

General Themes (I)

Lecture 12

What is a Forest?



A forest is a vegetative community dominated by trees and other woody perennials.



What Is a Tree?

A perennial woody plant characterized by one main stem or trunk bearing a more or less distinct and elevated crown of branches. Trees are generally larger than shrubs (six metres).

Trees Fall Into Two Main Groups

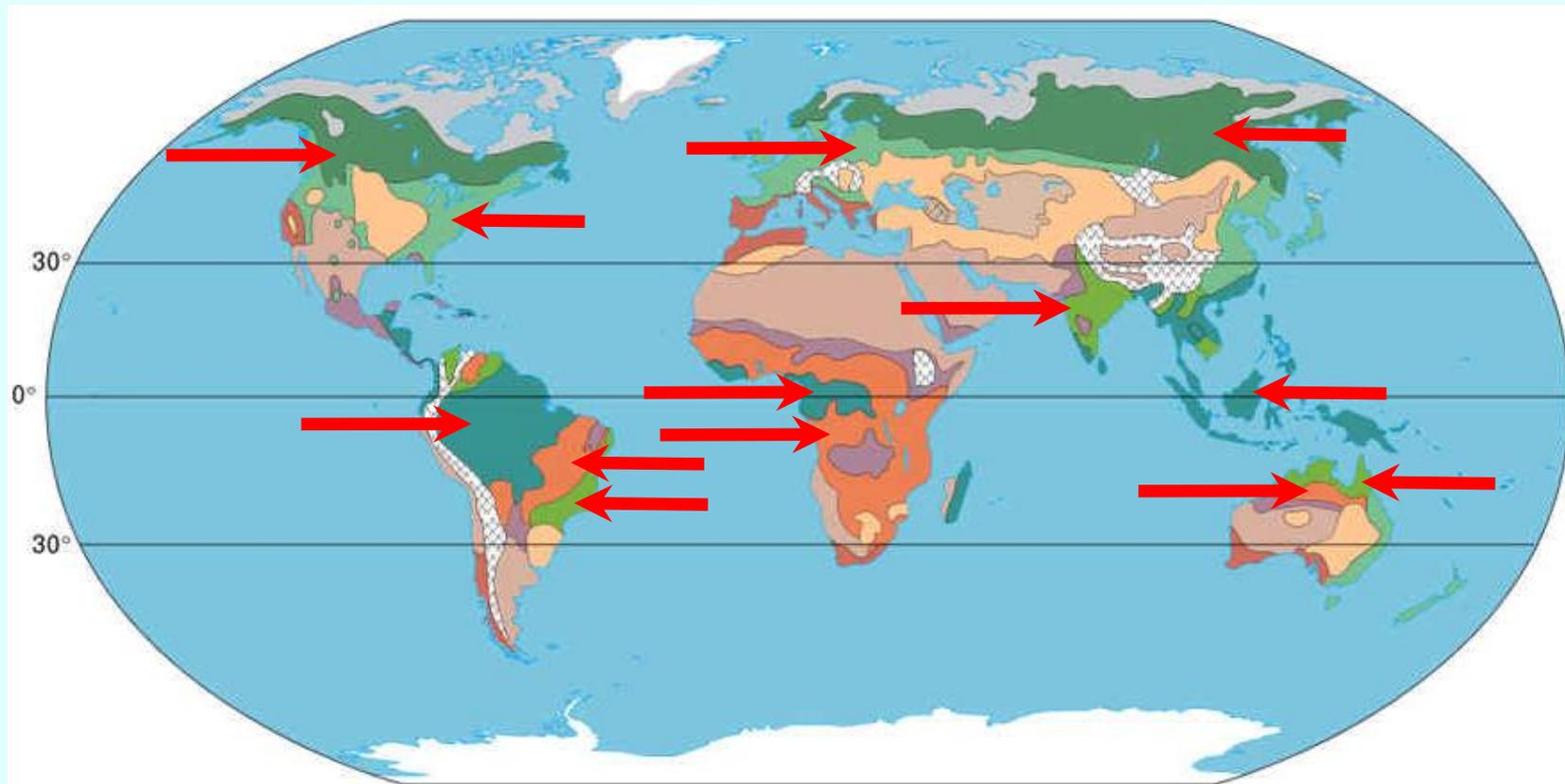
Angiosperms

- Enclosed seeds, flowering plants.

- **Gymnosperms**

- Naked seed plants, or cone bearers (conifers).

The Worlds Major Forest Biomes



□ Polar ice cap

□ Tundra

■ Boreal forest (taiga)

■ Temperate forest

■ Mediterranean scrub and woodland

■ Grassland

■ Desert

■ Tropical rainforest

■ Tropical seasonal forest

■ Savanna

■ Tropical thorn scrub and woodland

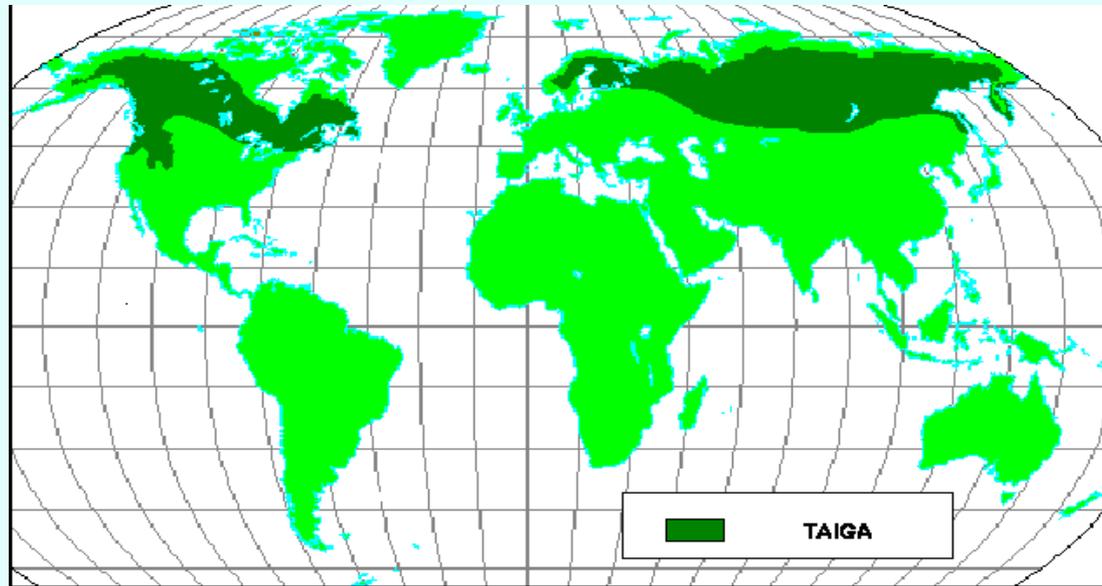
■ Mountain

The World's Major Forest Biomes

Temperate forests account for 44 percent of the world's forest area and tropical and subtropical forests 56%.

**Plantations – both temperate and tropical –
comprise about 7 percent of all forests
-produce about 35% of world roundwood**

Boreal Forest Biome



The boreal forest biome, which is also known as the “taiga”, occupies a broad belt around the globe in the northern hemisphere south of the arctic tundra

Boreal Forest Biome

- Boreal forests are characterized by long severe winters and short cool summers with only 50-100 frost free days. Precipitation is low (400-500 mm.) falling largely as snow. however, available soil moisture is high.
- Low growth rates (1-1.5 m³/ha/annum

Boreal Forest Biome

- Breakdown of organic matter and nutrient release is slow and the forest floor is covered by deep organic litter.
 - Over 80% of above ground nitrogen is found in forest floor forest floor litter.

The Temperate Forests

- **Commercial productivity is higher than the boreal averaging 4-5m³/ha/annum but has been increased considerably in many areas through forest management.**

The Temperate Forests

- **This is the area occupied by the world's industrialized nations. In Asia and Europe most of the forest has been cleared for agriculture and urban infrastructure.**
- **In all areas there is a long history of exploitation for commercial timber.**

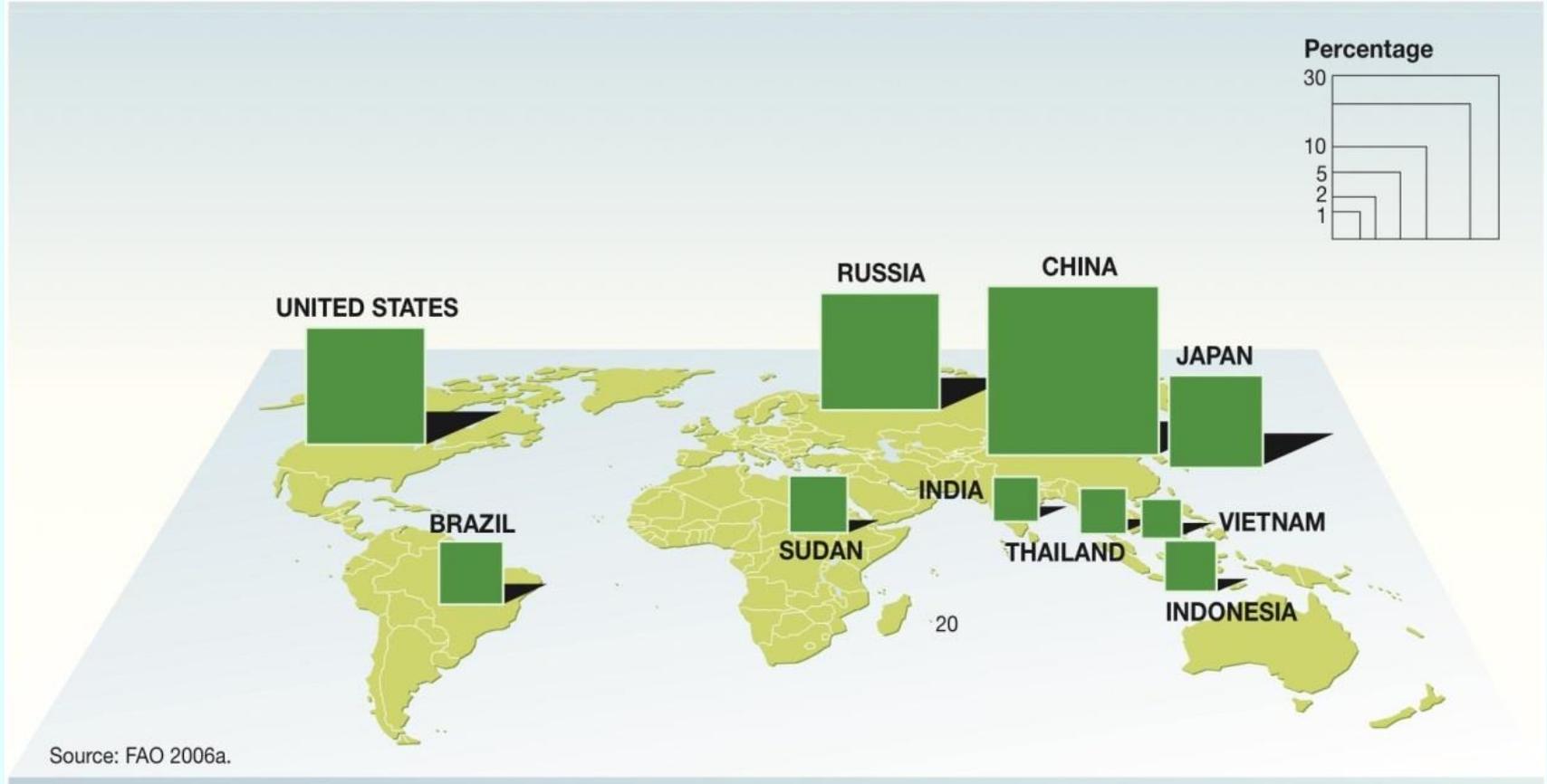


The Temperate Forests

There is virtually no primary forests remaining in the temperate forest zone.

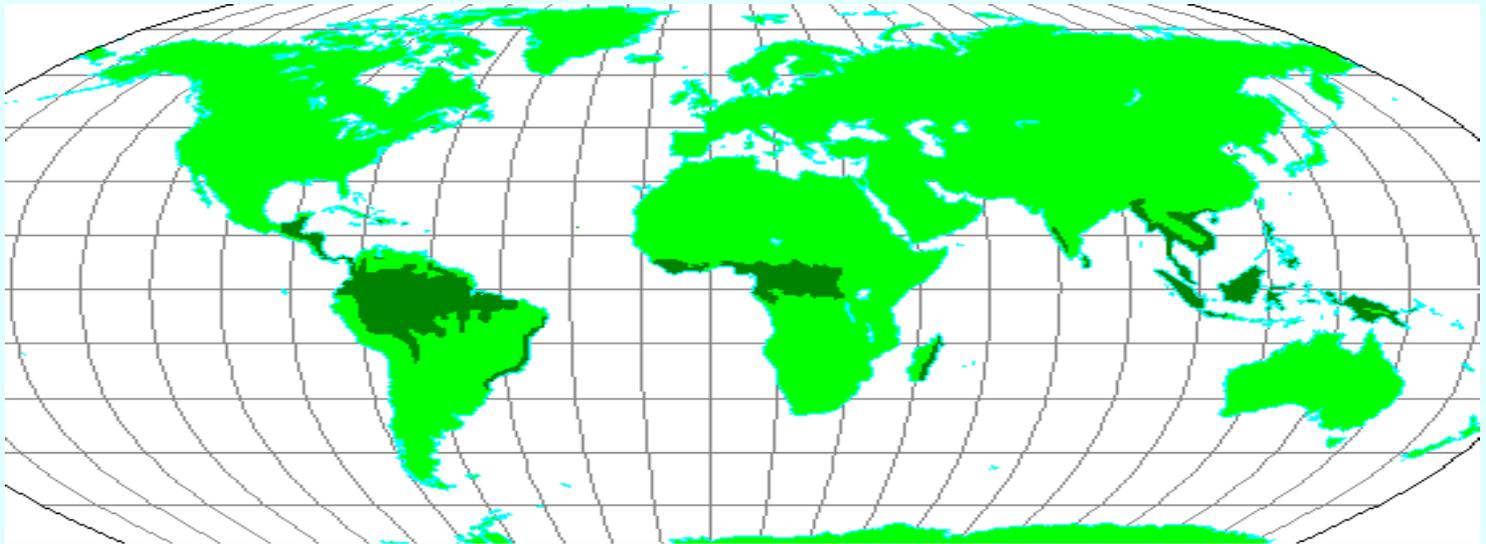
- China's forests have been cleared for intensive agriculture for over 4000 years.**
- Europe's forests have 2000 year history of exploitation are confined to relatively small areas of secondary forest.**
- Japan's forests are largely second-growth or plantations. In the mountains of Korea some intact forests remain.**

Ten Countries with the Largest Area of Productive Forest Plantations



Prepared by Philippe Rekacewicz assisted by Cecile Marin, Agnes Stienne, Guilio Frigieri, Riccardo Pravettoni, Laura Margueritte and Marion Lecoquierre.

Tropical Rain Forest



The equatorial or tropical broadleaf evergreen rainforest is mainly found in S. America, central Africa and the equatorial west coast of Africa, west coast of India, Burma, Malaysia, Indo-China Indonesia, Philippines, and Papua New Guinea.

Tropical Rain Forest



Image courtesy of Bart van der Kamp

- **The tropical rainforest is the earth's most complex biome in terms of structure and species diversity.**
- **Mean monthly temperatures are in excess of 18 degrees Celsius and annual rainfall is generally more than 2500 mm. The growing season is year round.**

Tropical Rain Forest

- **Tropical rainforests are very diverse biologically:**
 - **60% of all plant species**
 - **80% of all insect species**
 - **90% of all primates**
 - **hundreds of thousands, possibly millions, of species yet to identify.**

Tropical Rain Forest

Diversity of tropical rain forest includes tree species. Hundreds of genera and dozens of families are represented exhibiting very heterogeneous characteristics.

Tropical Rain Forest

6000 tree species in Brazilian Amazon. 50-100 different tree species per hectare of which only 1 or 2 may be of commercial importance.

- **300 species per hectare have been recorded in Peruvian Amazon.**

- **700 species per hectare in Kalimantan (approximately the same number as in the whole of North America)**

Tropical Rain Forest

Tropical forests generally exhibit low commercial productivity of only 0.3-0.5 m³/ha/annum

E.g. Brazilian Amazon has over 50 billion m³ of timber but log production is only about 4 million m³/annum.

Tropical Rain Forest

- **When tropical rain forests are cleared of vegetation they do not regenerate easily and do not regain their original structure and composition.**
- **Nutrients are leached from soils that are already nutrient deficient.**
- **Soils become compacted and harden (laterization).**

Waterlogging and erosion occur

Tropical Rain Forest



Image courtesy of Howard Harshaw

Cleared tropical rain forests frequently revert permanently to grasslands and derived savanna typified by palm trees and shrubs.

Tropical Seasonal Forest

- **The tropical moist deciduous (seasonal) forests are similar to the evergreen tropical rain forest in terms of temperature, growing season and diversity of species composition.**
- **However, they are typified by pronounced dry and wet (monsoon) seasons.**
- **Many species lose their leaves during the dry season.**
- **The zone is extensive in South America, South-central Africa, India and parts of S.E Asia.**

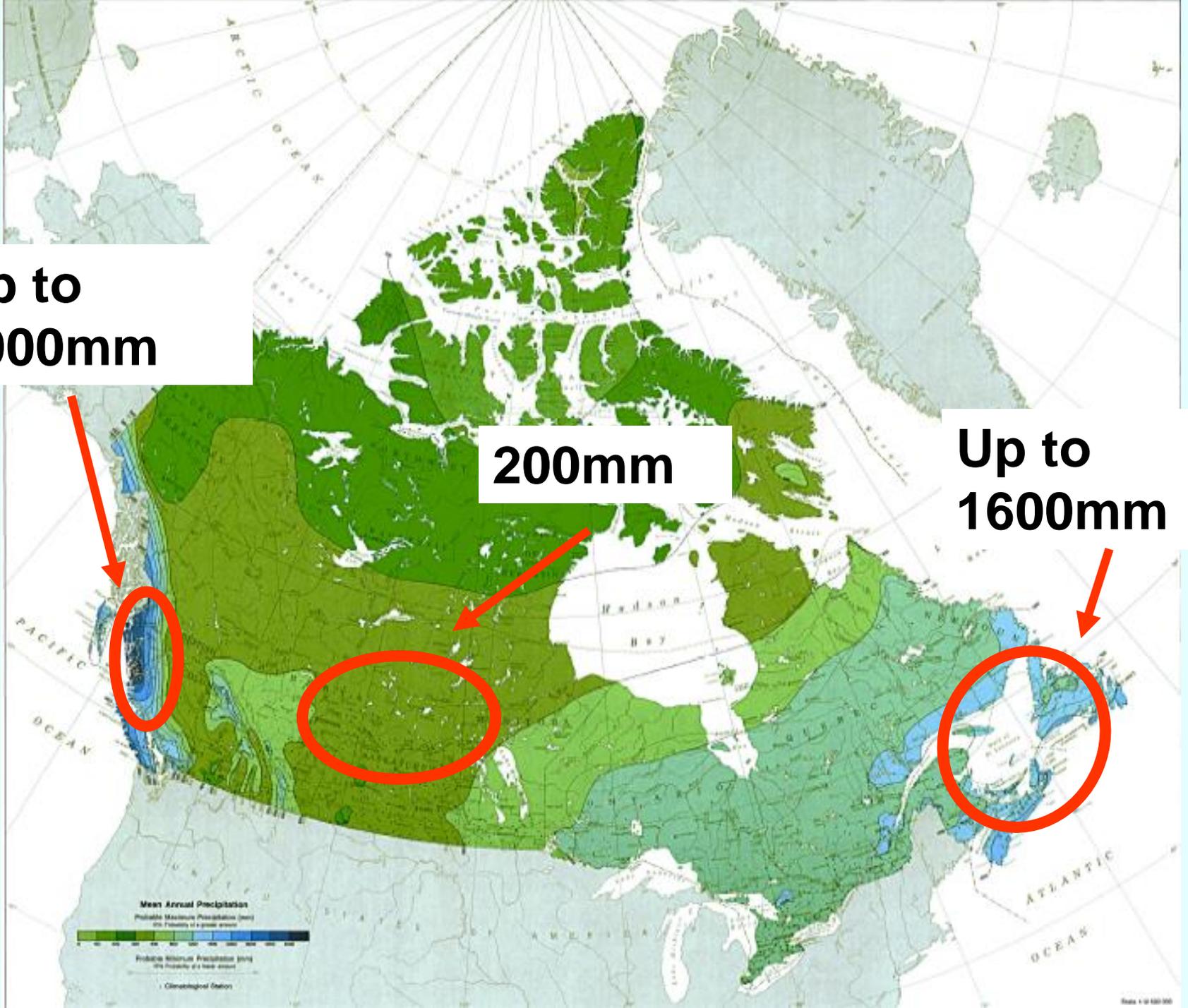
Forest cover

- Canada is about 45% forested
- 40% of Canada is too cold or too dry for trees

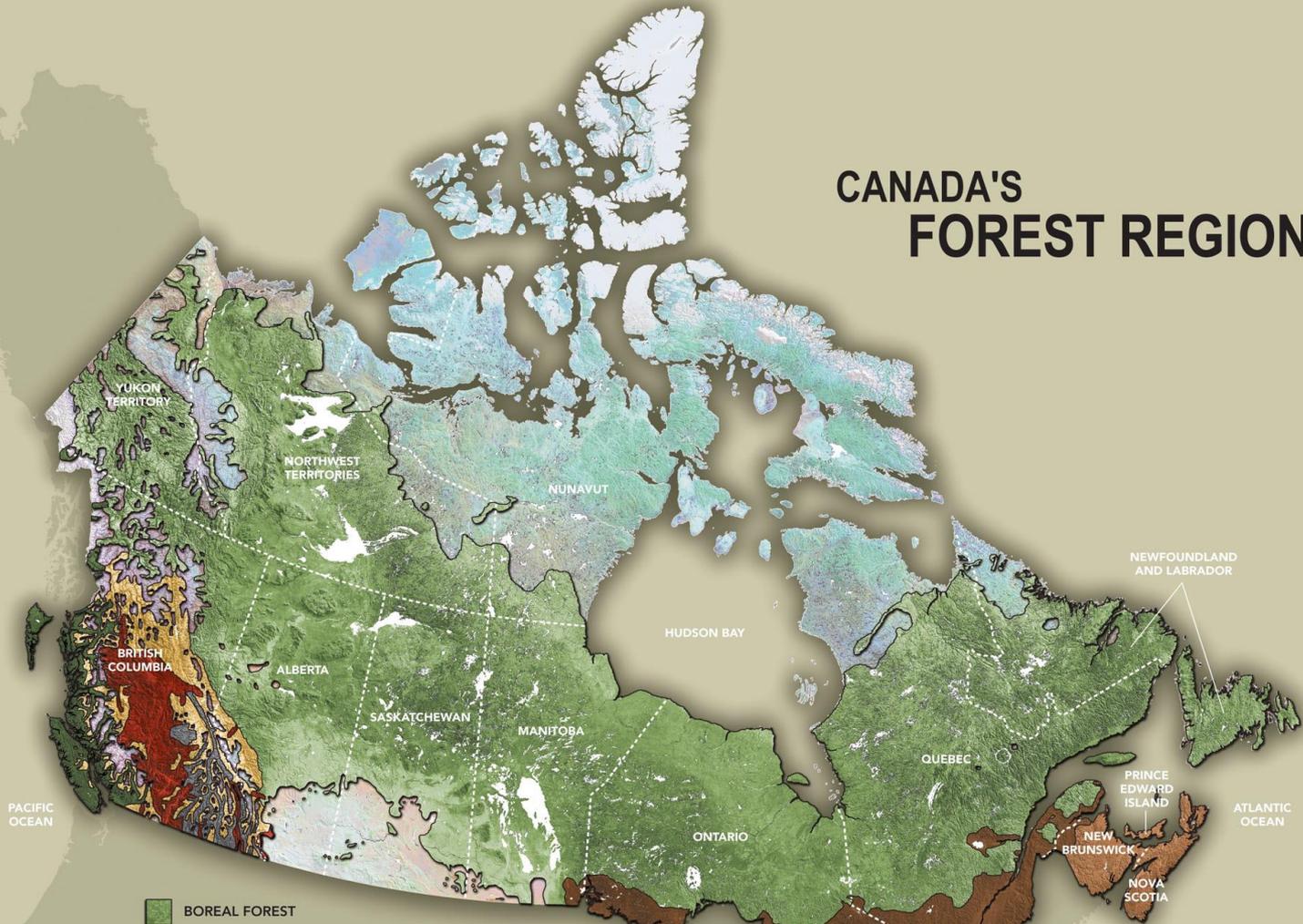
**Up to
5000mm**

200mm

**Up to
1600mm**



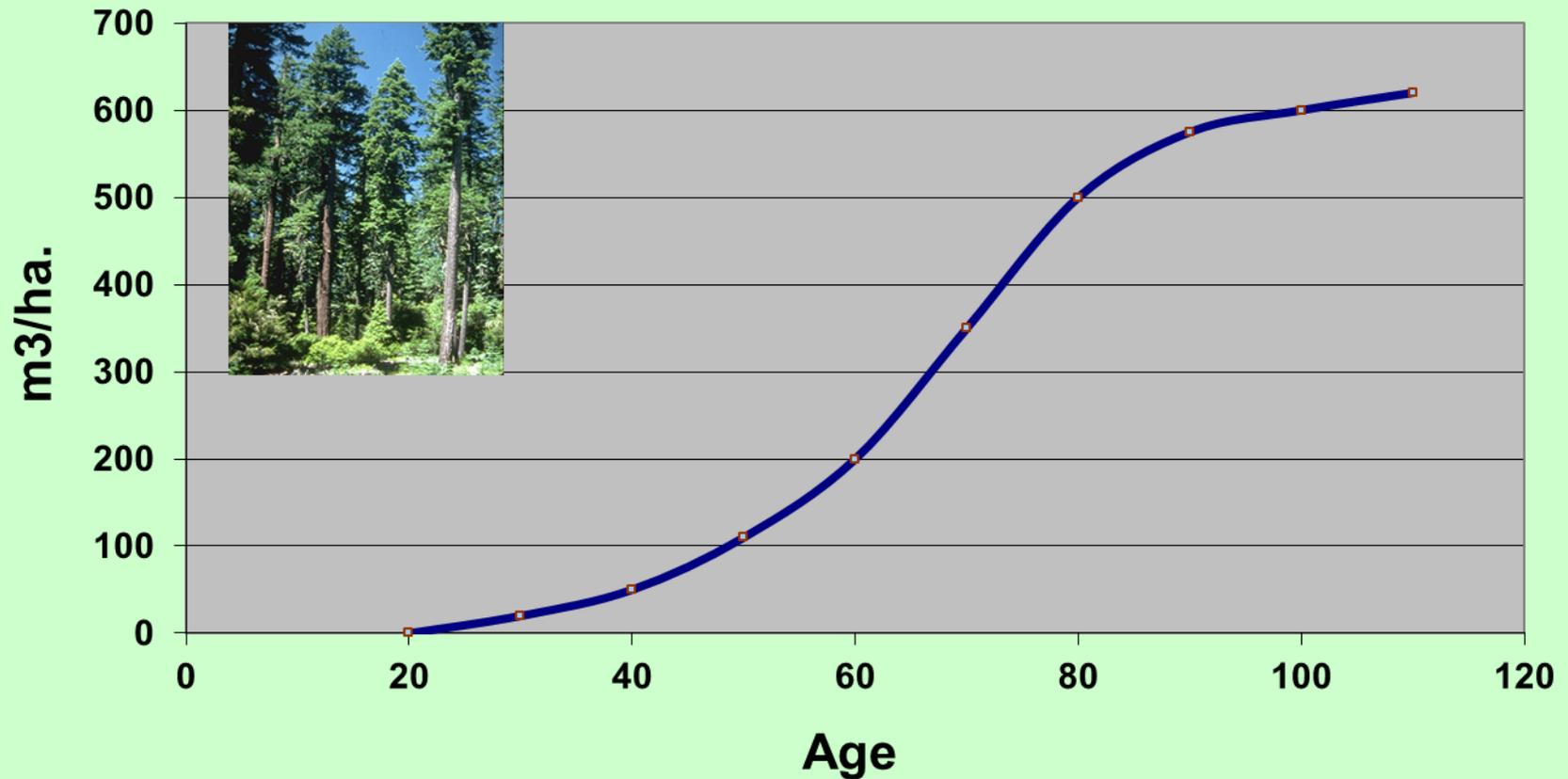
CANADA'S FOREST REGIONS



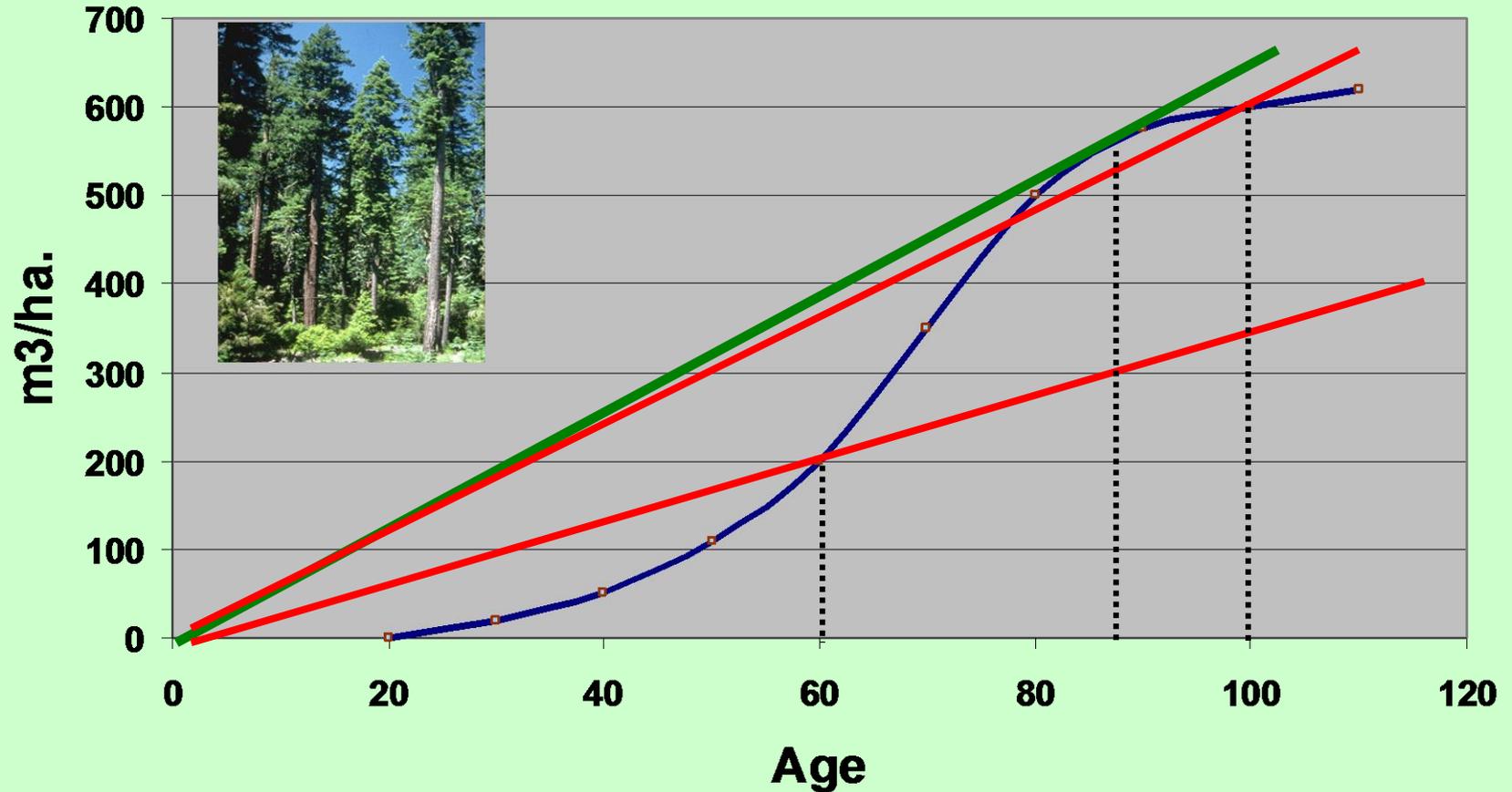
- BOREAL FOREST
- GREAT LAKES-ST. LAWRENCE FOREST
- ACADIAN FOREST
- CAROLINIAN FOREST
- SUBALPINE FOREST
- COLUMBIA FOREST
- MONTANE FOREST
- COASTAL FOREST
- NONFOREST
 - TUNDRA
 - GRASSLANDS

Comparing Productivity

Stand Volume as a Function of Stand Age



Maximum Mean Annual Increment



Maximum MAI = $550/85 = 6.47\text{m}^3/\text{ha./annum}$

Respiration

- **Release energy**
- **Priorities for energy**
 - **Respiration**
 - **Photosynthetic mechanism**
 - **(reproduction)**
 - **Primary growth**
 - **Secondary growth and compounds**

Respiration

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 - **(reproduction)**
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 - **Secondary growth and compounds**

Whittaker (1975)

“an ecosystem is a functioning system that includes an assemblage of interacting organisms (plants, animals, and saprobes) and their environment, which acts on them and on which they act”

Trophic Levels

Level 1: Plants and algae make their own food and are called primary producers.

Level 2: Herbivores eat plants and are called primary consumers.

Level 3: Carnivores which eat herbivores are called secondary consumers.

Level 4: Carnivores which eat other carnivores are called tertiary consumers.

Role of Disturbances

- Resistant
 - Ecosystem property of remaining essentially unchanged
- Resilient
 - Ecosystem property of recovering quickly
 - Recovering to what?

Ecosystem Management

- **Maintaining a healthy system**
 - What is “healthy”?
- **The heart of sustainability**
 - Meeting the needs of today and tomorrow