Evolution of North American Vegetation and Flora

The study of the North American flora and vegetation - its history and assembly - begins in the late Cretaceous with the major events staged later in the Tertiary of the Cenozoic.

The final shaping of North American (and Great Lakes) flora and vegetation occurs during the Recent Epoch (Holocene) following the glaciation of the Pleistocene.

North American Flora - the Fossil Record

To understand North American biogeography, follow it through the end of Paleozoic and Mesozoic.

Permian North America
260 mya

- N. America near equator
- Appalachian Mountains well developed
North American Flora - the Fossil Record

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Triassic North America
230 mya
- N. America moves north
- Extensive volcanic activity in oceanic western N. America

Jurassic North America
170 mya
- N. America moves north
- Appalachians eroding
- Western mountain building begins
- Interior sea forms

Cretaceous North America
100 mya
- Interior Seaway from Gulf of Mexico to Arctic Circle

North American Flora - the Late Cretaceous

The end of the Cretaceous and beginning of the Tertiary (100-50 mya) saw the warmest temperatures since the PreCambrian

Effect was widespread over latitudes

Cosmopolitan floras existed despite Pangaea breakup
Contributing to this moderation of climate were the large epicontinental seas that existed in North America and Eurasia in the Late Cretaceous due to high sea levels.

Water bodies absorb more heat than land and release it more slowly. These inland seaways lowered the intensity of seasonality - "lake effect" - as did the Tethys Sea during the Mesozoic.

More temperate/subtropical to higher latitudes.

An aerial view of the eastern coast line of western North America and the Interior Cretaceous Seaway, some 75 million years ago.

Also contributing to the warm and wet climate of much of North America was that low relief existed in much of North America. The Rockies form a mountain barrier that stretches from Canada through central New Mexico but were only of moderate relief in the Late Cretaceous.

Uplift of the present Rockies occurs 70-40 mya.

Also contributing to the warm and wet climate of much of North America was that low relief existed in much of North America. The Sierra Nevada were only a series of low foothills in the Late Cretaceous.

Uplift and tilting of the Sierra Nevada range begins 25 mya.
North American Flora - the Late Cretaceous

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High Cascades would not appear until the Pliocene around 10 mya.

Shade relief of the Cascades

North American Flora - the Tertiary

Paleocene of the Tertiary 65-66 mya
- warm temperatures, inland seas, and low relief
- tropical, subtropical, and temperate climates from southern United States to the Arctic

Paleothermometers indicate:
- temperature gradient
  - 0.3°C / 1° latitude (Paleocene)
  - 1.0°C / 1° latitude (today)
- 30° N it was 5-10°C warmer
- 80° N it was 30°C warmer
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### North American Flora - the Tertiary

Major points about the Tertiary - 1st half

1. subtropical (or temperate evergreen) forests up to 50° N latitude through Eocene

2. Araucariaceae type conifers go extinct in North America, but redwoods and dawn redwoods become dominant conifers

3. Grasses evolve and appear at the Paleocene/Eocene border (54 mya)

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4. Major radiation of deciduous forest families [Arcto-Tertiary Flora]
   - Fagaceae - beeches
   - but also rose, walnut, and maple families

5. Montane regions become dominant in western North America; pine family diversifies
   - Ponderosa pine: Canadian Rockies

6. Epicontinental sea in North America retreats to Gulf of Mexico; interior dries out

7. Euramerica separated by North Atlantic widening by 55 mya
Major points about the Tertiary - 2nd half

1. Significant cooling worldwide from late Eocene - Oligocene - Miocene

North American Flora - the Tertiary

- Gondwanan events affects Northern Hemisphere heat budget via ocean currents
  - Tasman Passage
  - Drake Passage

2. Cooling and drying of central North America forces the fragmentation and decline of the Arcto-Tertiary flora

Sequoia, now confined to coastal California and adjacent Oregon, had a Holarctic Tertiary distribution as indicated by some of its fossil sites ( ).
and the beginning of the four areas of forest endemism

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North American Flora - the Tertiary
Major points about the Tertiary - 2nd half
3. Rocky Mountain uplift finished by the Miocene (10 mya) and beginning for Sierra Nevada (25 mya) provided significant barriers to moisture

Rainshadow caused plains and prairie formation and the diversification of ungulates

Missouri, Pliocene 5-10 mya