Biological Communities: The Biome Concept

Educational Goals

Be familiar with:

- How ecological communities are classified at the global scale
- The significance of convergence
- Reasons for basing the biome classification on dominant plant forms and climate
- Walter's climate classification
- Whittaker's biome classification

Form and function match the environment

Convergence:

E.g. desert plants

Classification – A Global Perspective

- Biome =
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Classification – Global Perspective

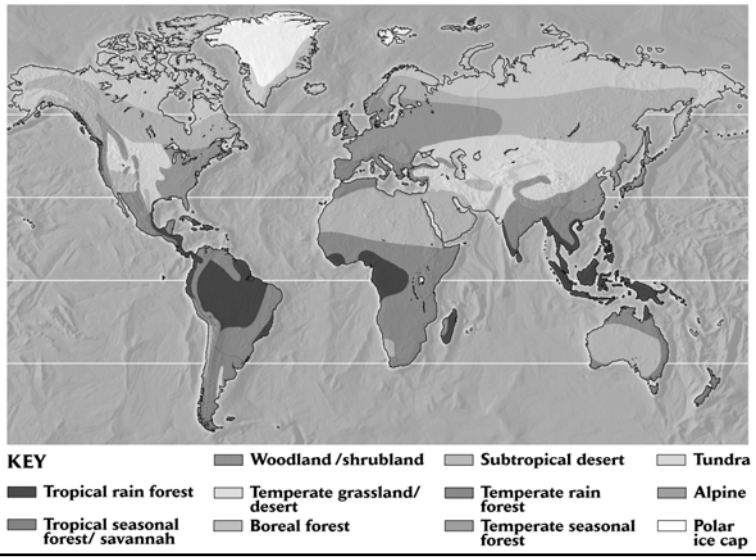
- Why plants?

- Why climate?

One Plant Form, Two Biomes

- Temperate salt marshes and grasslands
  - Both dominated by the same plant form
  - 2 very different environments

Not all biome classifications are the same….



Adaptations and Environment -- Not the Whole Story

- Species distribution not **solely** function of relationships to physical environment:
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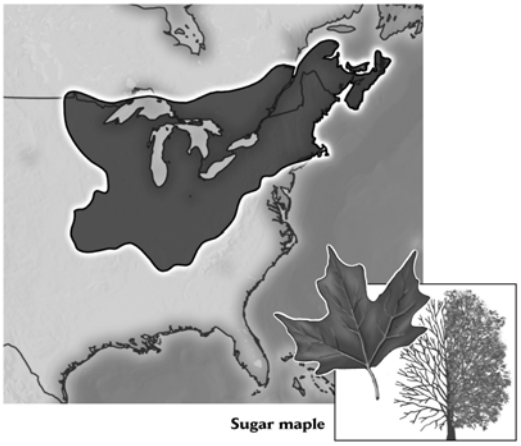
Climate is the major determinant of plant distribution



Climate defines the boundaries of terrestrial biomes

- Heinrich Walter – schemes based upon

- **Relates to moisture and temperature stress on the dominant plants**

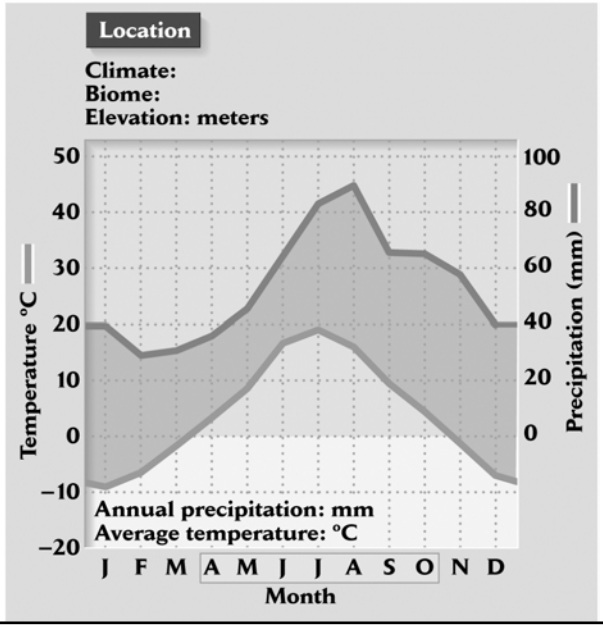
Walter's Climate Classification

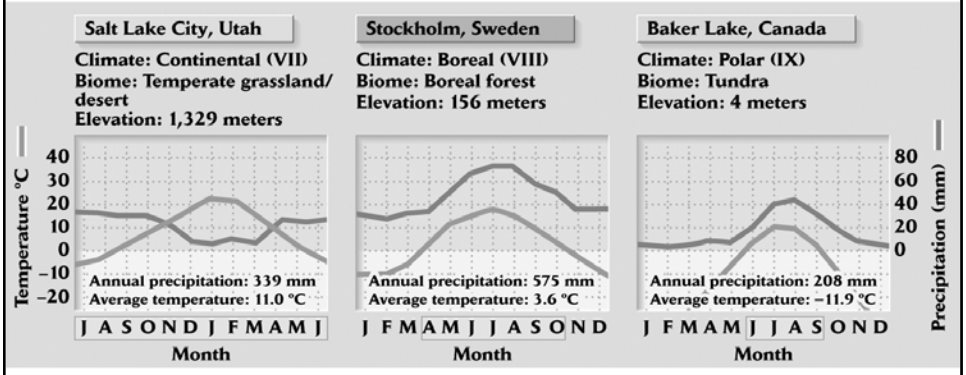
Climate zone		Vegetation
I	Equatorial: Always moist and lacking temperature seasonality	Evergreen tropical rain forest
II	Tropical: Summer rainy season and "winter" dry season	Seasonal forest, scrub, or savanna
III	Subtropical (hot deserts): Highly seasonal, arid climate	Desert vegetation with considerable exposed surface
IV	Mediterranean: Winter rainy season and summer drought	Scerophyllous (drought-adapted), frost-sensitive shrublands and woodlands
V	Warm temperate: Occasional frost, often with summer rainfall maximum	Temperate evergreen forest, somewhat frost-sensitive
VI	Nemoral: Moderate climate with winter freezing	Frost-resistant, decidous, temperate forest
VII	Continental (cold deserts): Arid, with warm or hot summers and cold winters	Grasslands and temperate deserts
VIII	Boreal: Cold temperate with cool summers and long winters	Evergreen, frost-hardy needle-leaved forest (taiga)
IX	Polar: Very short, cool summers and long, very cold winters	Low, evergreen vegetation, without trees, growing over permanently frozen soils

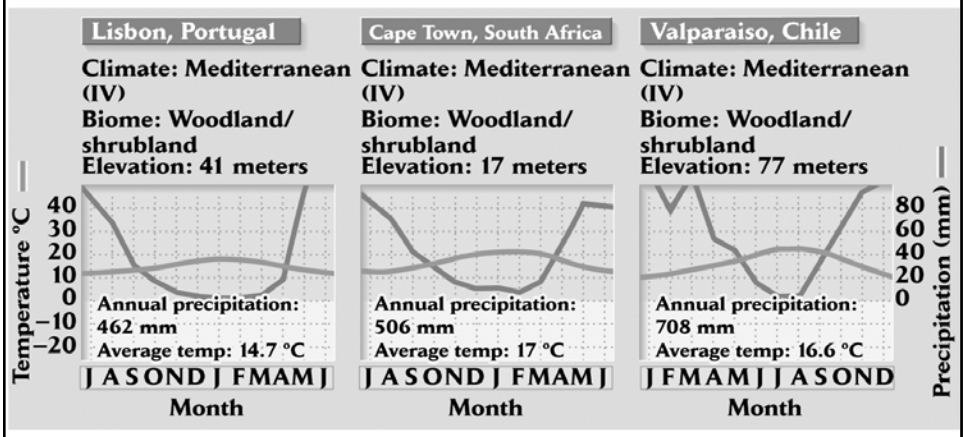
Biomes correspond closely to major climate zones

Biome name	Climate zone		Vegetation
Tropical rain forest	I	Equatorial: Always moist and lacking temperature seasonality	Evergreen tropical rain forest
Tropical seasonal forest/savanna	II	Tropical: Summer rainy season and "winter" dry season	Seasonal forest, scrub, or savanna
Subtropical desert	III	Subtropical (hot deserts): Highly seasonal, arid climate	Desert vegetation with considerable exposed surface
Woodland/shrubland	IV	Mediterranean: Winter rainy season and summer drought	Scerophyllous (drought-adapted), frost-sensitive shrublands and woodlands
Temperate rain forest	V	Warm temperate: Occasional frost, often with summer rainfall maximum	Temperate evergreen forest, somewhat frost-sensitive
Temperate seasonal forest	VI	Nemoral: Moderate climate with winter freezing	Frost-resistant, decidous, temperate forest
Temperate grassland/desert	VII	Continental (cold deserts): Arid, with warm or hot summers and cold winters	Grasslands and temperate deserts
Boreal forest	VIII	Boreal: Cold temperate with cool summers and long winters	Evergreen, frost-hardy needle-leaved forest (taiga)
Tundra	IX	Polar: Very short, cool summers and long, very cold winters	Low, evergreen vegetation, without trees, growing over permanently frozen soils

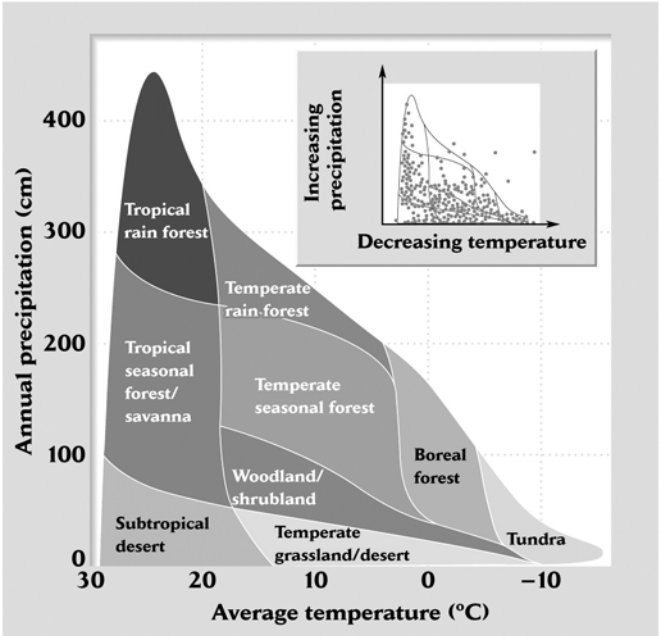
Walter's Climate Diagrams



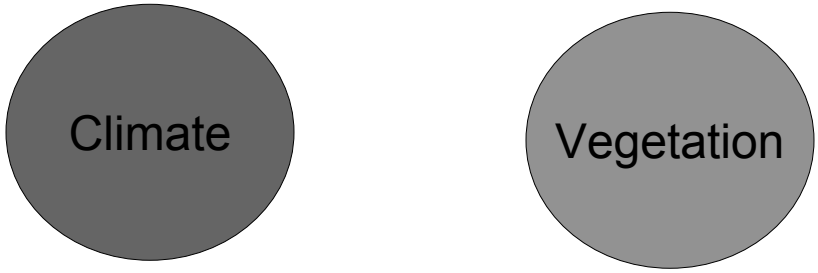




Whittaker's Biome Classification



Classification Scheme's



Other Considerations

- Fire shapes vegetation toward drier end of spectrum

Biome Concept Doesn't Exist for Aquatic Systems

- What distinguishes a biome?

- Have their own classification system:

Aquatic Ecosystems – each has unique physical factors and biota

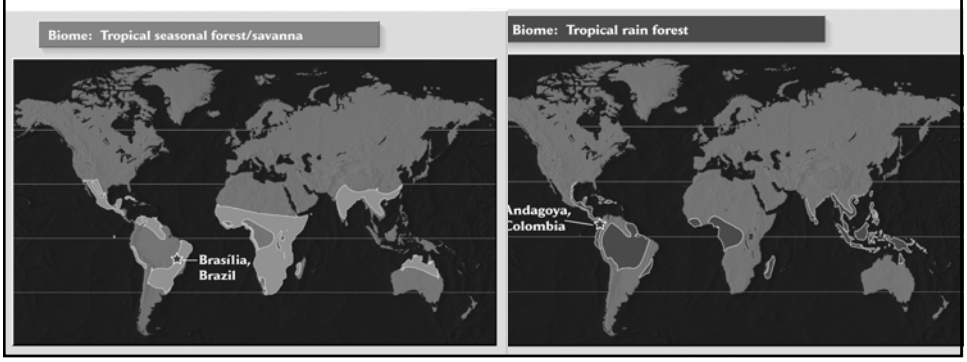
Apply Climate/Biome Classification

Equatorial and tropical biomes

Temperate biomes

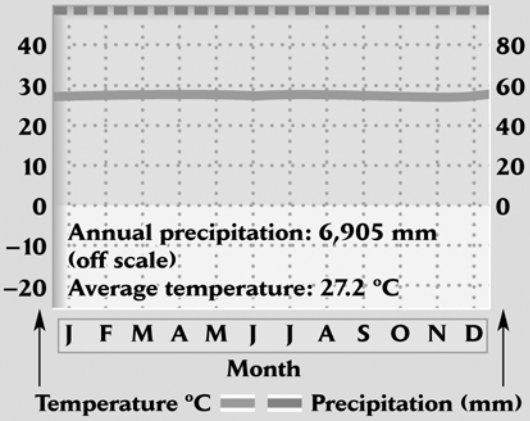
Boreal and polar biomes

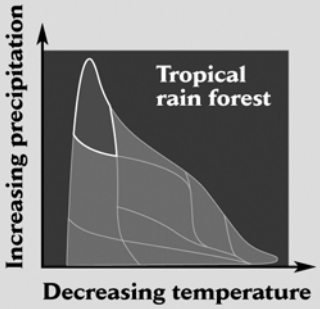
Equatorial and Tropical Climate Zones



Andagoya, Colombia

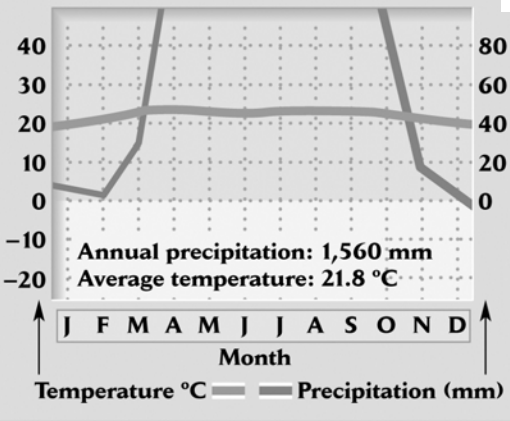
Climate: Equatorial (I)
Elevation: 65 meters

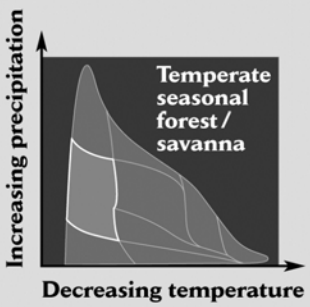




Brasília, Brazil

Climate: Tropical (II)
Elevation: 910 meters





Temperate Climate Zones

Biomes differentiated by:

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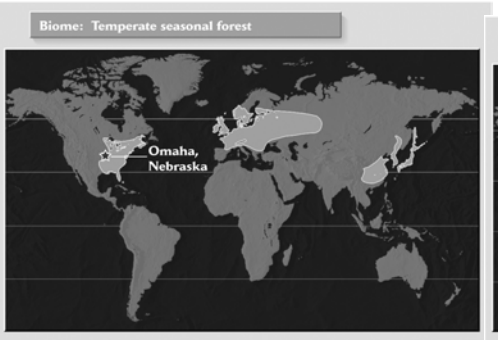
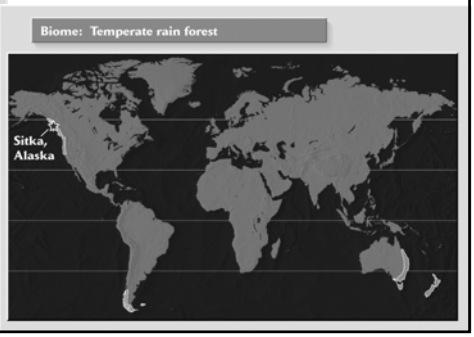
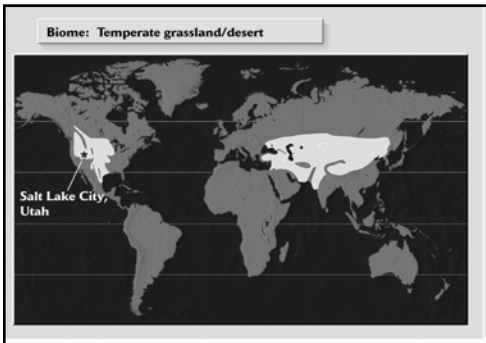
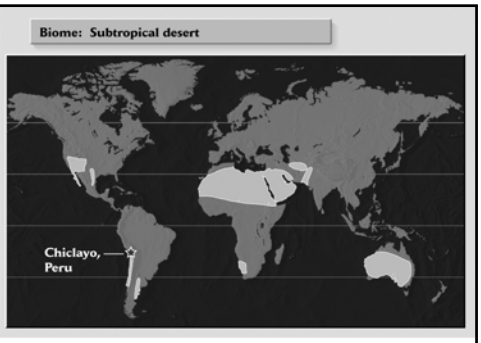


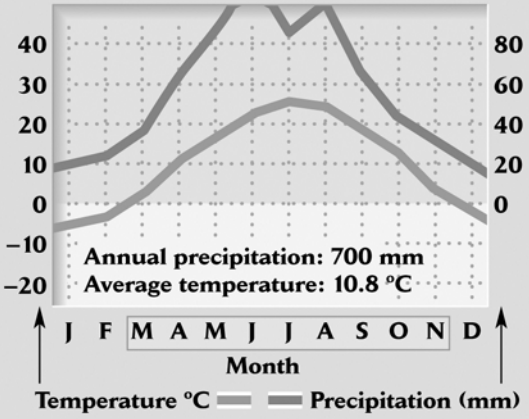


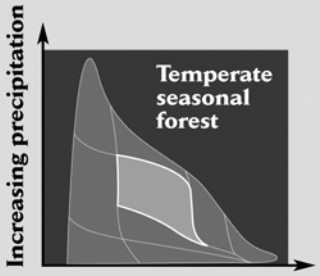




Omaha, Nebraska

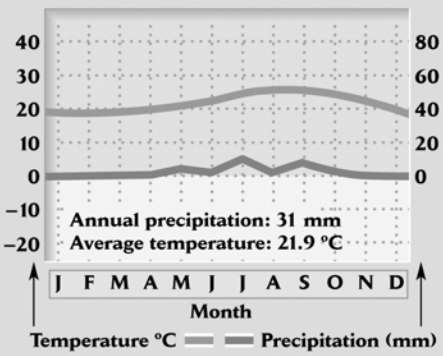
Climate: Nemoral (VI)
Elevation: 337 meters

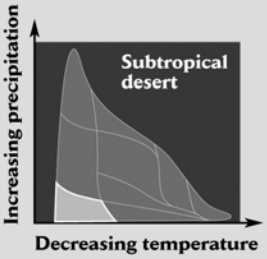




Chiclayo, Peru

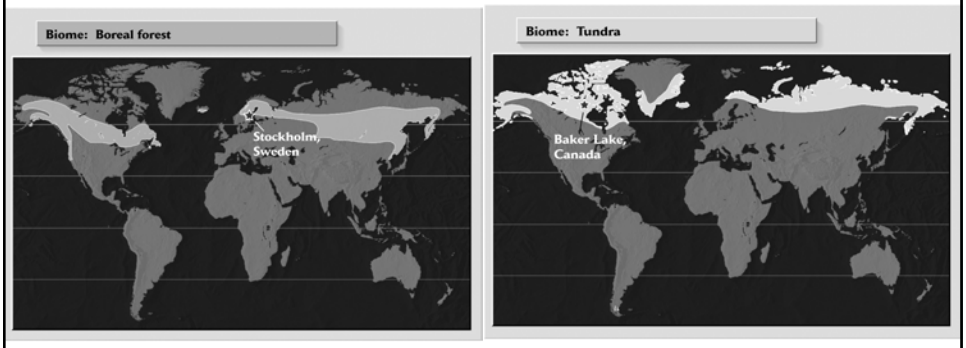
Climate: Subtropical (hot deserts) (III)
Elevation: 31 meters



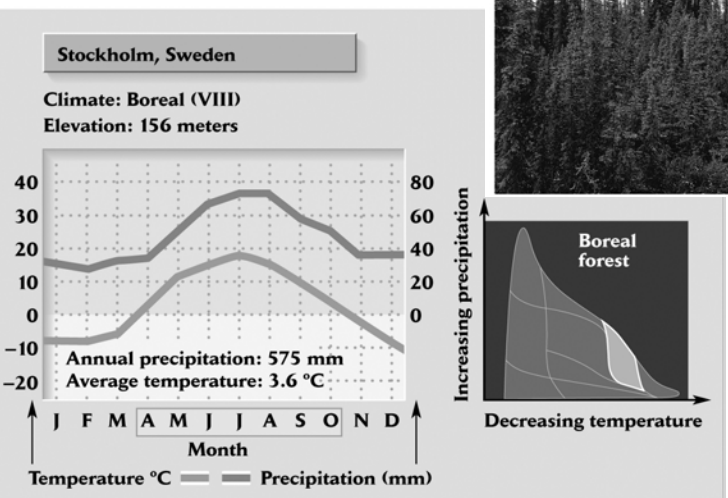


Boreal and Polar Climate Zones

- Boreal forest (**taiga**) 5°C and -5°C.
- Tundra below -5°C.



Boreal Forest Biome



Significance

- Biome approach integrates **plant form** and **climate**
- Whittaker's biome and Walter's climate classification are **compatible**
- Climate zones/biomes distinguished by: