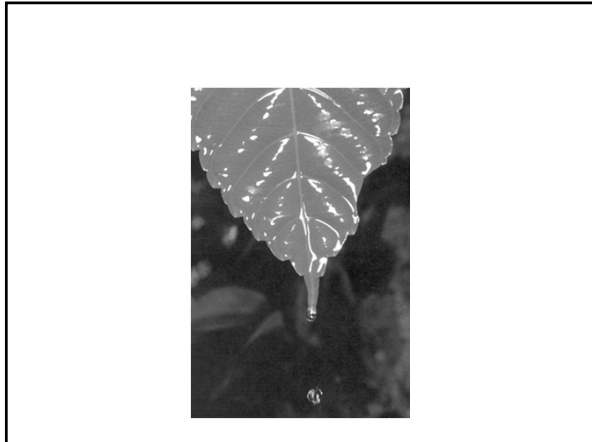
Vegetation

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% !!!







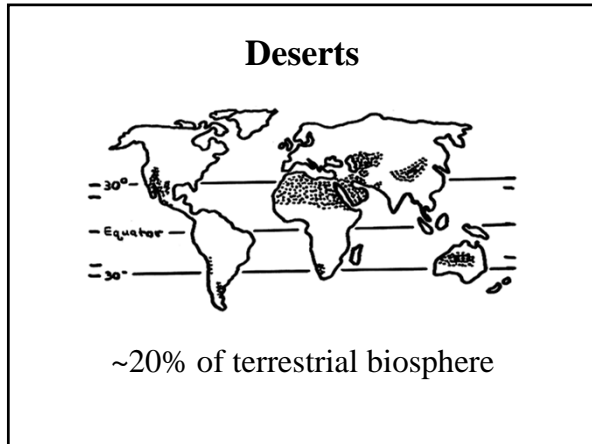


Tropical Rain Forests

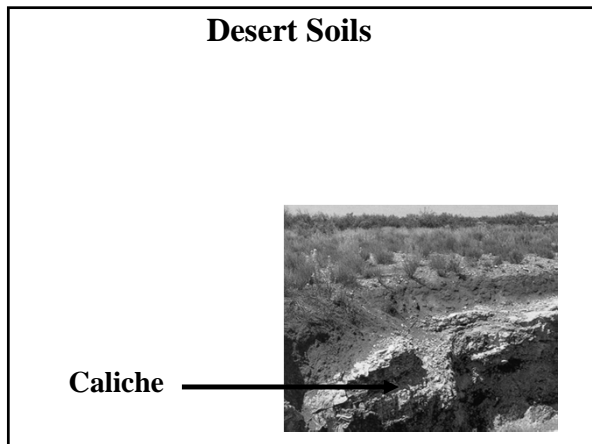
Animals

The Challenge of Research in the Canopy

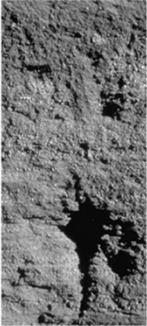
A collage of four black and white photographs illustrating canopy research. The top-left photo shows a dense forest canopy. The top-right photo shows a canopy walkway with a person. The bottom-left photo shows a researcher in a basket. The bottom-right photo shows a canopy crane.



Deserts & arid lands
Climate & Location



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. $95 \text{ g C m}^{-2} \text{ yr}^{-1}$
5% of total terrestrial productivity on Earth

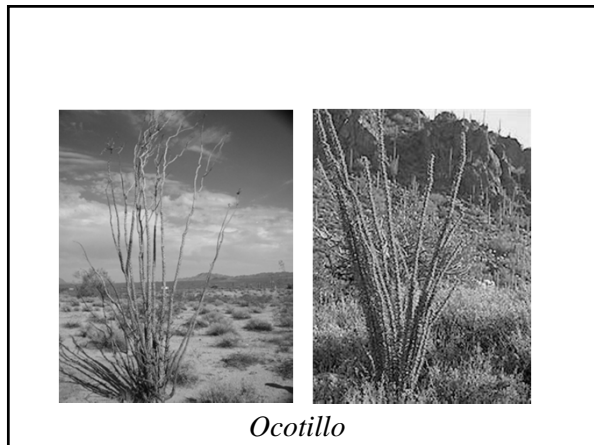
Saguaro Cactus



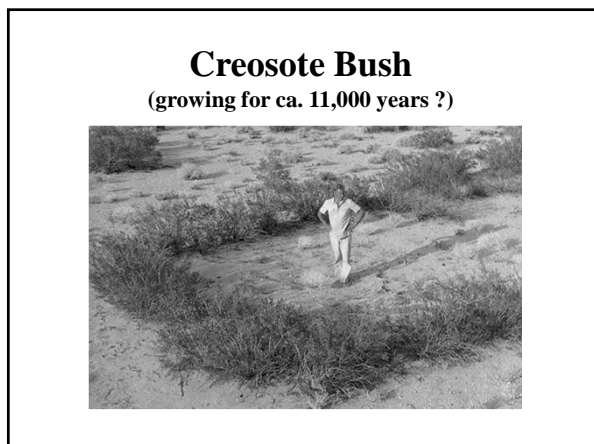
Desert in Bloom







Ocotillo





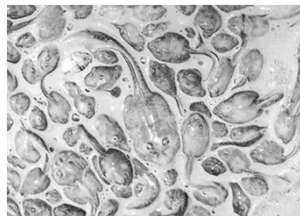
Prosopis juliflora (honey mesquite)

Deserts

Animals

Adaptations to conserve moisture & keep cool

Spadefoot Toad



The Camel's Hump

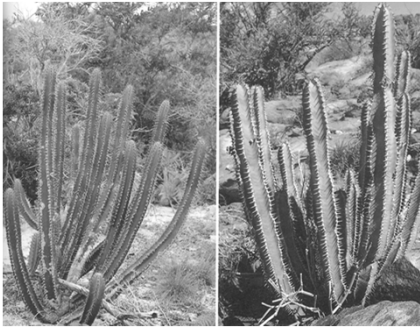
Is not filled with water! Rather ectopic fat storage.



Convergent Evolution

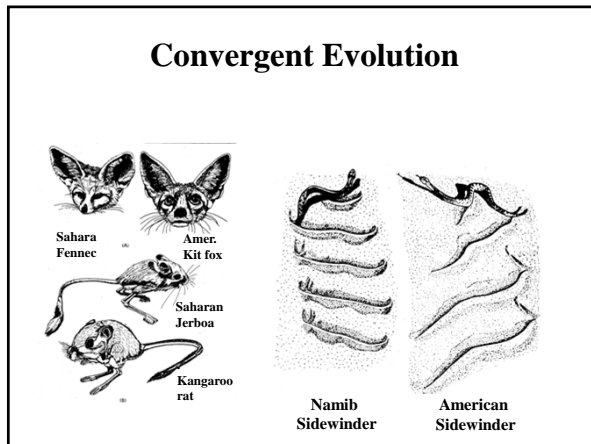
American Cacti

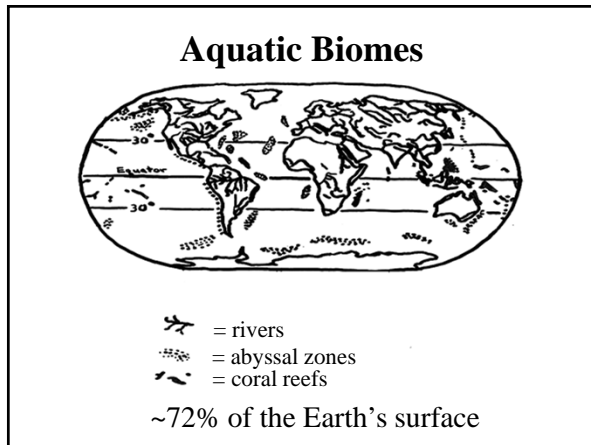
African Euphorbias



Extreme environments, such as deserts, often contain examples of convergent evolution.

Convergent Evolution -





Terrestrial vs Aquatic Biomes

	<u>Terrestrial</u>	<u>Aquatic</u>
Buoyancy		
Viscosity		
Temperature		
Autotrophs		
Oxygen		
Limits to NPP		

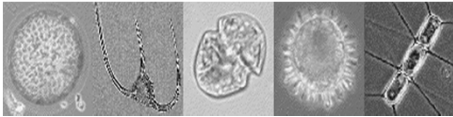
Consequences of living in water

- High buoyancy
- High viscosity
- Constancy of temperature
- Autotrophs are

Three categories of aquatic organisms

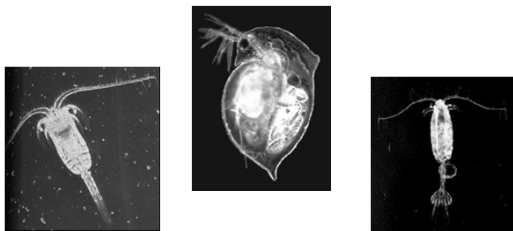
- Plankton –

Phytoplankton -



- Plankton –

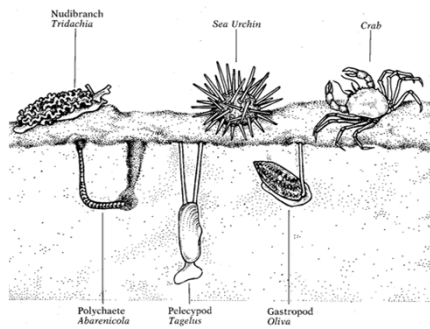
Zooplankton -



• Nekton -

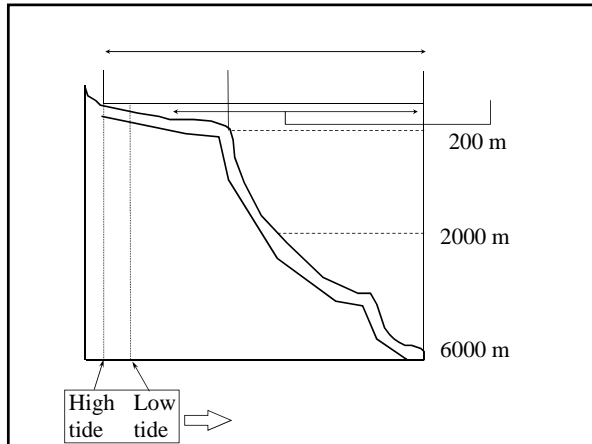


• Benthos -



Marine habitats are classified on the basis of :

- Depth & the distance from the shore.
- Open water or bottom.
- The ability of light to penetrate.



Ocean Biome

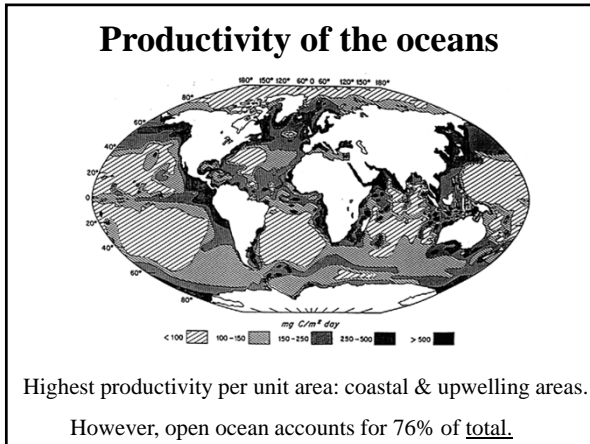
Intertidal - stressful

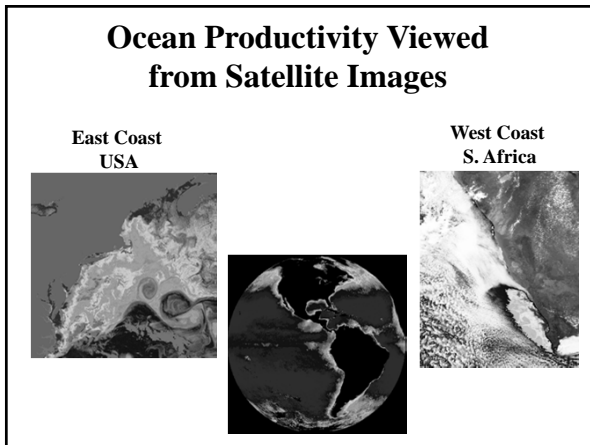
Neritic - highly productive WHY???

Oceanic - ~ 88% of ocean

Creatures from the Abyss

The block contains two black and white photographs of deep-sea creatures. The top image shows a bioluminescent fish, possibly a lanternfish, with a glowing light on its head. The bottom image shows a spiny creature, possibly a brittle star or brittle sea star, with many long, thin spines radiating from its central disk.





Biomes Provide a Useful Classification For Global Estimates

Ecosystem	Area (10 ⁶ m ²)	Mean plant biomass (kg C/m ²)	Carbon in vegetation (10 ¹⁶ g)	Mean net primary production (g C/m ² /yr)	Net primary productivity (10 ¹⁶ g/yr)
Tropical wet and moist forest	10.4	15	156.0	800	8.3
Tropical dry forest	7.7	6.5	49.7	620	4.8
Temperate forest	9.2	8	73.3	650	6.0
Boreal forest	15.0	9.5	143.0	430	6.4
Tropical woodland and savanna	24.6	2	48.8	450	11.1
Temperate steppe	15.1	3	43.8	320	4.9
Desert	18.2	0.3	5.9	80	1.4
Tundra	11.0	0.8	9.0	130	1.4
Wetland	2.9	2.7	7.8	1500	3.8
Cultivated land	15.9	1.4	21.5	760	12.1
Rock and ice	15.2	0	0.0	0	0.0
Global total	145.2	0	558.8	0	60.2

* From Houghton and Skole (1990).
