Global Biogeography

- Natural Vegetation
- Structure and Life-Forms of Plants
- Terrestrial Ecosystems-The Biomes
Natural Vegetation

natural vegetation is the plant cover that develops with little or no human interference.

human-influenced vegetation is modified by human activities, e.g. farming, forestry, urbanization, etc.
Basic Plant Types
Trees

trees are large, woody perennial (their woody tissues endure from year to year) plants with a single upright main trunk, and the majority of branching in the upper crown.
Shrubs are small woody perennial plants that have several stems branching from a base near the soil surface, so as to place the mass of foliage close to ground level.
SPRING & SUMMER
FLOWERING SHRUBS

Kalmia latifolia 'Olympic Fire'
Kalmia latifolia 'Elf'
Kalmia latifolia 'Minuet'
Kalmia latifolia 'Kaleidoscope'
Kalmia latifolia 'Heart of Fire'
Physocarpus opulifolius 'Darrel's Gold'
Hydrangea macrophylla 'Glowing Embers'
Forsythia x intermedia 'Lynwood Gold'
Ittea virginica 'Henry’s Garnet'
Chaenomeles 'Cameo'
Chaenomeles 'Iwat Nishiki'
Chaenomeles 'Jet Trail'
Spiraea japonica 'Shirobana'
Viburnum davidii
Viburnum plicatum
Viburnum plicatum 'car. tomentosum' 'Pink Sensation'
Calluna vulgaris 'Dark Beauty'
Calycanthus floridus

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Lianas (vines) are also woody plants, but they take the form of vines supported on trees and shrubs.

Figure 9.1, p. 333
Herbaceous plants (herbs)

*Herbs* lack woody stems and so are usually small, tender plants; occur in a wide range of shapes and leaf types (broad and narrow leaved); some are *annuals*, living only for a single season—while others are *perennials*; usually form a low layer as compared with shrubs and trees.

Figure 9.1, p. 333
**Lichens and Moss**

*Lichens* are another life-form occupying a layer close to the ground (plant forms in which algae and fungi live together to form a single plant structure) **symbiosis**
Life Cycle of a Typical Moss

**Fertilization**
- Sperm
- Antheridium
- Archeognial head
- Venter
- Egg cell
- Neck canal

**Mature Gametophytes**
- Non-vascular "leaves"
- Non-vascular "stem"
- Male
- Female
- Rhizoids
- Spore case
- Bud
- Protonema
- Rhizoid
- Meiospores (spores)
- Young gametophyte
- Operculum
- Capsule
- Calyptra
- Spore case
- Rhizoid
- Bud

**Meiosis**

**Sporophyte**
- Early embryo
- Calyptra
- Developing calyptra
- Venter wall
- Capsule
- Enlarged venter wall
- Seta
- Foot
Layers
Terrestrial ecosystems are controlled by climate (temperature and precipitation) and geography (marine vs continental, highlands vs lowlands)

A biome is the total assemblage of plant and animal life in an area
Terrestrial Ecosystems - The Biomes

Five principal biomes: forest, grassland, savanna, desert, and tundra.

Formation classes are subdivisions of biomes based on vegetation structure and life-form.
Terrestrial Ecosystems - The Biomes
But first,

What type of projection is this, and why is it used?
six major types of **forest biome**:

- Tropical and Equatorial (low latitude) rainforest
- Monsoon forest
- Subtropical evergreen forest
- Temperate (Midlatitude) deciduous forest
- Needleleaf forest (Evergreen)
- Schlerophyll forest
The Low Latitude Rainforest

- found in the equatorial and tropical zone

- continuously warm temperatures with consistent abundant rainfall

- a forest of tall, closely set trees with multilayered canopy

- the largest diversity of species of any life zone
Tropical and Equatorial Rain Forests
Tropical forests are characterized by the greatest diversity of species. They occur near the equator, within the area bounded by latitudes 23.5 degrees N and 23.5 degrees S. One of the major characteristics of tropical forests is their distinct seasonality: winter is absent, and only two seasons are present (rainy and dry). The length of daylight is 12 hours and varies little.

1. Temperature is on average 20-25° C and varies little throughout the year: the average temperatures of the three warmest and three coldest months do not differ by more than 5 degrees.
2. Precipitation is evenly distributed throughout the year, with annual rainfall exceeding 2000 mm.
3. Soil is nutrient-poor and acidic. Decomposition is rapid and soils are subject to heavy leaching.
4. Canopy in tropical forests is multilayered and continuous, allowing little light penetration.
5. Flora is highly diverse: one square kilometer may contain as many as 100 different tree species. Trees are 25-35 m tall, with buttressed trunks and shallow roots, mostly evergreen, with large dark green leaves. Plants such as orchids, bromeliads, vines (lianas), ferns, mosses, and palms are present in tropical forests.
6. Fauna include numerous birds, bats, small mammals, and insects.
Terrestrial Ecosystems - The Biomes

Tropical and Equatorial (low latitude) rainforest layers
The Monsoon Forest

- Found in a wet-dry tropical climate, the dry season results in a deciduous forest that sheds its leaves, allowing more development in the lower forest layers.
Subtropical Evergreen Forest
- associated with the moist subtropical climate
- vegetation consists of broadleaf and needleleaf evergreen trees
- little natural forest remains due to agricultural development
The Midlatitude Deciduous Forest
- tall dense canopy in summer
- sheds its leaves in winter in response to the cold temperatures
Temperate forests occur in eastern North America, northeastern Asia, and western and central Europe. Well-defined seasons with a distinct winter characterize this forest biome. Moderate climate and a growing season of 140-200 days during 4-6 frost-free months distinguish temperate forests.

1. Temperature varies from -30°C to 30°C.
2. Precipitation (75-150 cm) is distributed evenly throughout the year.
3. Soil is fertile, enriched with decaying litter.
4. Canopy is moderately dense and allows light to penetrate, resulting in well-developed and richly diversified understory vegetation and stratification of animals.
5. Flora is characterized by 3-4 tree species per square kilometer. Trees are distinguished by broad leaves that are lost annually and include such species as oak, hickory, beech, hemlock, maple, basswood, cottonwood, elm, willow, and spring-flowering herbs.
6. Fauna is represented by squirrels, rabbits, skunks, birds, deer, mountain lion, bobcat, timber wolf, fox, and black bear.
Many hardwoods – maple, ash, walnut…
Boreal forests, or taiga, represent the largest terrestrial biome. Occurring between 50 and 60 degrees north latitudes, boreal forests can be found in the broad belt of Eurasia and North America: two-thirds in Siberia with the rest in Scandinavia, Alaska, and Canada. Seasons are divided into short, moist, and moderately warm summers and long, cold, and dry winters. The length of the growing season in boreal forests is 130 days.

1. Temperatures are very low.
2. Precipitation is primarily in the form of snow, 40-100 cm annually.
3. Soil is thin, nutrient-poor, and acidic.
4. Canopy permits low light penetration, and as a result, understory is limited.
5. Flora consist mostly of cold-tolerant evergreen conifers with needle-like leaves, such as pine, fir, and spruce.
6. Fauna include woodpeckers, hawks, moose, bear, weasel, lynx, fox, wolf, deer, hares, chipmunks, shrews, and bats.
Terrestrial Ecosystems-The Biomes

The Needleleaf Forest

- a few species of tall cone-shaped mostly evergreen coniferous trees

- these trees create a continuous deep shade at ground level which inhibits the growth of shrubs and herbs

- is associated with the boreal forest climate and the high elevations of mountainous areas
Terrestrial Ecosystems - The Biomes

The Needleleaf Forest

Figure 9.13, p. 348, 349
Terrestrial Ecosystems-The Biomes

The Schlerophyll Forest

- develops in the Mediterranean climate

- trees have adapted to the dry, hot summers by producing small, hard, thick (leathery) leaves that minimize water loss
Terrestrial Ecosystems - The Biomes

The Schlerophyll Forest

Figure 9.16, p. 351
The Savanna Biome

- a product of the tropical wet-dry climate

- changes from woodland to thorn-tree grassland with increasing dryness

- adaptation to dryness includes deciduous habit and small leaves or thorns

- trees are widely spaced and area is prone to fires in dry season
Baobob

Acacia
The Grassland Biome

- found in the midlatitude and subtropical zones which have well developed winter and summer seasons

- includes both tall-grass prairie and steppe

- steppe vegetation grows in the semi-arid subtype of the dry continental climate
Terrestrial Ecosystems - The Biomes

The Grassland Biome

Figure 9.16, p. 352, 353
The Desert Biome

- includes both desert and semi-desert subtypes

- semi-desert ranges from the tropical to midlatitude zone

- vegetation includes sparse xerophytic shrubs adapted to a long hot dry season with a short wet season

- desert vegetation includes spiny shrubs, succulent plants and hard grasses

- many areas with no vegetation
Terrestrial Ecosystems - The Biomes

The Desert Biome

Figure 9.19, p. 354, 355
The Tundra Biome

- found at high latitudes and high elevations

- include low herbs, dwarf shrubs, sedges, grasses, mosses and lichens

- high latitudes plant growth influenced by long winters with little light and short cool summers with very long days

- permafrost restricts drainage and root development
Arctic tundra is located in the northern hemisphere, encircling the north pole and extending south to the coniferous forests of the taiga. The arctic is known for its cold, desert-like conditions. The growing season ranges from 50 to 60 days. The average winter temperature is -34° C (-30° F), but the average summer temperature is 3-12° C (37-54° F) which enables this biome to sustain life. Rainfall may vary in different regions of the arctic. Yearly precipitation, including melting snow, is 15 to 25 cm (6 to 10 inches). Soil is formed slowly. A layer of permanently frozen subsoil called permafrost exists, consisting mostly of gravel and finer material. When water saturates the upper surface, bogs and ponds may form, providing moisture for plants. There are about 1,700 kinds of plants in the arctic and subarctic, and these include: low shrubs, sedges, reindeer mosses, liverworts, and grasses. 400 varieties of flowers, crustose and foliose lichen...
Alpine Tundra

Alpine tundra is located on mountains throughout the world at high altitude where trees cannot grow. The growing season is approximately 180 days. The nighttime temperature is usually below freezing. Unlike the arctic tundra, the soil in the alpine is well drained. The plants are very similar to those of the arctic ones and include: tussock grasses, dwarf trees, small-leafed shrubs, and heaths.

Animals living in the alpine tundra are also well adapted:
Mammals: pikas, marmots, mountain goats, sheep, elk
Birds: grouselike birds
Insects: springtails, beetles, grasshoppers, butterflies
The Tundra Biome – Elevation

-as elevation increases, temperatures decrease and precipitation increases

- this leads to a sequence of vegetation zones or life zones related to altitude

Figure 9.23, p. 357
Figure 9.23, p. 357
Terrestrial Ecosystems - The Biomes

three continental transects showing the sequence of formation classes across climatic gradients

Figure 9.24, p. 358