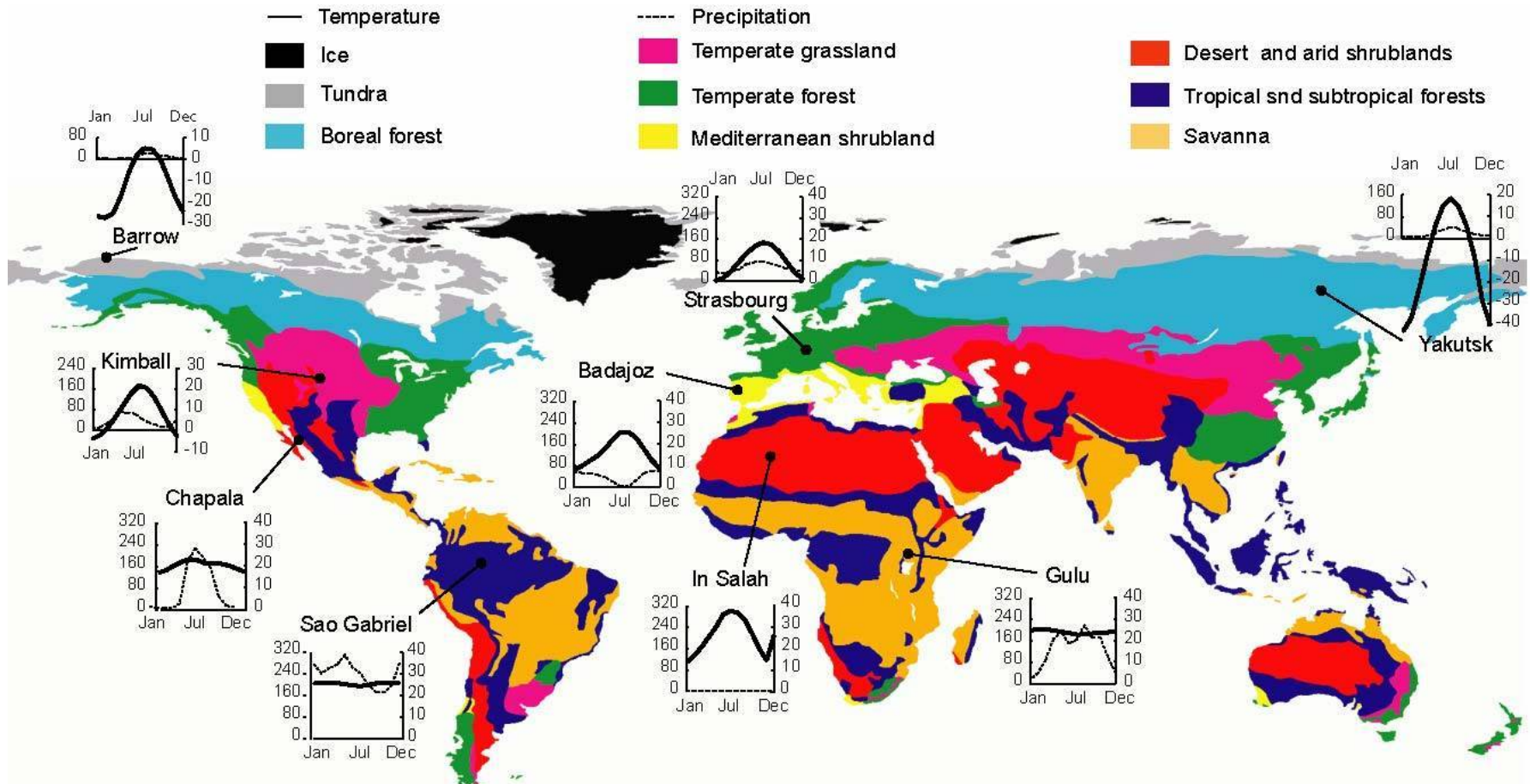


Abiotic Environment

- Objectives
 - Overview of the ecological importance of:
 - Solar Radiation
 - Temperature
 - Wind
 - Water
 - Implications of the abiotic environment for forest management
 - First, thoughts, insights or questions from the reading assignment

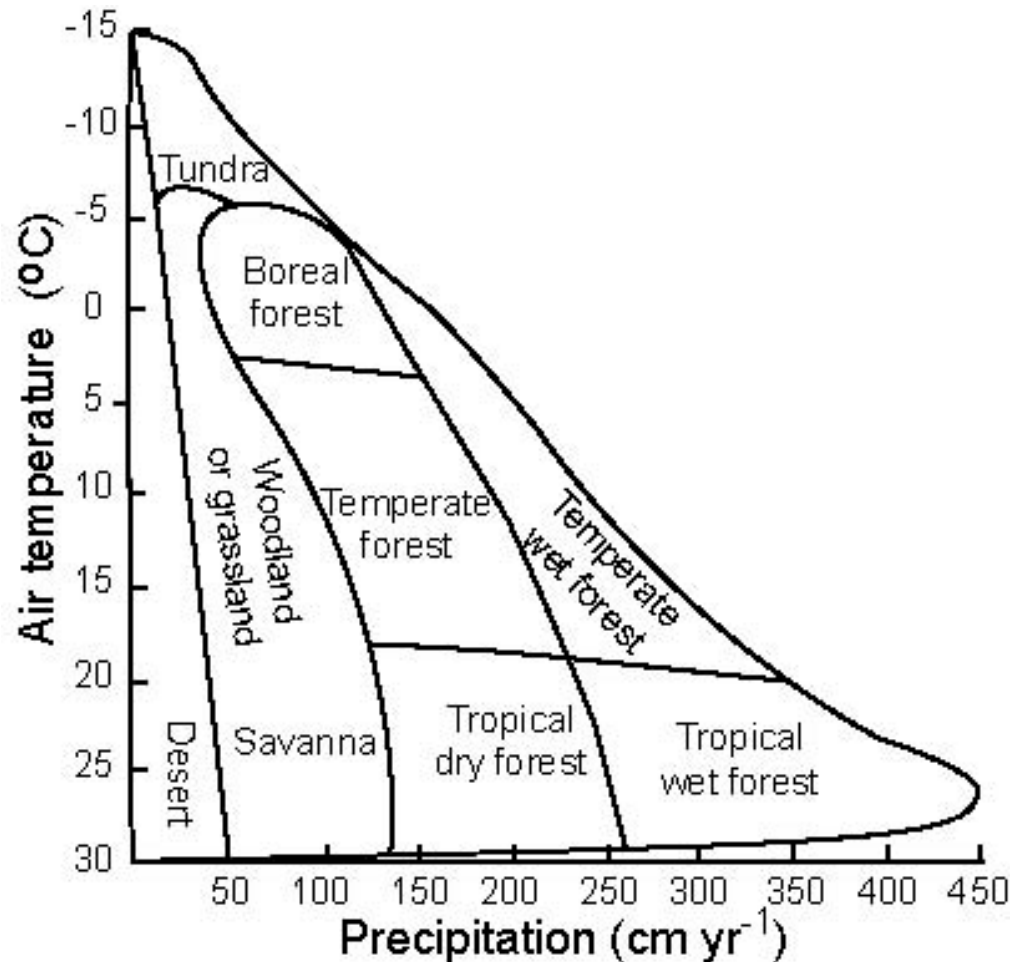
Abiotic Environment

- Global Distribution of Vegetation Types



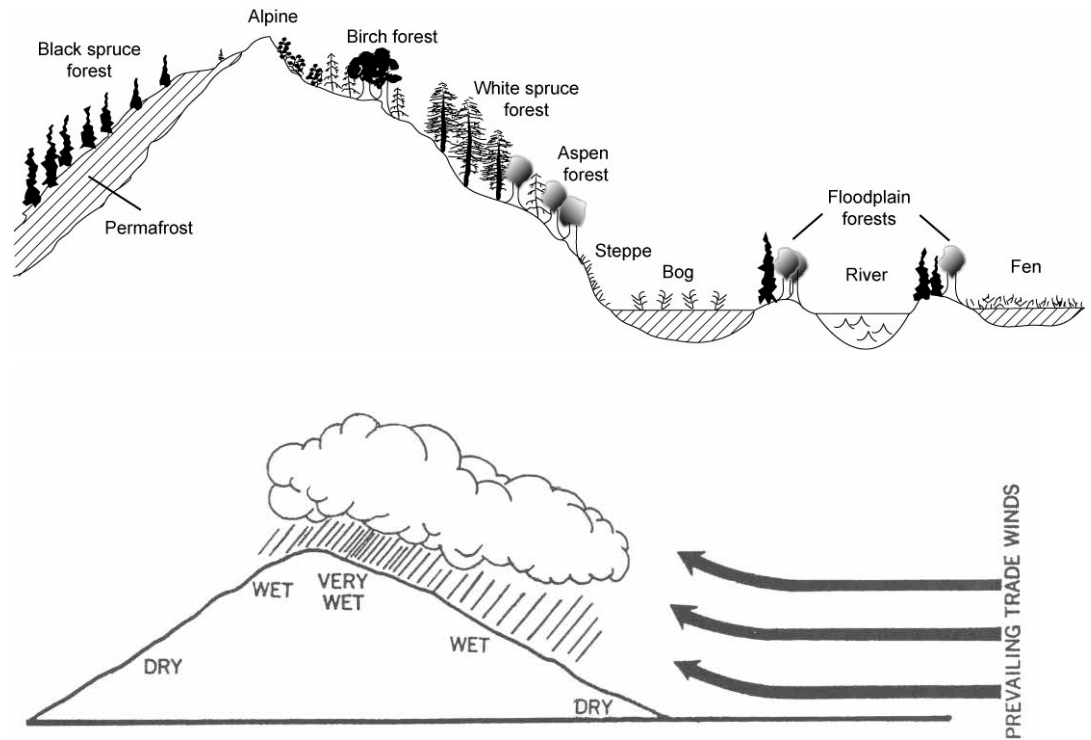
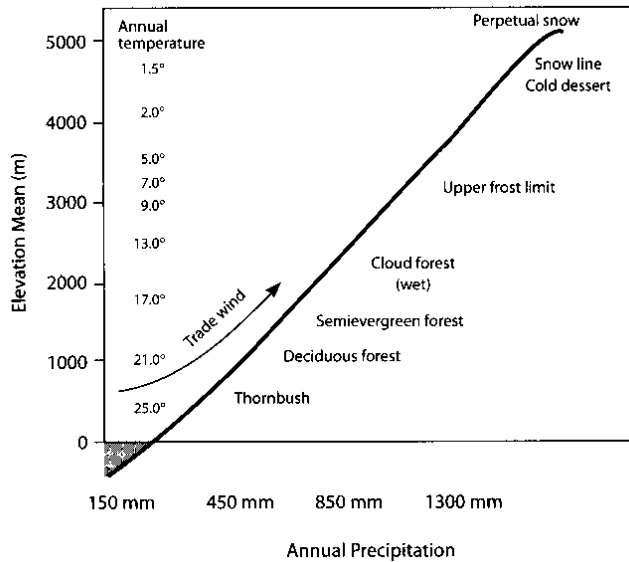
Abiotic Environment

- Global Distribution of Vegetation Types



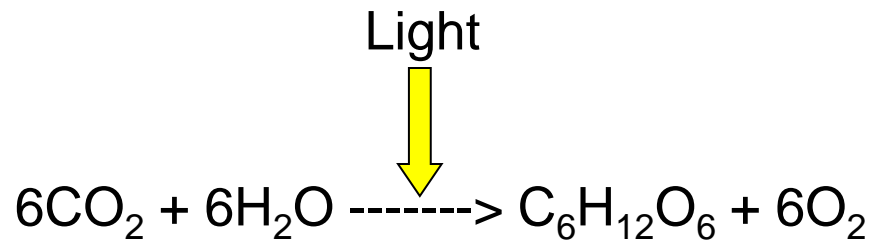
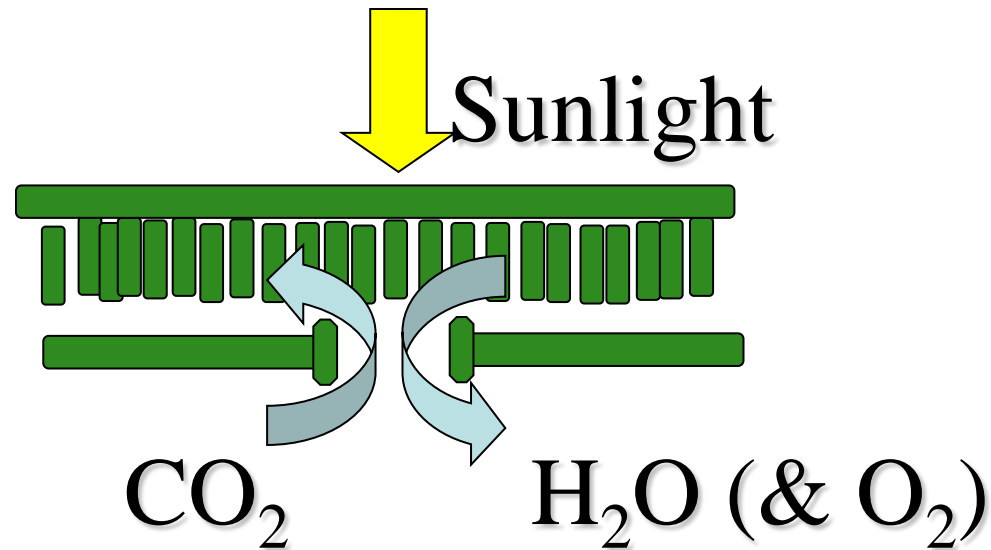
Abiotic Environment

- Local Distribution of Vegetation Types
 - Topography



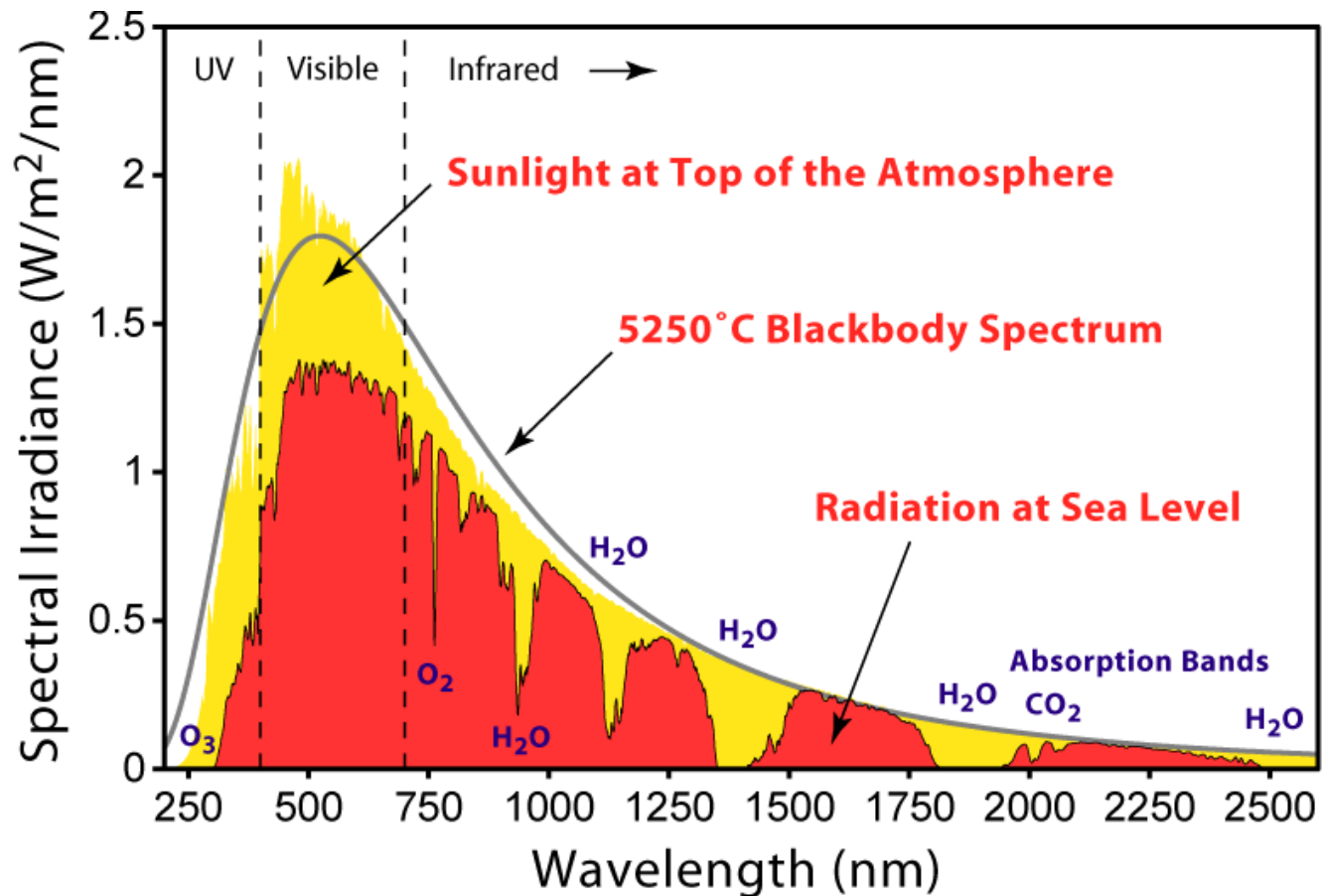
Abiotic Environment

- Solar Radiation



Abiotic Environment

- Solar Radiation



Abiotic Environment

- Solar Radiation – Global Energy Budget

Over ~1 yr, Earth is in a state of radiative equilibrium

in = out

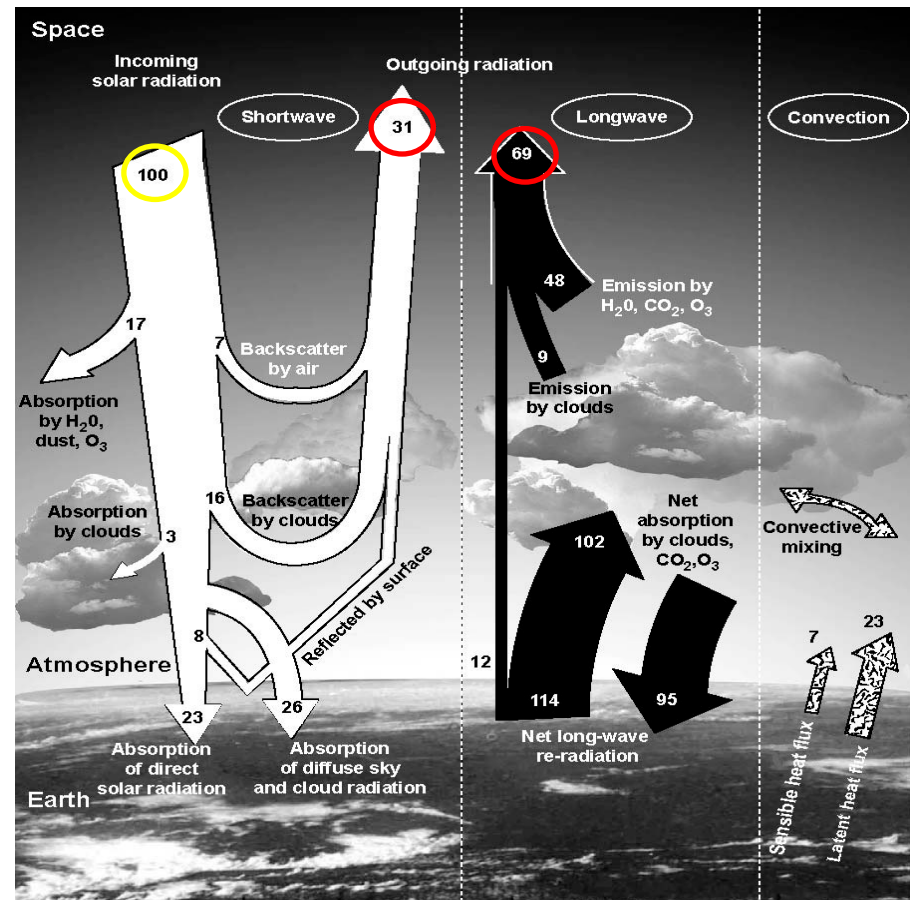
$$(100\% = 31\% + 69\%)$$

Absorbed Short =
Emitted Long

$$(17 + 3 + 23 + 26\% = 69\%)$$

Absorbed Surface =
Emitted Surface

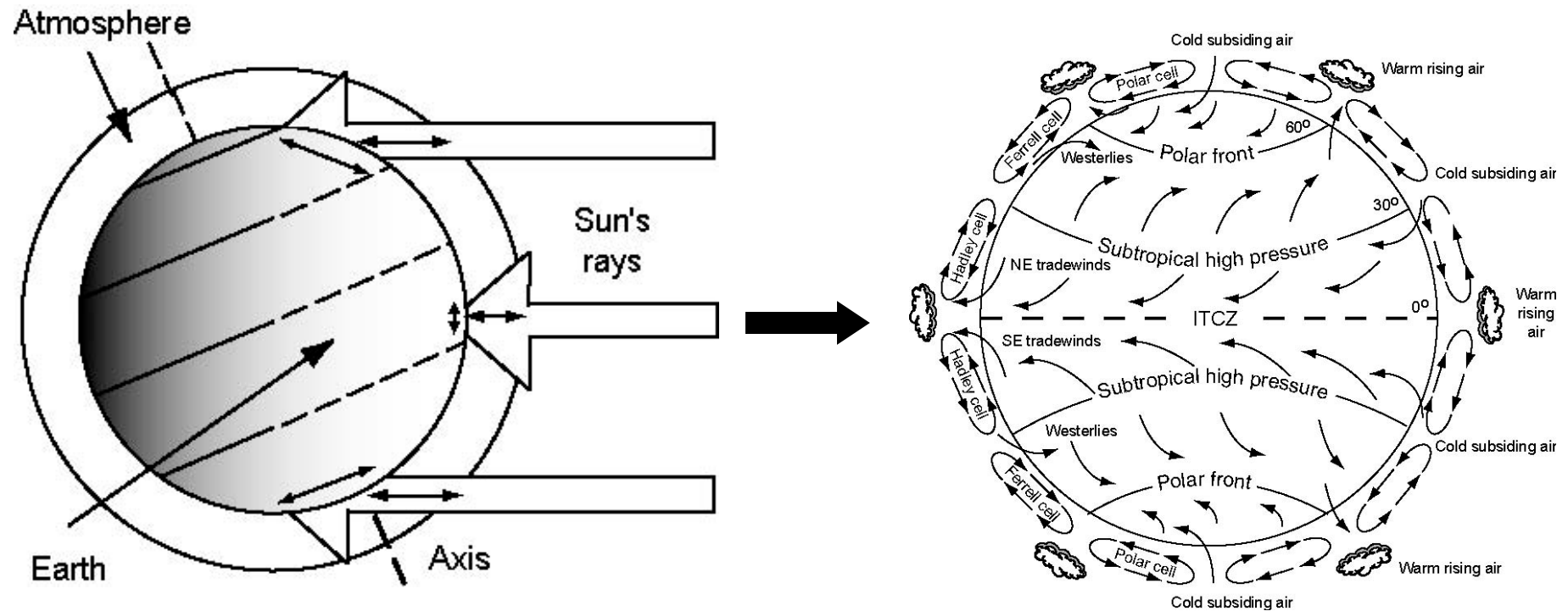
$$(23 + 26 + 95\% = 114 + 7 + 23\%)$$



(% of energy received as incoming solar radiation)

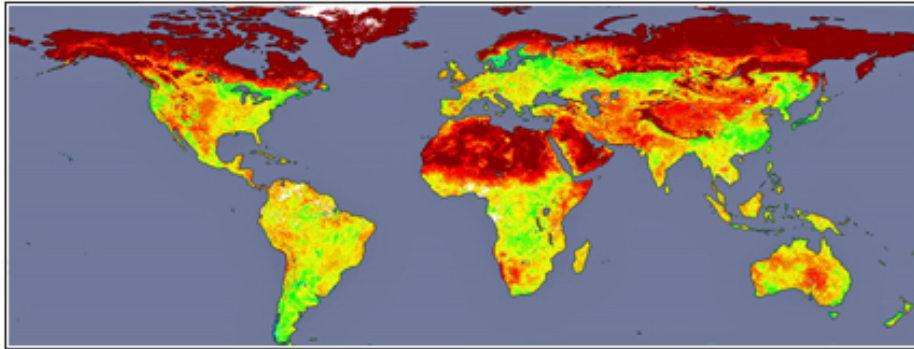
Abiotic Environment

- Solar Radiation - Global Energy Budget



Abiotic Environment

- Solar Radiation - Albedo



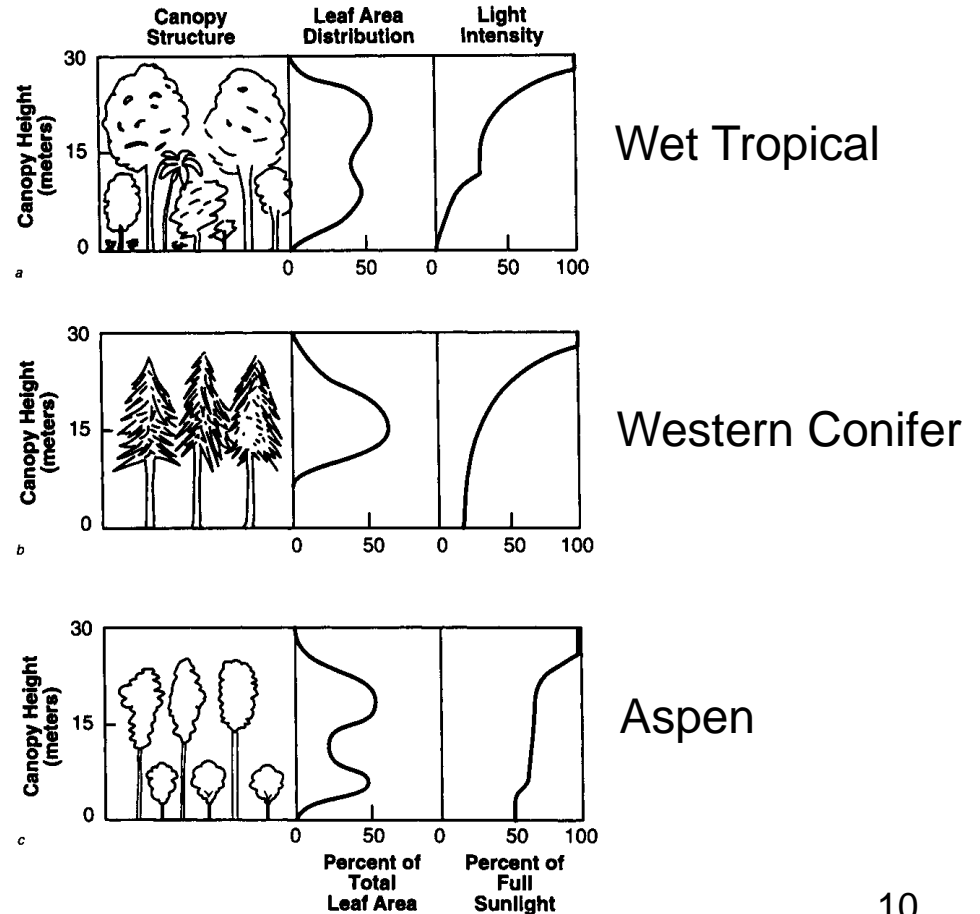
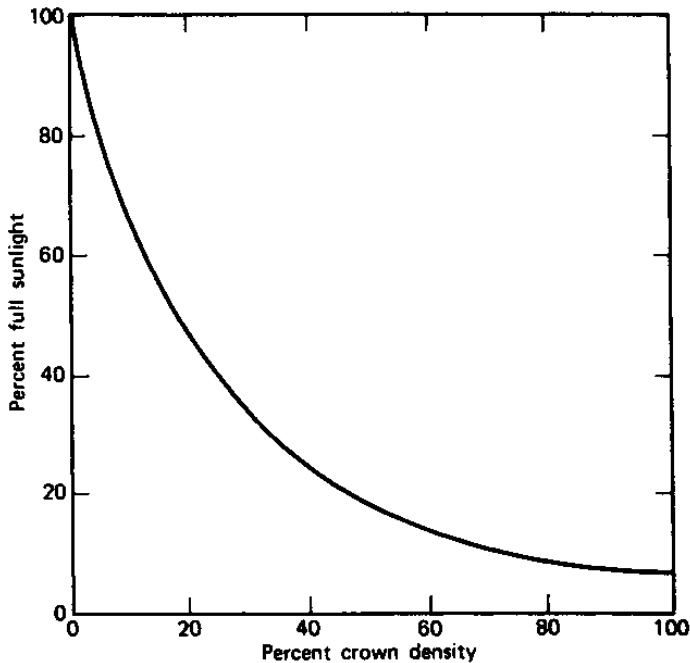
Albedo
Dagmar Budikova

Table 7-1 Albedo Values for Various Surfaces

Surface	Albedo, % Reflectance
Fresh snow cover	75–95
Old snow cover	40–70
Sand dunes, ocean surf	30–60
Sandy soil	15–40
Meadows and fields	12–30
Fresh grass	26
Dry grass	15–25
Dark cultivated soil	7–10
Woodland	5–20
Forest	3–10

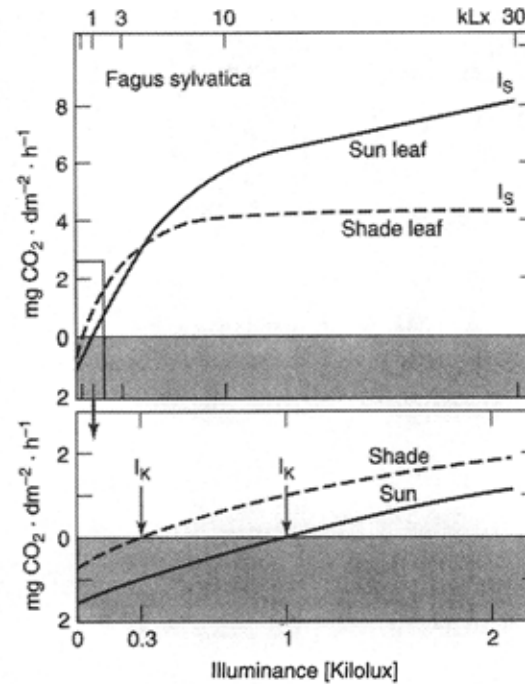
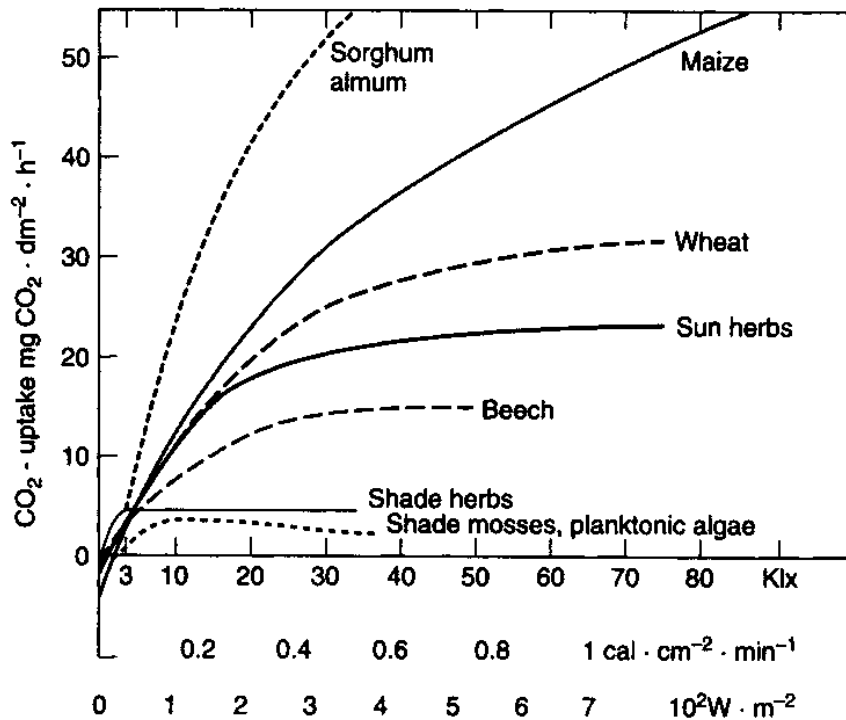
Abiotic Environment

- Solar Radiation - Ecological Effects



Abiotic Environment

- Solar Radiation - Ecological Effects



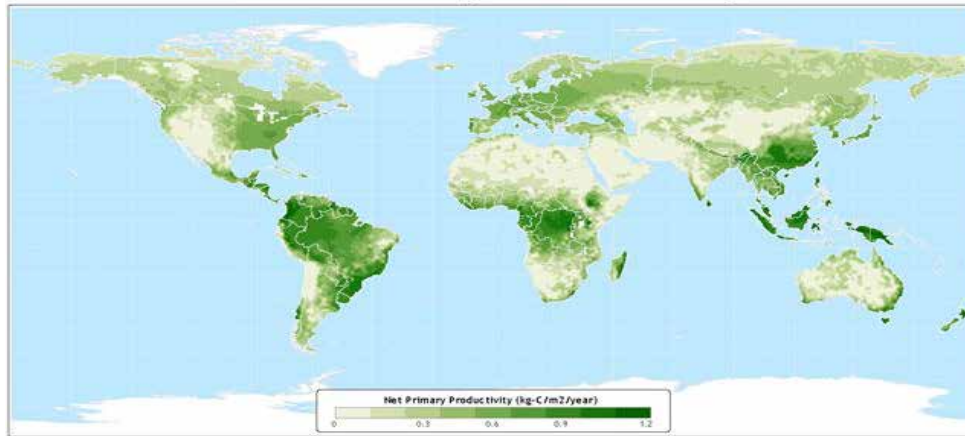
Abiotic Environment

- Solar Radiation – Forest Management
 - Nursery management (plant growth & morphology)
 - “Planting shock”
 - Thinning techniques
 - Natural regeneration
 - Management of species composition
 - Tree form
 - *Management of light condition in the stand to give trees of desired form and timber quality, and to obtain desired species composition and stand structure, is a major objective of silviculture (Kimmins 2004).*

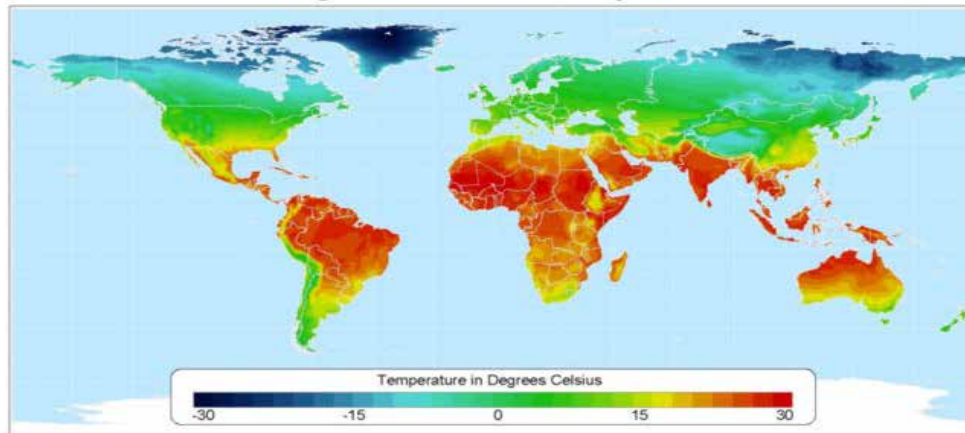
Abiotic Environment

- Temperature

Net Primary Productivity

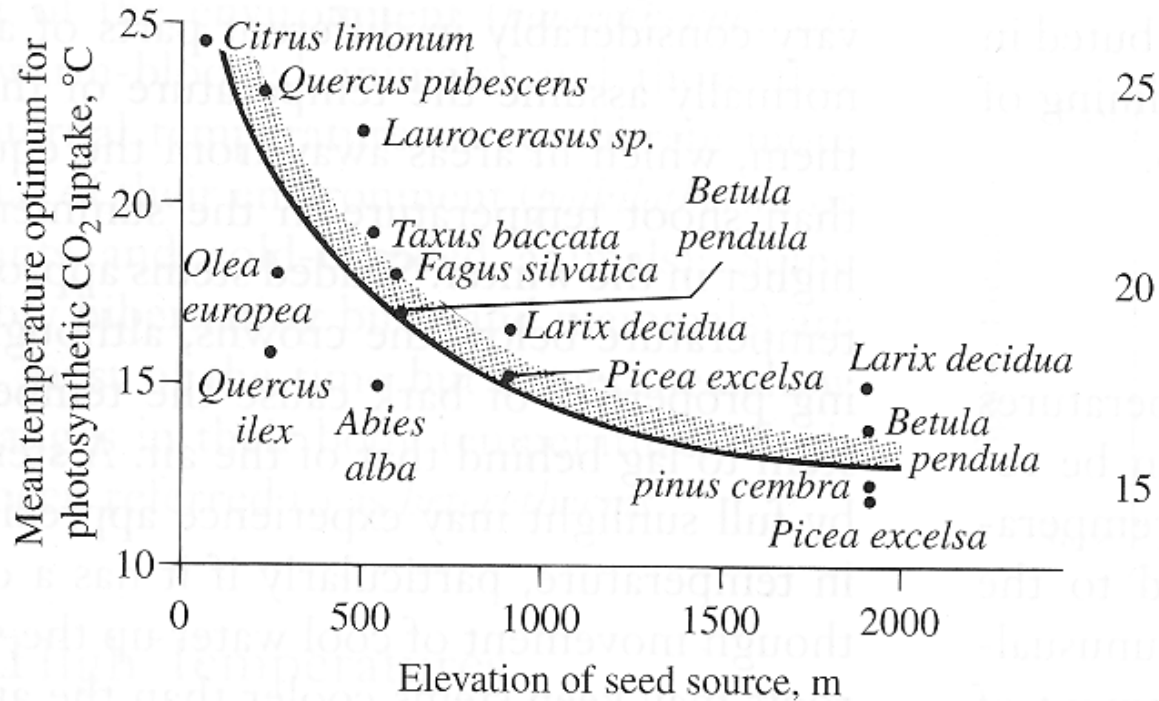


Average Annual Temperature



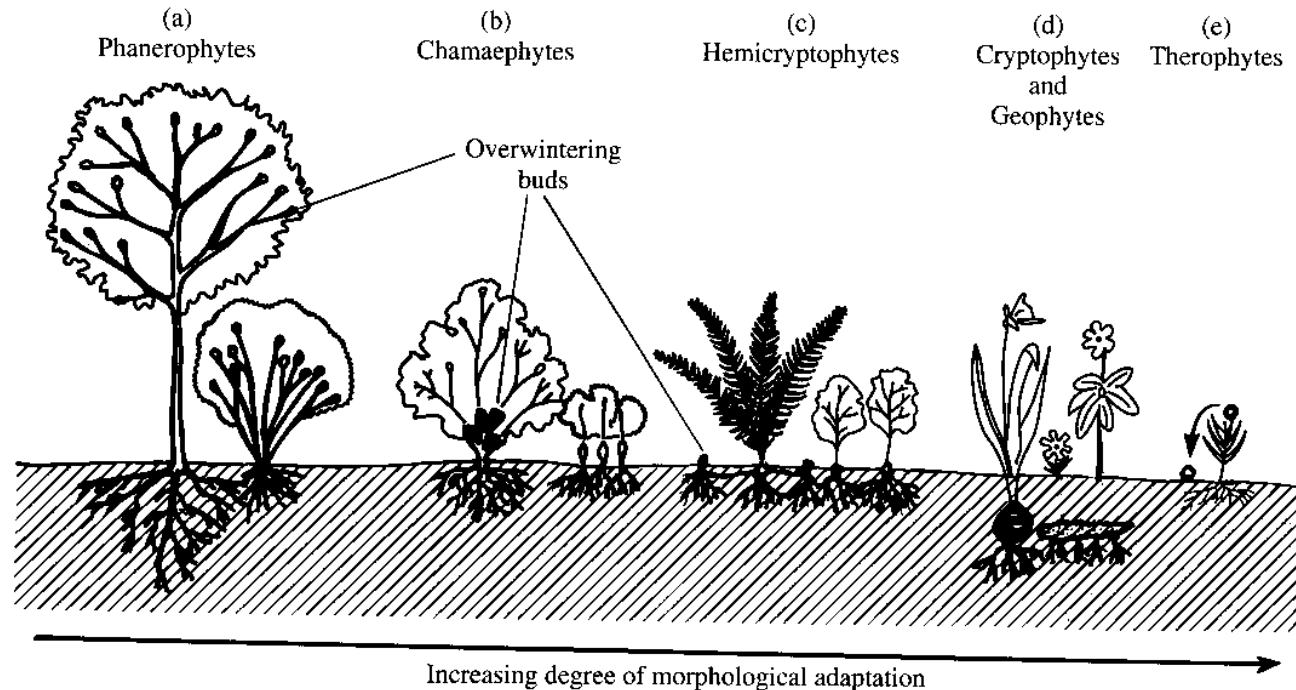
Abiotic Environment

- Temperature



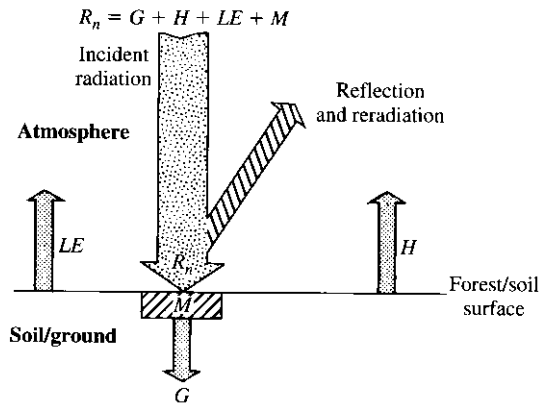
Abiotic Environment

- Temperature



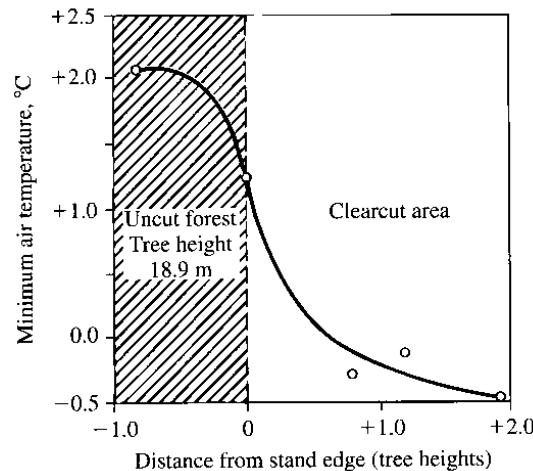
Abiotic Environment

- Temperature - Clearcuts (Energy Budget)



Parameter	Douglas-Fir Stand	Clearcut (No Vegetation Regrowth)
R_n Net radiation flux density	520	550
G Soil heat flux density	32	40
LE Latent heat flux density	301	70
H Sensible heat flux density	183	440
M Rate of heat storage in vegetation (on an area basis)	4	0

Energy Flux, $W\ m^{-2}$		
Parameter	Douglas-Fir Stand	Clearcut (No Vegetation Regrowth)
R_n Net radiation flux density	520	550
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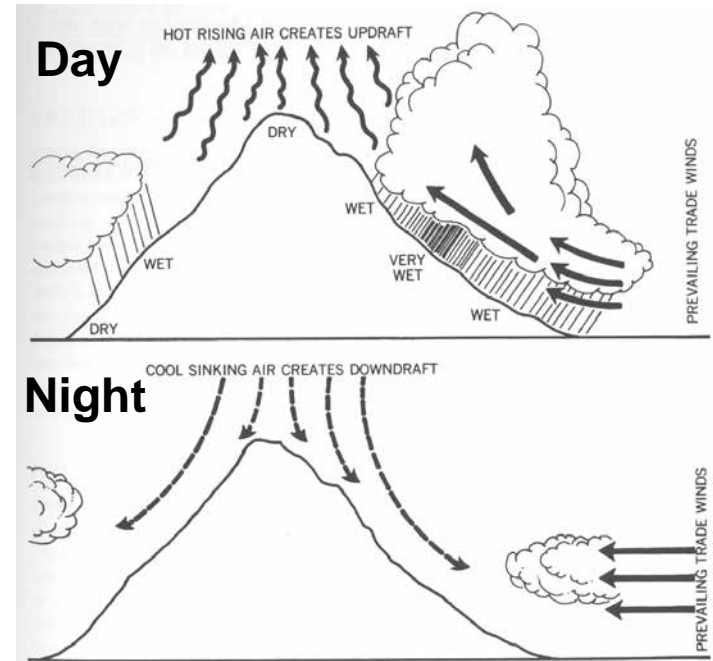
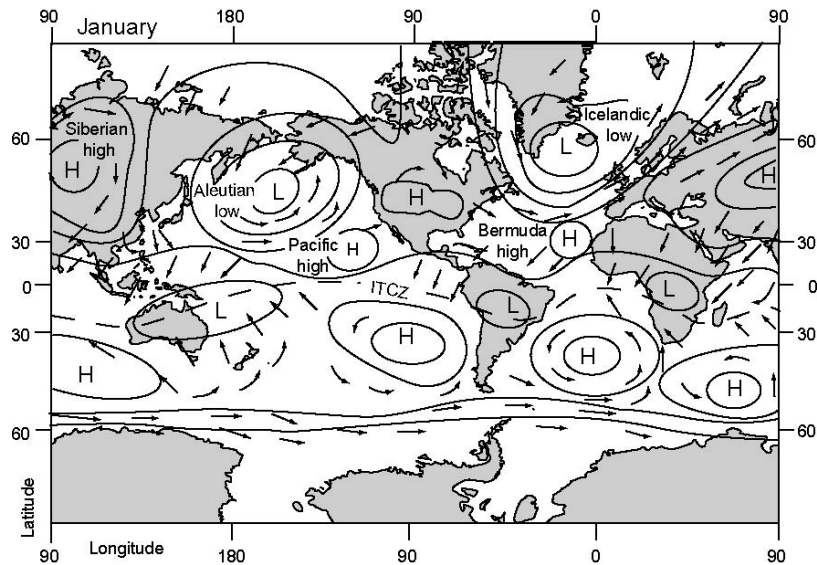


Abiotic Environment

- Temperature – Forest Management
 - Extreme temperatures and rapid changes
 - Soil temperature
 - Nurseries and winter hardening
 - Microsites (Macro- vs. microclimate)
 - DIPs
 - Matching species with optimal temperature
 - *Most of the world's timber supply is grown and harvested in environments where either macroclimatic or microclimatic temperatures influence forest land management in some manner (Kimmins 2004).*

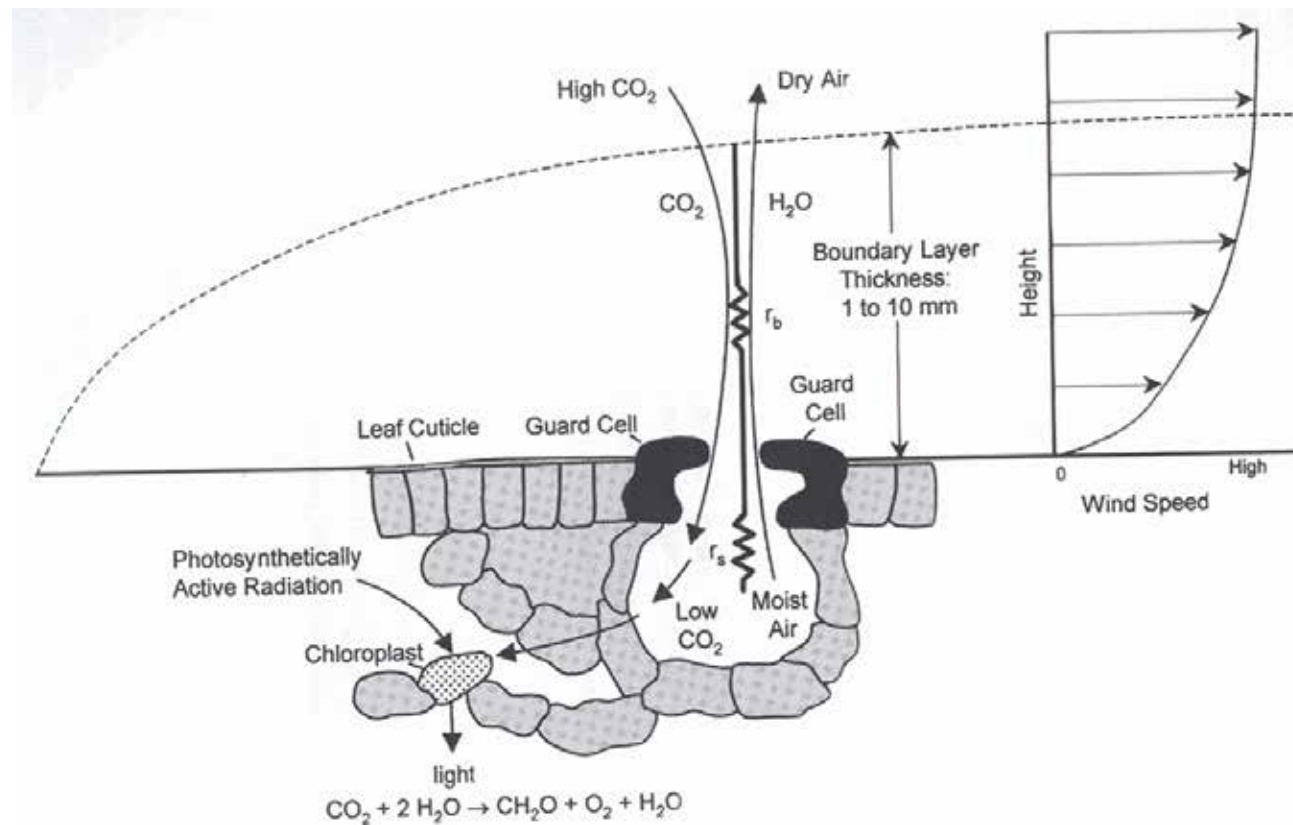
Abiotic Environment

- Wind - Global & Local Patterns



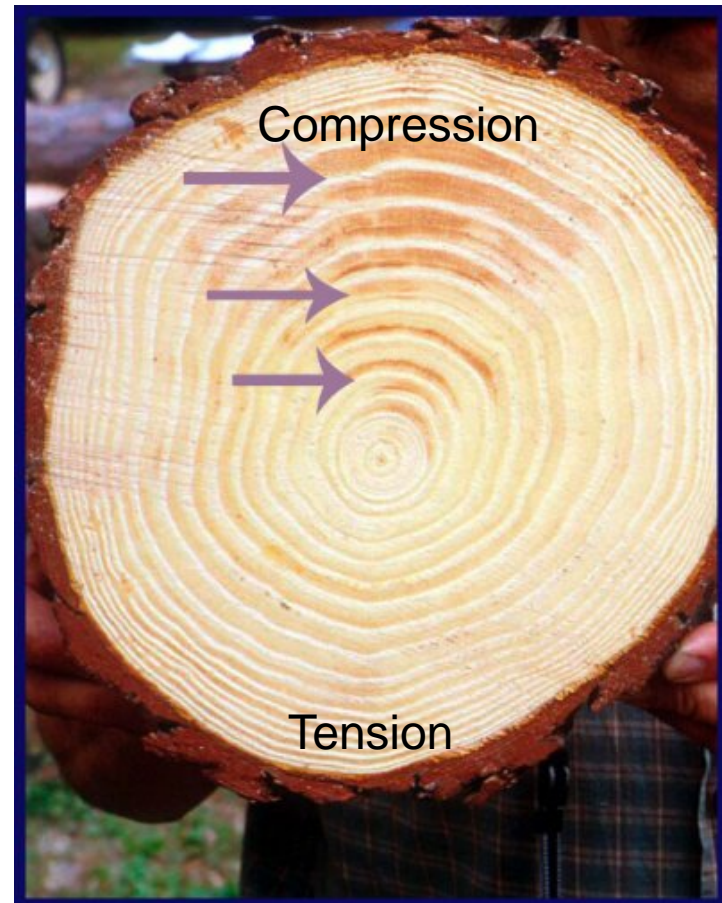
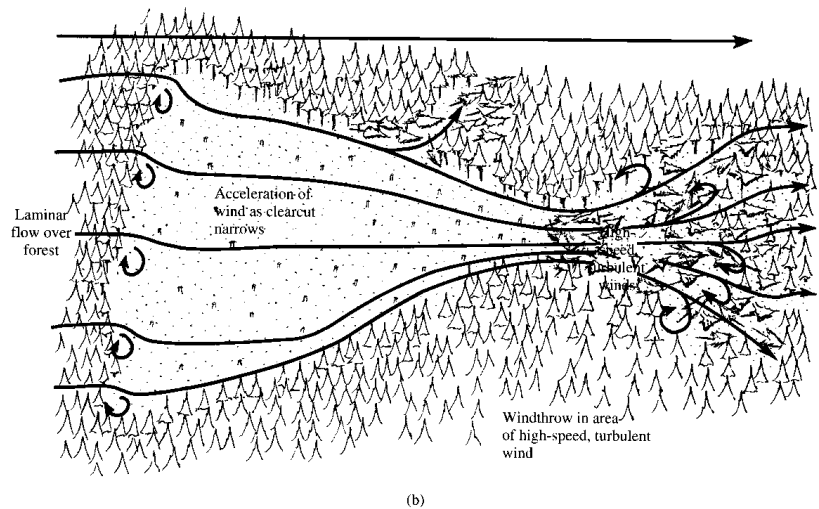
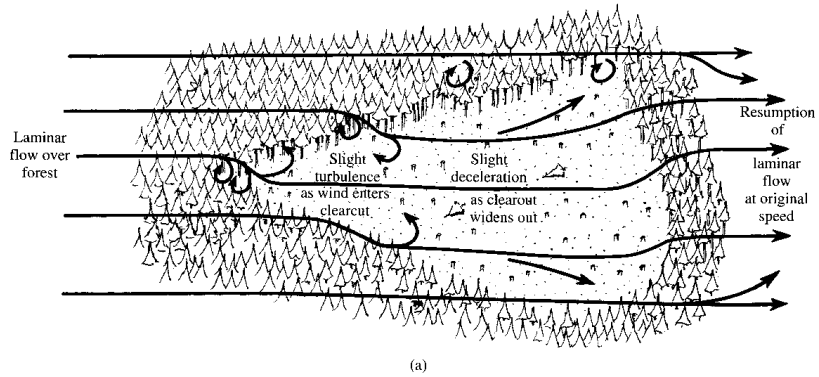
Abiotic Environment

- Wind - Ecological Effects



Abiotic Environment

- Wind – Forest Management



Abiotic Environment

- Wind - Ecological Effects
 - Transport H₂O vapor to land from lakes and oceans
 - Friction of turbulent air masses
 - Deposition of dust and air particles
 - Impacts on evaporation and transpiration (ET)
 - Moderates temperatures
 - Reproduction and dissemination of plant propagules
 - Natural disturbance agent
 - Wood anatomy and quality

Abiotic Environment

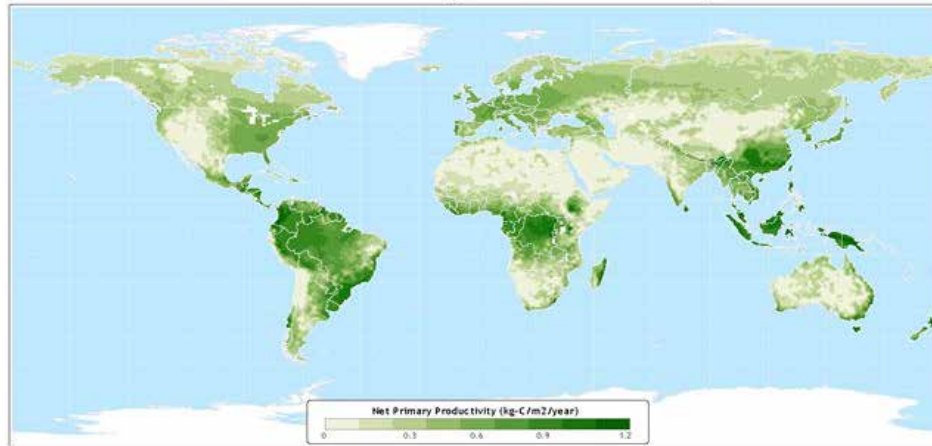
- Water - The material that makes life possible

Water is the very essence of life, and it is almost impossible to discuss the ecology of any organism without reference to its adaptations to the moisture conditions of its environment (Kimmins 2004).

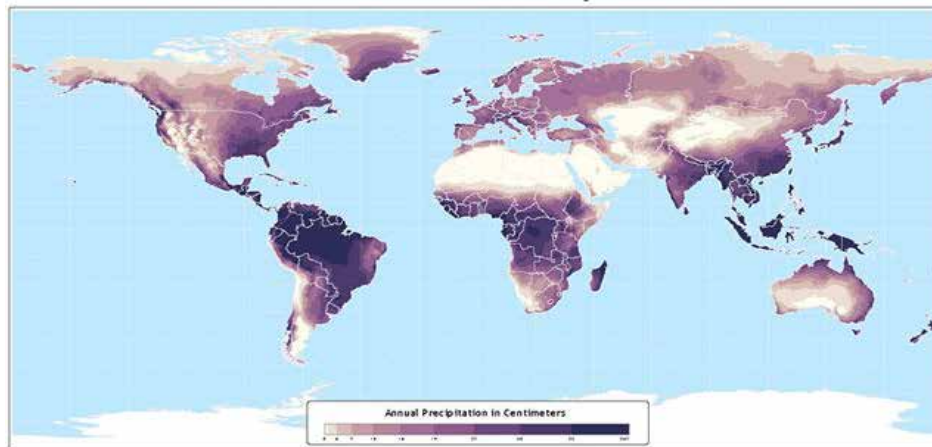
Abiotic Environment

- Precipitation

Net Primary Productivity

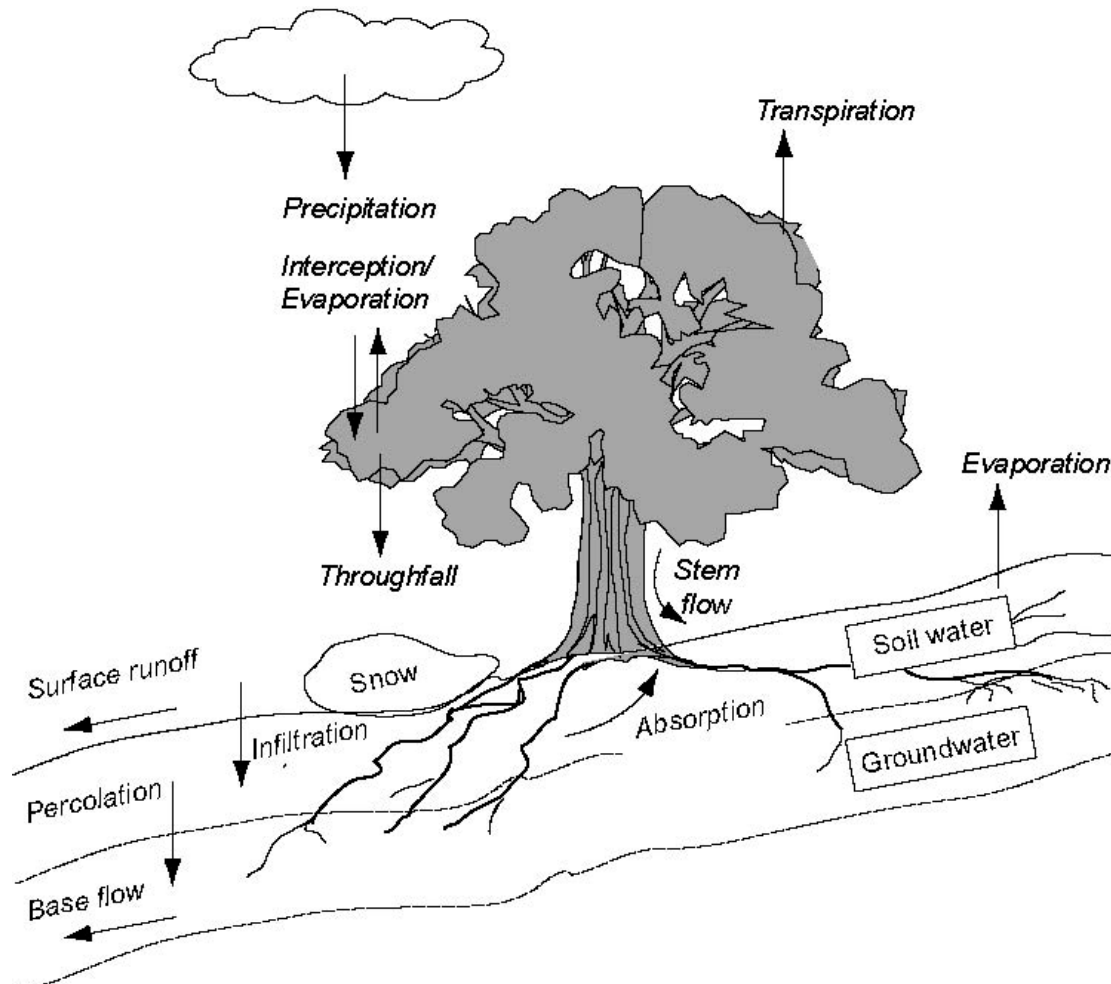


Annual Total Precipitation



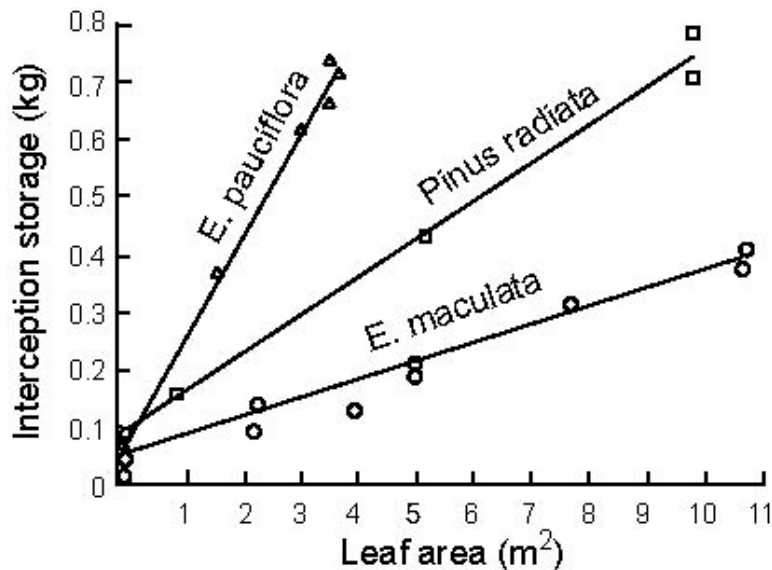
Abiotic Environment

- Water - Budgets



Abiotic Environment

- Water - Influence of Vegetation



Vegetation Type	Precipitation Beneath the Vegetation, cm	Fog Drip, cm
Open (no vegetation)	58	0
Shrubs: <i>Ceanothus</i> sp., 2.4 m tall	58	0
Trees		
Canyon live oaks, 13.7 m tall	121	63
<i>Pseudotsuga macrocarpa</i> , 12.2 m tall	122	64
<i>Pinus ponderosa</i> , 24.4 m tall	154	96

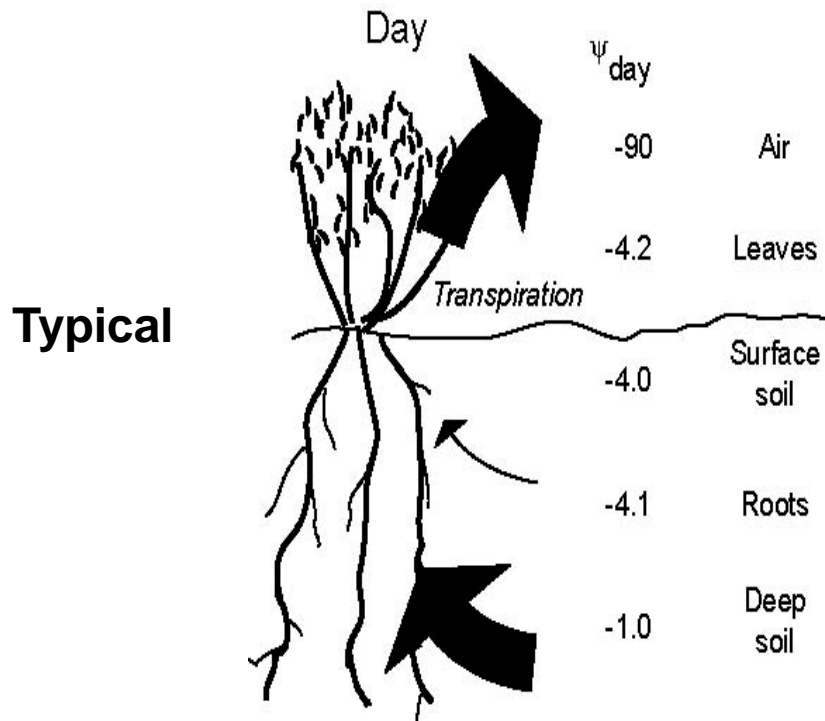
Abiotic Environment

- Water - Influence of Vegetation

Forest Type	Annual Precipitation, cm	Annual Evapotranspiration Loss	
		cm	%
Northern taiga conifer forest, Russia	52.5	28.6	54
Southern taiga conifer forest, Russia	60.0	32.9	55
Spruce stand, Great Britain	135.0	80.0	59
Mixed conifer and deciduous stand, Switzerland	165.0	86.1	52
Mixed conifer and deciduous stand, N. Japan	261.7	54.2	21
Evergreen rain forest, Kenya	195.0	157.0	81
Deciduous forest, European Russia	45.7	42.4	93
Coulter pine, California	123.0	63.7	52
Ponderosa pine, California	126.0	58.0	46
Coulter pine, San Dimas, California	52.5	63.7	75

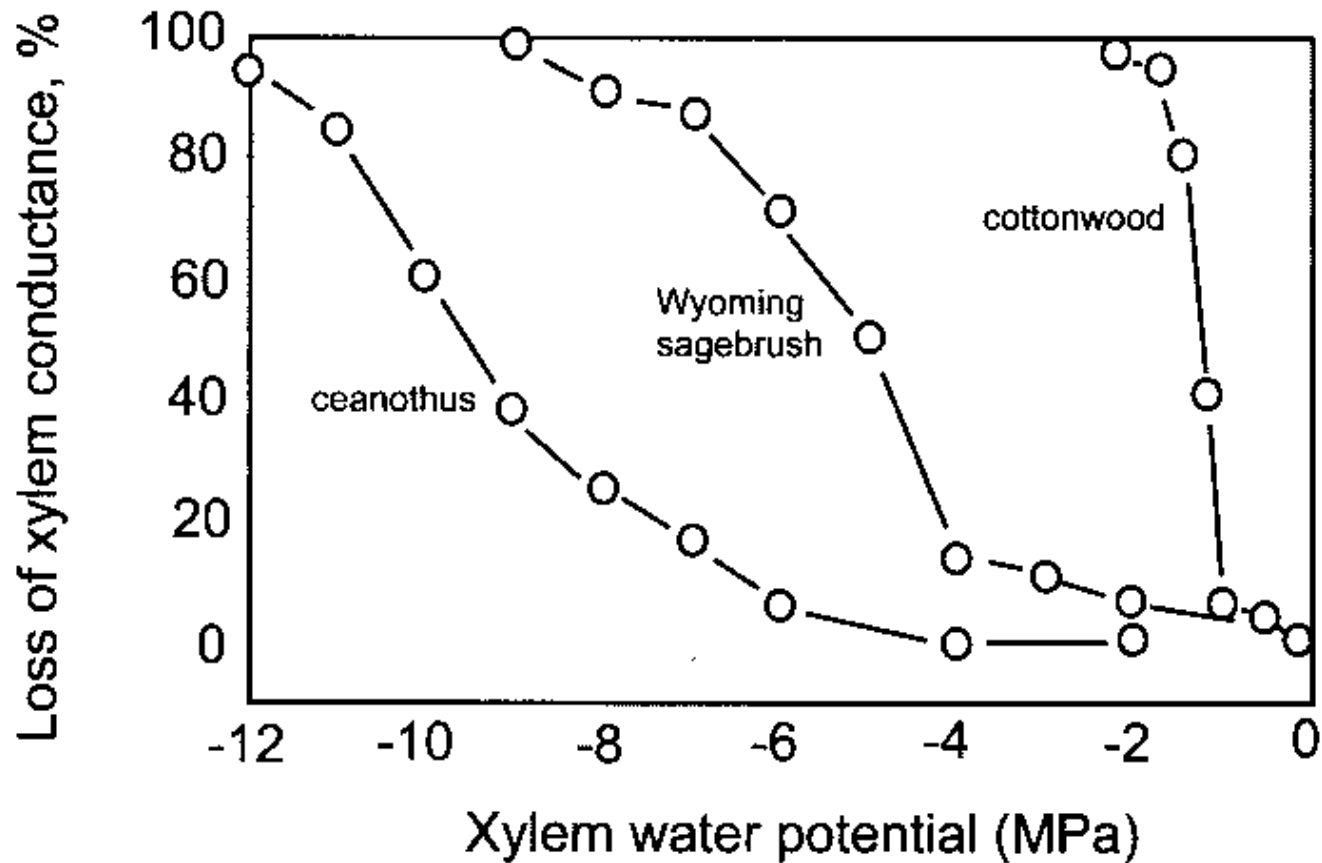
Abiotic Environment

- Water - Transpiration



Abiotic Environment

- Water – Plant adaptations



Abiotic Environment

- Water – Forest Management
 - Forest managers must consider:
 - Competition for water
 - Controls on nutrient cycling and availability
 - Regeneration
 - Socioeconomic factors
 - Management often leads to:
 - Major impacts on water cycle
 - Alterations to soil physical properties
 - Erosion and sedimentation