

Conifer Forest Biomes

Focus on Rocky Mt Conifer Forests
Review Knight, Ch. 12

11/11/09

1

FOREST BIOMES

Forest types can be divided based on three main climatic zones:

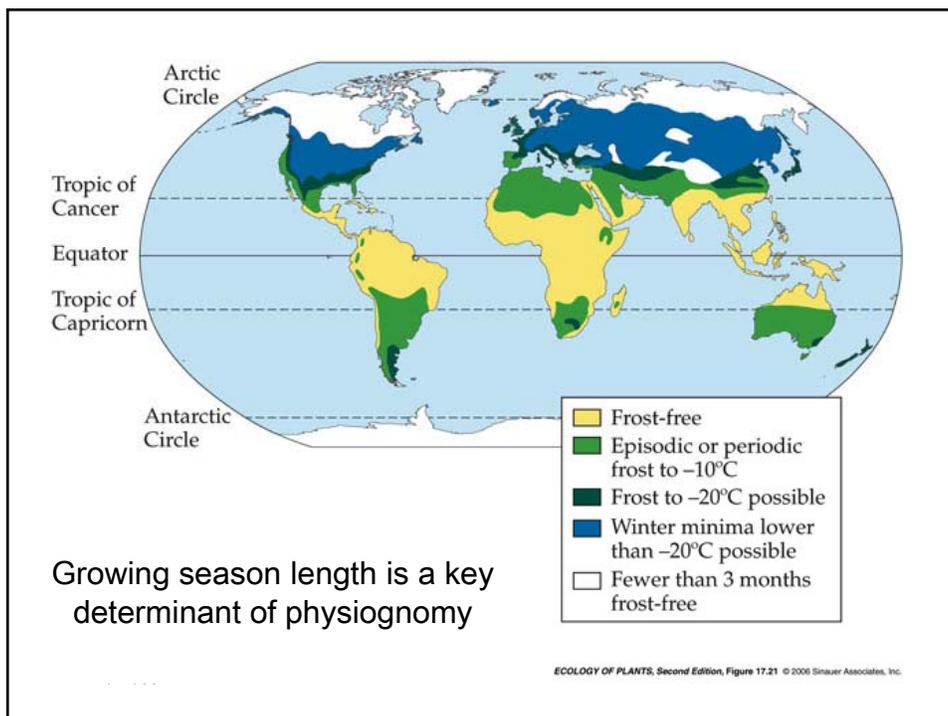
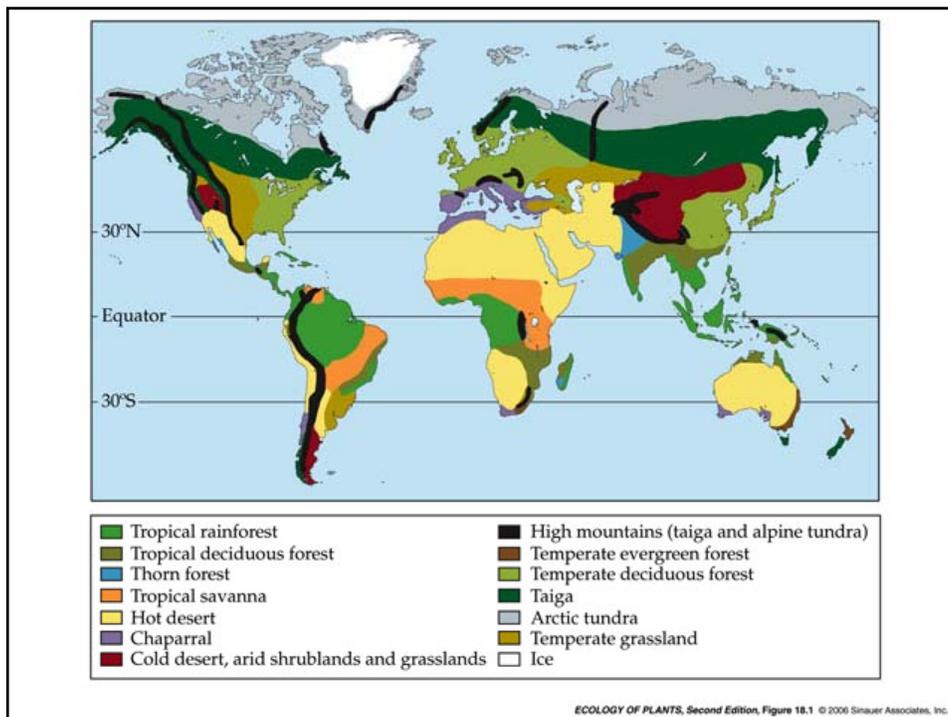
- tropical (warm year-round)
- temperate (warm summers, cool winters)
- boreal (warm, short summers, cold winters)

Types can also be classified by physiognomy:

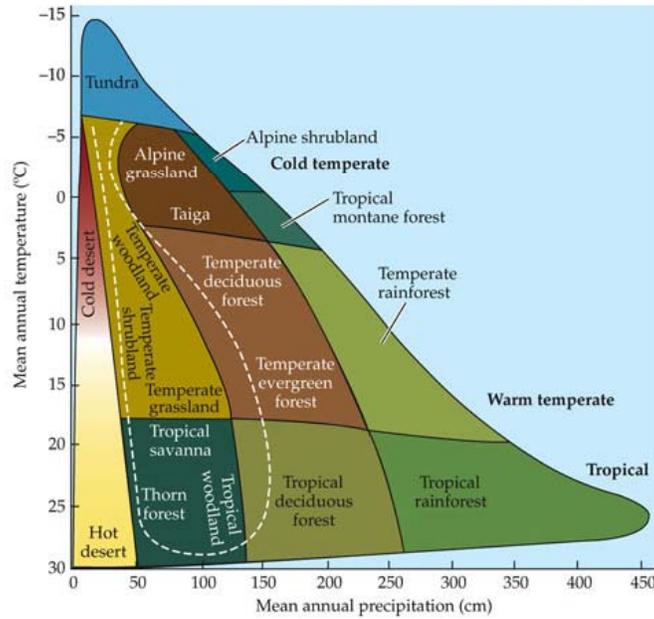
- broad-leaved vs. needle-leaved or coniferous
- deciduous vs. evergreen

11/11/09

2

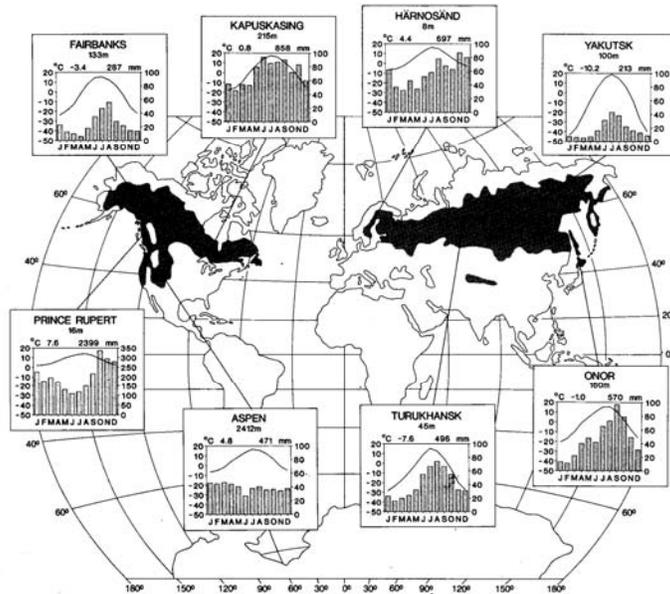


Biome distribution in climate space



ECOLOGY OF PLANTS, Second Edition, Figure 18.2 © 2006 Sinauer Associates, Inc.

Coniferous Forests: boreal and temperate combined



11/11/

6

Coniferous Climates

- Growing season temp $>10^{\circ}\text{C}$ for wood to form
- Temperate evergreens (e.g. conifers) grow in drier areas than deciduous trees, with wet/dry seasonality
- Three main types
 - Boreal forests have VERY cold winters and low precipitation
 - Montane forests are somewhat milder and wetter than boreal
 - Coastal forests are very wet and mild but have growing season moisture deficits so deciduous trees are limited

11/11/09

7

Environmental Gradients

- Many vegetation zonation systems have been based on elevation, but this is too simplistic
- Elevation gradients are **complex gradients** because they comprise several factors

11/11/09

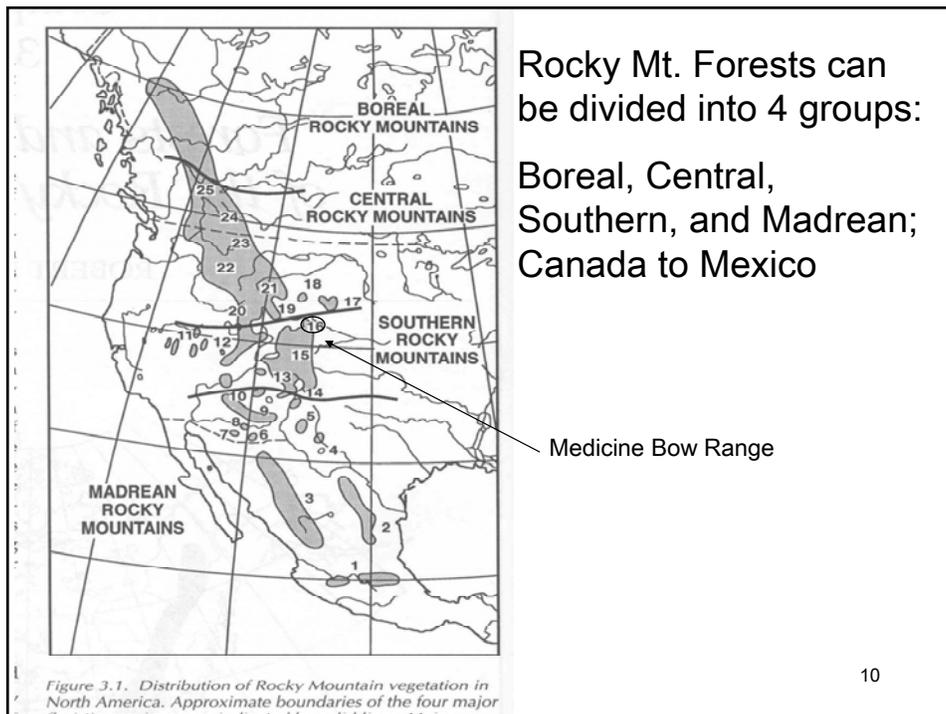
8

Environmental Gradients

- Aspect and slope impose an additional moisture gradient that is critical in determining vegetation distributions
- Edaphic conditions make up a third, complex environmental variable that can influence species distribution
 - Trees dominate on thin, rocky or gravelly soils
 - Grasses and forbs (meadows) tend to dominate fine-textured soils

11/11/09

9



10

Boreal Rockies

- Transitional to true boreal forests (covered later)
- Remote, little studied
- Common trees:
 - Northern range limit of lodgepole, subalpine fir
 - Also black spruce, Englemann spruce, white spruce
- Disturbance:
 - long fire return intervals (200-400 years)
 - Stand replacing fires

11/11/09

11

Central Rockies

- Transitional between boreal and Cascades
- Pacific air masses influence both regions
- Common trees:
 - Lodgepole, Englemann spruce, subalpine fir
 - Whitebark and limber pine
 - W. hemlock, W. redcedar (Cascadian species add biodiversity)
- Disturbance:
 - large, stand-replacing fires
 - native insects (pine beetle, budworm)



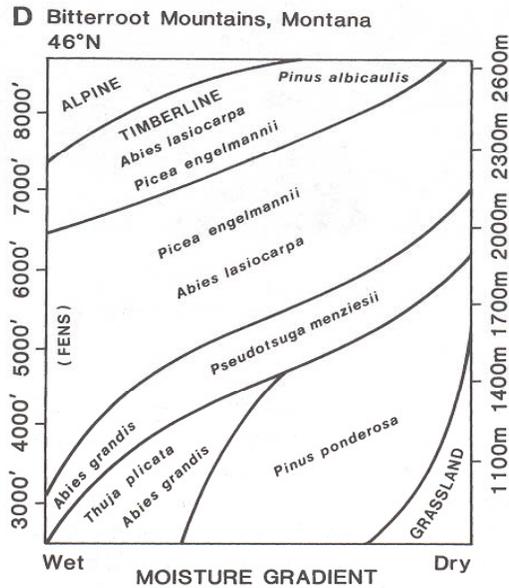
11/11/09

12

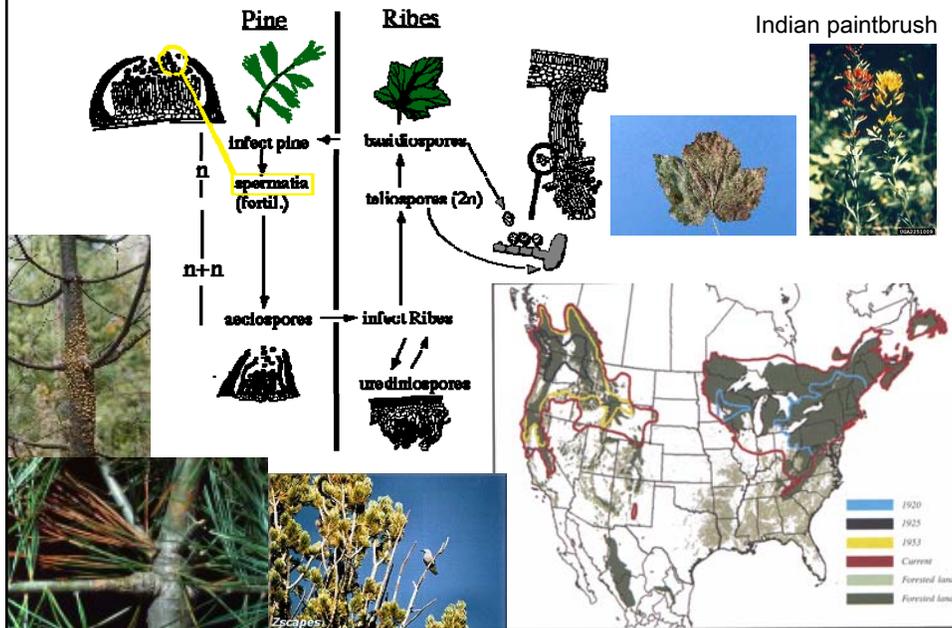
Elevation-Moisture Gradients in the Central Rockies

- When elevation and topo-moisture gradients are plotted at right angles, vegetation zones appear as diagonal bands
- Vegetation types occur at higher elevations on drier sites or lower elevations on moist sites

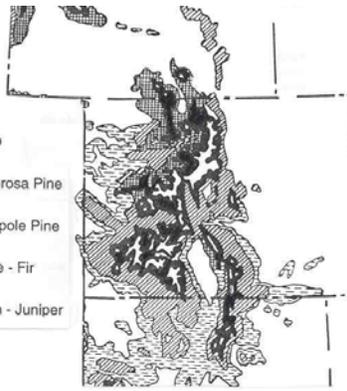
11/11/09



White pine blister rust: exotic agent of disturbance

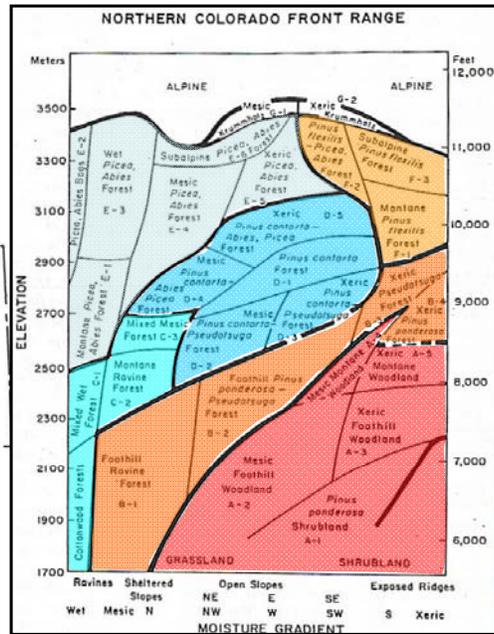


Southern Rockies



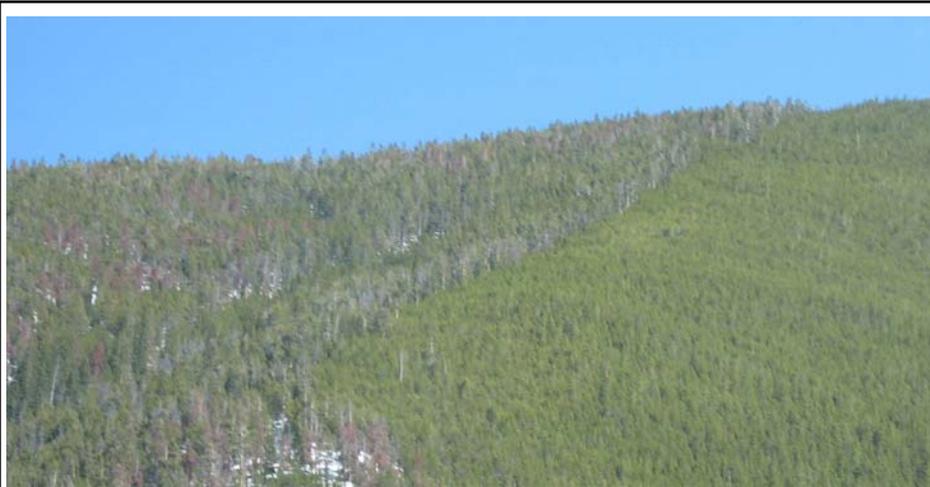
- LEGEND
- Ponderosa Pine
 - Lodgepole Pine
 - Spruce - Fir
 - Pinyon - Juniper

11/11/09



Robert Peet 1981

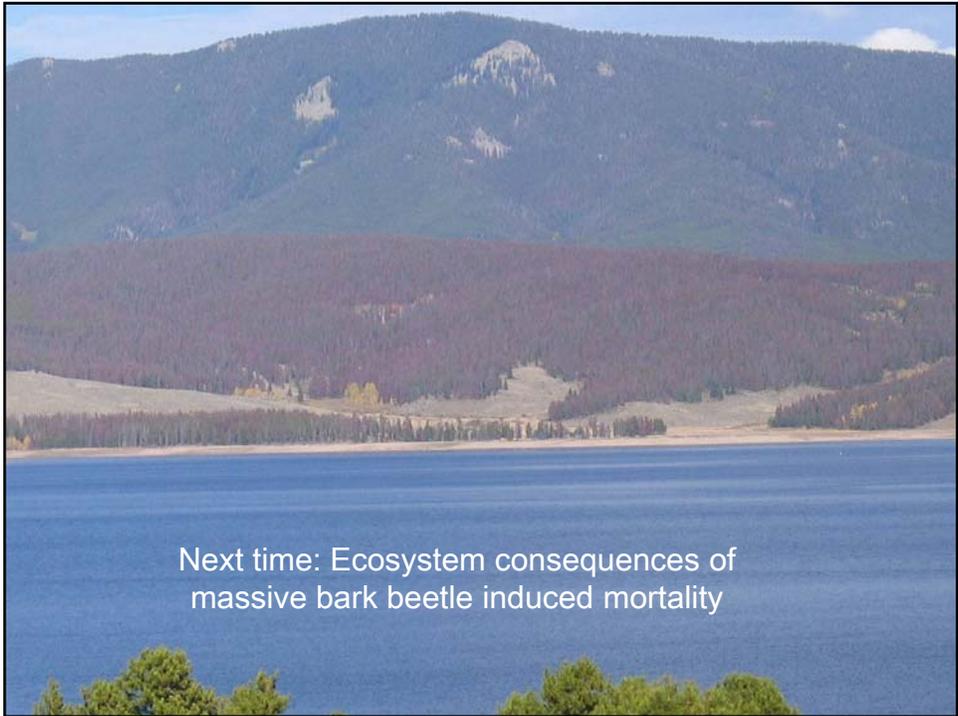
15



Past management history interacts with disturbance regime to influence spatial patterns and succession

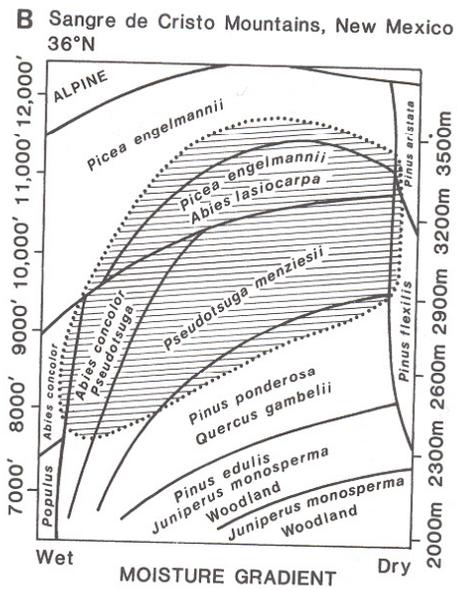
11/11/09

16



Elevation-Moisture gradients in the Southern Rockies

Dashed area can be dominated by aspen after disturbance



11/11/09

18

Piñon pines are dying from widespread ips beetle and drought

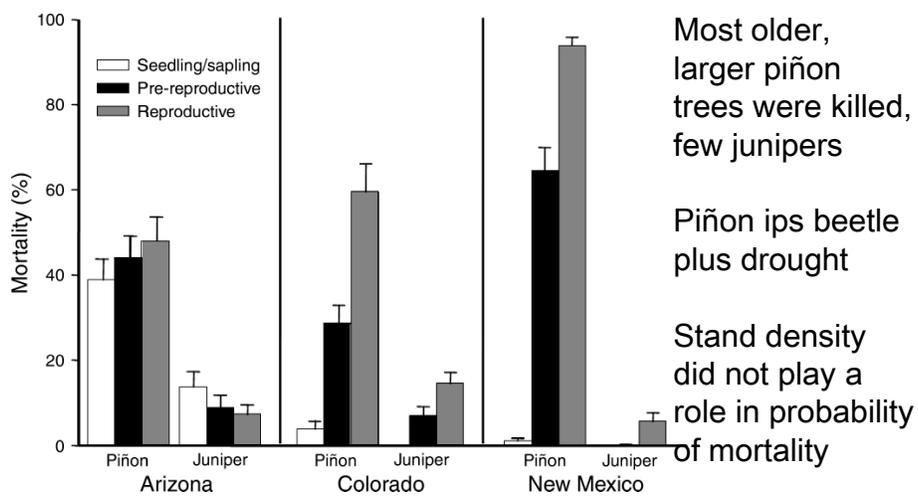


Skeletons of trees that died in 2003 after several years of drought (Photo credit: N.S. Cobb)

11/11/09

19

Piñon mortality varies with size class and study area



11/11/09

Floyd et al. 2009

20

Want more info on vegetation types?

Try Bioimages, which has links to North American Ecoregions with lots of nice photos of dominant species and background

<http://www.cas.vanderbilt.edu/bioimages/frame.htm>

Terrestrial Vegetation of North America
(Barbour & Billings, 2000)

11/11/09

23

Some things to think about

- How do elevation and topography interact to affect growing season length?
- Why do ponderosa forests have high fire frequency but lodgepole forests low?
- How might global warming interact with insect infestations?
- What factors govern the likelihood of lodgepole succession to spruce-fir?
- Can we predict successional trajectories following massive forest mortality events?
- Review field trip notes and handouts

11/11/09

24