

## NORTHERN CONIFEROUS FORESTS

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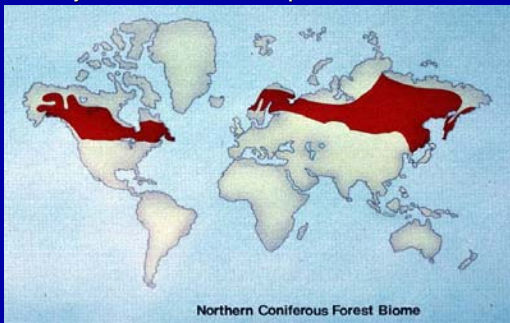
## Northern Coniferous Forest

- Taiga
  - Russian for the forests that occupy the northern latitudes of Siberia, Russia, and northern Europe
- Boreal Forest
  - From “Boreas”, the Greek god of the north winds



### Northern Coniferous Forest

- 17% world's land area
- 33% world's forested land area
- 2/3 occurs in Siberia
- only occurs in Northern Hemisphere



### Northern Coniferous Forest in North America



## Northern Coniferous Forest

- Vast forested land
- Heavily and recently glaciated
- Numerous lakes and bogs - big and small
- Relatively uninhabited - except at southern margins
- Relatively uninfluenced by human activity—but that's changing
- Dominated by a relatively few species of trees



## Three Major Conifer Forest Types

- Closed forests of the south
- Lichen woodlands farther north
- Forest-tundra transitional forests



## CLIMATE: Northern Coniferous Forest

- Cold continental or sub-polar
- Temperature: wide variation
  - Winter: very cold (to -70F)
  - Summer: warm but seldom hot (to 80F)
  - Freezing temperatures any day of the year
- Precipitation:
  - Variable by region (10"- 40")
  - Dominated by snow
- Growing Season:
  - Short: 60-100 days
  - Limited by cold soils and cold temperatures

## Evergreen Conifers

- Evergreen nature makes them well adapted to harsh growing conditions and short growing seasons
  - Don't have to re-grow photosynthetic machinery every year
  - Conical shapes help them shed snow loads



## Evergreen needles

- Small surface area and thick waxy cuticles limit water loss
- Withdraw fluid from cells in winter to inhibit freezing



## ...but broadleaved trees also have adaptations

- Often disturbance related
- Produce lots of wind-borne seeds for fast and long distance dispersal
- Reproduce vegetatively following disturbance
- Most are shallow-rooted to grow in shallow wet or rocky soils
- Most grow rapidly following disturbance
- Many bend but don't break—or recover rapidly following breakage



## Principal Tree Genera

### Conifers (most widespread):

- Pines
- Spruces
- Larches
- Firs

### Broadleaves (typically niche specific or disturbance-related):

- Aspens, cottonwoods, and poplars
- Birches
- Willows
- Alders



## Simple Systems: Structure and Composition



- Relatively few species of trees
- Small in stature; often widely spaced
- Typically sparse understories

## High potential for wood production due to vast expanse



## SOILS: Northern Coniferous Forest

- **Mineral Soils**
  - Derived from the decomposition of rock
- **Outwash soils**
  - Deposited from melting glaciers
- **Organic Soils**
  - Derived from slowly decomposing plants



## Mineral soils

- Formed by decomposition of sand, silt, and clay
- Often thin over solid rock
- Layers indicate both the accumulation and leaching of specific nutrients
- Typically higher in nutrients and better drained than organic soils
- Support more diverse plant life and more productive forests than organic soils



## Glacial Outwash Soils



## Organic Soils

- Formed in cold, moist environment that slows decomposition
- Dominated by dense, rapidly growing moss
- Stiff, waxy evergreen needles breakdown slowly
- Typically very moist and low in nutrients
- Plants must tolerate high moisture and acidity



## Tamarack (eastern larch)



## Black Spruce (*Picea mariana*)



## Influence of Permafrost

- Occurs on both mineral and organic soils
- Often patchy rather than continuous
- Typically lies below the surface
- Some forests can develop on top of it
- Often causes jack-strawed trees



## Strands of black spruce over permafrost



## Jack-strawed black spruce on permafrost



## Productivity and Nutrient Cycling

- Generally low productivity
- Soils acidic and low in nutrients
  - Most nutrients held in foliage and organic layers rather than in the soil
  - Nutrients returned slowly to soil via decomposition
- Creates potential for nutrient loss due to harvesting



## Primary Disturbance Agents

- Fire
- Wind
- Glaciers
- Avalanches
- Timber Harvest



## Fires in Boreal Forest

OM gets very dry in summer—ignition from lightning  
 Few roads and low population results in large fires that burn for a long time  
 Can burn underground in winter and reappear next summer



## Why are these forests important?

- Wood production—to meet increasing demand from both developed and developing countries
- Store vast amounts of carbon—in the trees and in the organic layers
- Home to many species of wildlife, both permanent and migratory



## Wildlife



## Issues and Concerns

- Global climate change
  - Trees adapted to cool, wet conditions. Factors that warm and dry will create stress—increasing susceptibility to insects, diseases, and fire
  - Niches likely to move many times faster than trees can migrate.
  - Not all areas will warm and dry at same rate—likely to affect transition zones the most. Some areas may become more productive; some less.
- Rate of timber harvest
  - Increased world-wide demand dramatically increasing rate of harvest
  - Most harvesting is by clear cutting (some of the largest in the world)
  - These forests (and litter layers) are important for carbon sequestration
  - Need to leave slash on site; protect organic layers; be aware of impact on permafrost
- Difficult reforestation and slow growth rates
- Potential for moving insects and disease across borders and oceans with log import-export

### Boreal Forest: British Columbia

western redcedar, white spruce, subalpine fir  
mixed broadleaves (avalanche chute & river)



### Boreal Forest: Northern Minnesota

red pine  
*Pinus resinosa*



### Boreal Forest: Alaska

black spruce  
*Picea mariana*

white spruce  
*Picea glauca*



### Boreal Forest: Alaska

white spruce, quaking aspen, paper birch



### Boreal Forest: southern Norway

silver birch: *Betula pendula*



### Boreal Forest: Alberta, Canada

white spruce and subalpine fir



**Boreal Forest:  
Alaska**

**black spruce  
and  
white spruce**



**Boreal Forest: eastern Canada**  
white spruce, balsam fir, and paper birch



**Boreal Forest: Alaska**

white spruce, quaking aspen and paper birch

