

# The PA Flora from Macroevolutionary and Physiogeographical Perspectives




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## I. Overview of PA Flora

### A. Generalities

- 3009 vascular plant species (2/3 are native)
- 191 trees (130 native)
- 273 shrubs (170 native)
- 32 lianas (22 native)
- 70 vines (46 native)
- 116 extirpations



Rhoads & Block. 2007. *Plants of Pennsylvania*.

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## Overview of PA Flora

### B. Taxonomic (Phylogenetic) Breakdown




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## Overview of PA Flora

### B. Taxonomic (Phylogenetic) Breakdown




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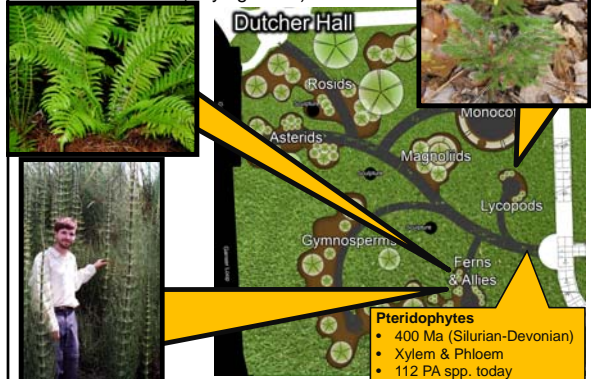
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## Overview of PA Flora

### B. Taxonomic (Phylogenetic) Breakdown




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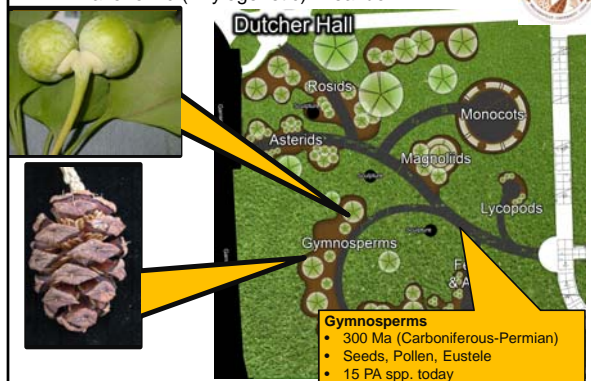
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## Overview of PA Flora

### B. Taxonomic (Phylogenetic) Breakdown




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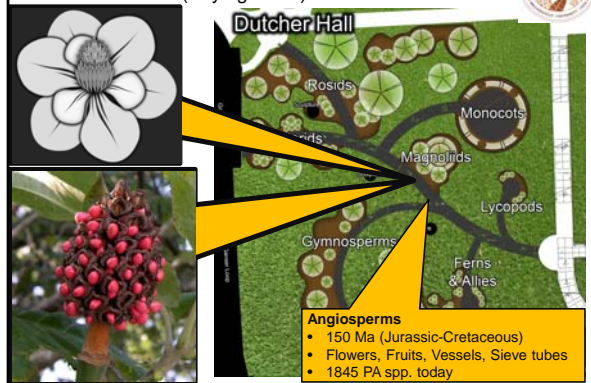
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## Overview of PA Flora

### B. Taxonomic (Phylogenetic) Breakdown




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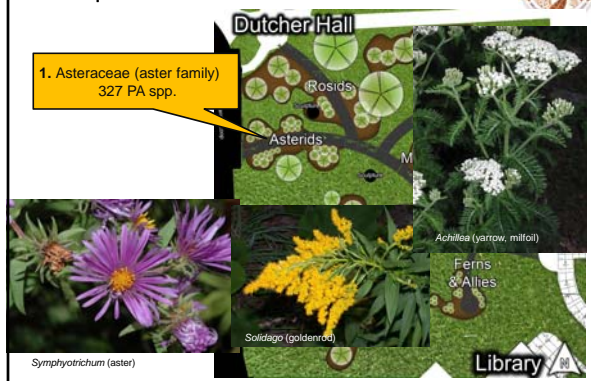
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## Overview of PA Flora

### C. Important Families




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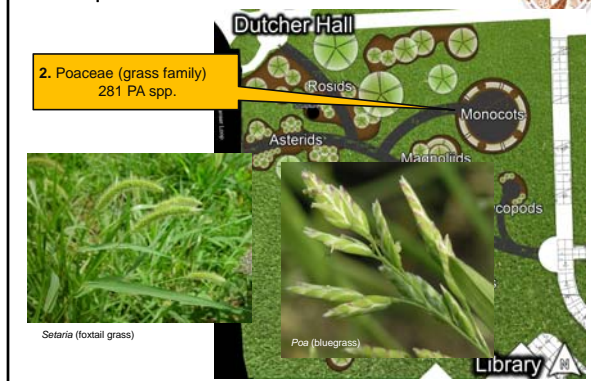
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## Overview of PA Flora

### C. Important Families




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Overview of PA Flora

C. Important Families

3. Cyperaceae (sedge family)  
275 PA spp.

Cyperus esculentus (yellow nutcracker)  
Cyperus papyrus (papyrus)  
Carex grayi (sedge)

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Overview of PA Flora

C. Important Families

4. Fabaceae (legume family)  
98 PA spp.

Chamaecrista (partridge-pea)  
Lathyrus (sweet-pea)  
Albizia (mimosa tree)

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Overview of PA Flora

C. Important Families

5. Orchidaceae (orchids)  
58 PA spp.

Goodyera (rattlesnake-plantain)  
Cypripedium (lady's slipper)

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## Overview of PA Flora

### D. Important Genera

- *Carex* (166)
- *Cyperus* (29) and *Juncus* (29)
- *Symphyotrichum* (26)
- *Solidago* (25) and *Dichanthelium* (25)
- *Quercus* (21)




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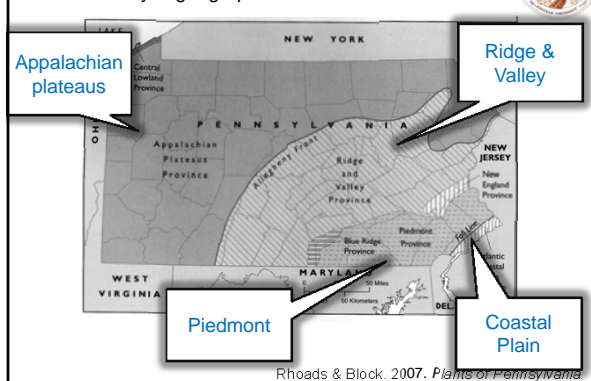
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## II. Physiogeography & The Flora

### 4 Main Physiogeographic Provinces



Rhoads & Block, 2007. *Plants of Pennsylvania*

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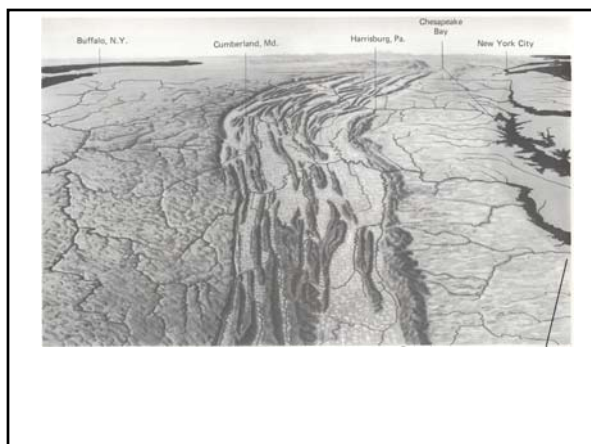
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## Physiogeography & The Flora

### 4 Main Physiogeographic Provinces



- *Geographic regions with uniform geo-physical characteristics.*
- *These influence broad patterns of plant distribution & diversity.*

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### A. Appalachian Plateaus

**Boundary:** R&V, marked by escarpment (Plateau front) rising several 100 ft.



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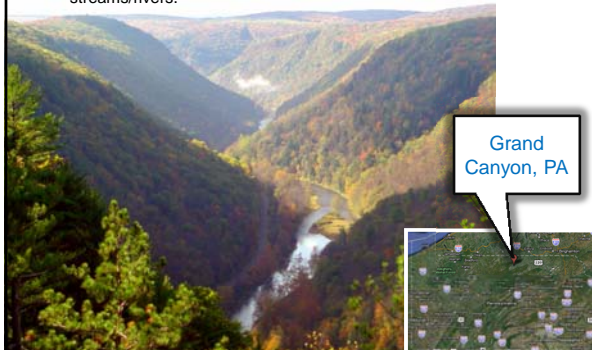
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### A. Appalachian Plateaus

**Topography:** High elevation, low relief: relief due to dissection by streams/rivers.



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## A. Appalachian Plateaus

### Surface Geology:

Resistant sandstone and shale outcrops, acid soils.

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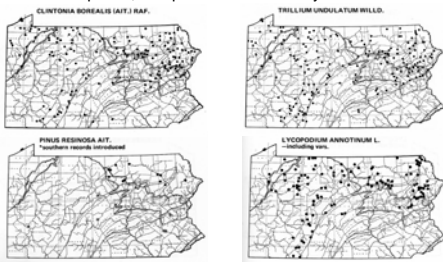
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## A. Appalachian Plateaus

### Vegetation:

Northern plants; and plants of Ohio Valley and Great lakes basin.



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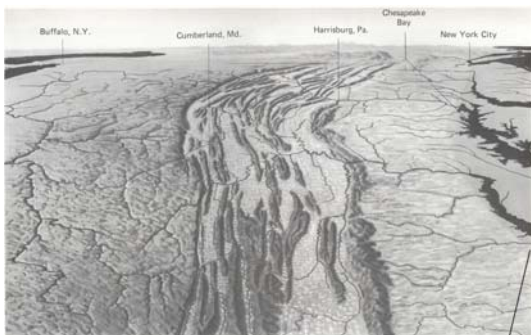
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## B. Ridge & Valley

### Boundary: AP & Piedmont



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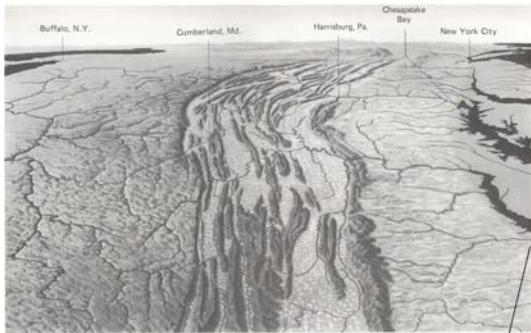
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## B. Ridge & Valley

**Topography:** Parallel high elevation ridges and lower valleys.



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## B. Ridge & Valley

**Surface Geology (main features):**

1. Ridges = resistant sandstone and acid soils;  
from ancient shorelines and offshore river-delta deposits.
2. Valleys = soluble limestone and circumneutral, basic soils;  
from ancient coral reefs.



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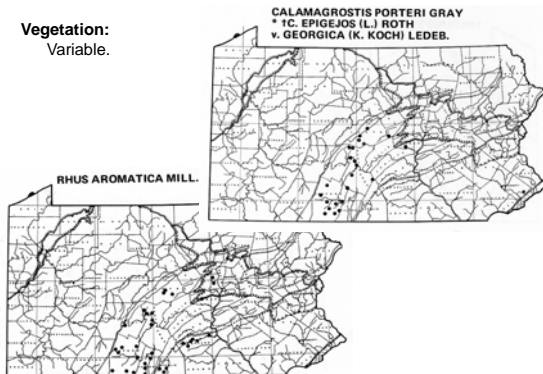
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## B. Ridge & Valley

**Vegetation:**  
Variable.



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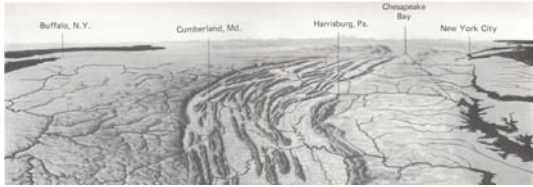
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### C. Piedmont

**Boundary:** R&V, CP



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### C. Piedmont

**Topography:**  
Low to moderate relief  
Complexly folded/faulted.



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### C. Piedmont

**Surface Geology:**  
1. Hilly on crystalline bedrock; acid soils. Ridges are sandstone outcrops.  
2. Low elevations limestone; circumneutral/basic soils.  
3. Metamorphic rocks & plutons.



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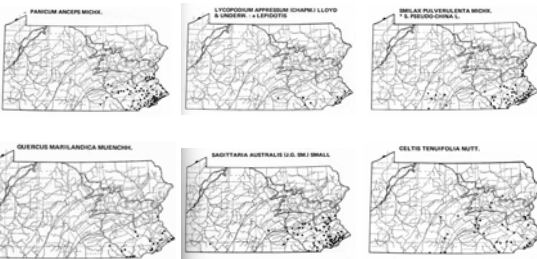
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### C. Piedmont

#### Vegetation:

Variable, including southern plants at northern edge;  
Lower Susquehanna Valley important.




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### D. Coastal Plain

#### Boundary: Piedmont, Fall Line.

#### Topography:

Flat, low.




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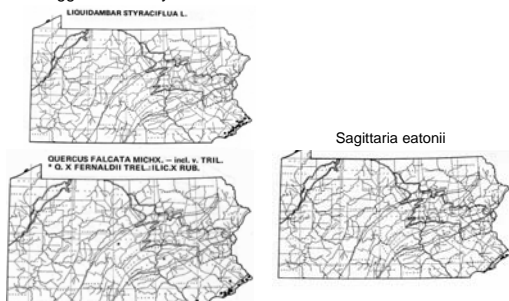
### D. Coastal Plain

#### Surface Geology:

Unconsolidated gravels and sands.

#### Vegetation:

Southern plants and Delaware River. Wetland plants common in sluggish waterways. Numerous invasives.




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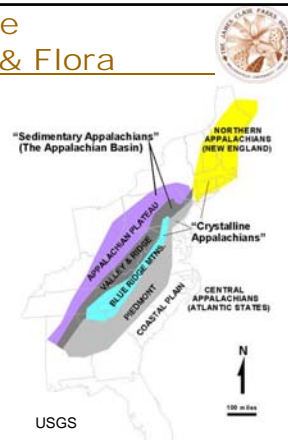
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### III. Evolution of the Physiogeography & Flora

Part of larger system based on Appalachian uplift.




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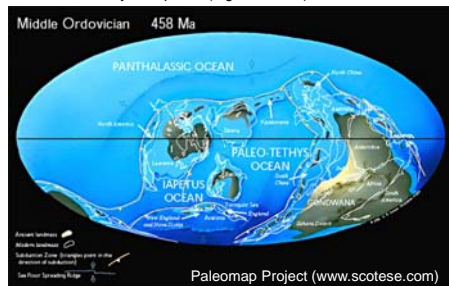
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### Evolution of the Physiogeography & Flora

The PA Flora 458 Ma:

- Little if any exposed land in PA.
- Few if any land plants (e.g. liverworts) or animals at this time anyway.




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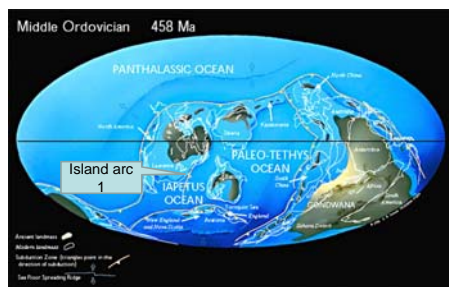
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### Evolution of the Physiogeography & Flora

A. Taconic Orogeny (450-435 Ma, Late Ordovician)




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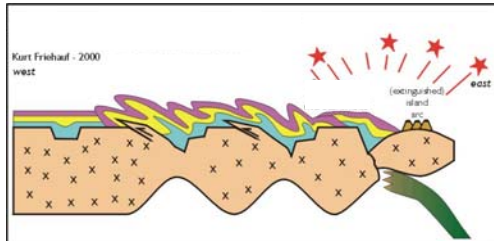
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## Evolution of the Physiogeography & Flora



### A. Taconic Orogeny (450-435 Ma, Late Ordovician)

- Island arc accretion
- Taconic Mountains (Pennsylvania) form.
- Piedmont = eroded & metamorphosed Taconic base.
- PA's first plants (bryophytes) along lakes and streams




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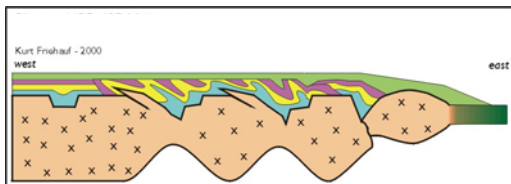
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## Evolution of the Physiogeography & Flora



### B. Post-Taconic Passive Phase (435-405 Ma, Silurian)

- Erosion
- Arthropods follow bryophytes onto land




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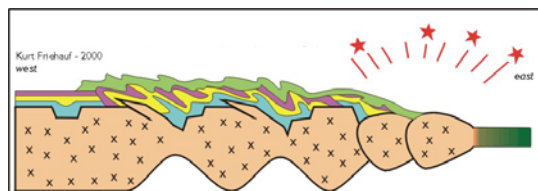
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## Evolution of the Physiogeography & Flora



### C. Acadian Orogeny (405-360 Ma, Devonian)

- Island arc #2 accretion
- Acadian Mtns.
- PA's first vascular plants diversify.




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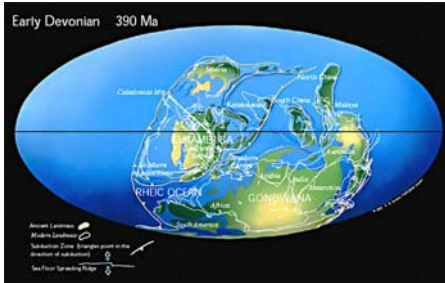
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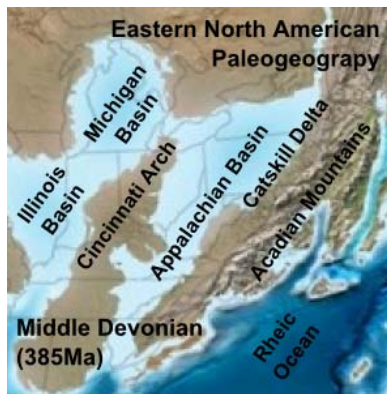
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## Evolution of the Physiogeography & Flora



### D. Post-Acadian Passive Phase (360-285 Ma, Carboniferous)

- Fern, Lycopod, Horsetail forest swamps yield coal beds in PA.
- Limestone of R & V valleys from reefs
- Sandstone of AP and R&V derived from delta sediment.




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## Evolution of the Physiogeography & Flora

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## Evolution of the Physiogeography & Flora



<http://extra-life.de/index.html>

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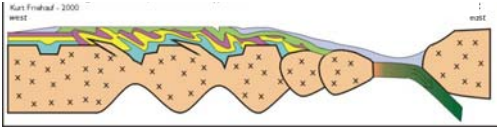
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## Evolution of the Physiogeography & Flora

D. Post-Acadian Passive Phase (360-285 Ma, Carboniferous)

- Fern, Lycopod, Horsetail forest swamps yield coal beds in PA.
- Limestone of R & V valleys from reefs
- Sandstone of AP and R&V derived from delta sediment.
- Acadian Mtns erode.
- Amphibians diversify.
- First seed plants (not yet dominant)




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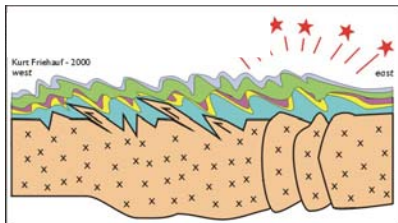
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## Evolution of the Physiogeography & Flora



### E. Alleghenian Orogeny (285-245 Ma, Permian)

- African/Eurasian Collision w/ NA




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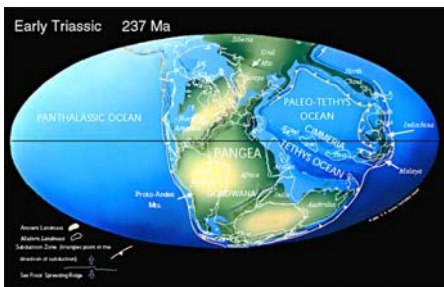
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## Evolution of the Physiogeography & Flora



### E. Alleghenian Orogeny (285-245 Ma, Permian)

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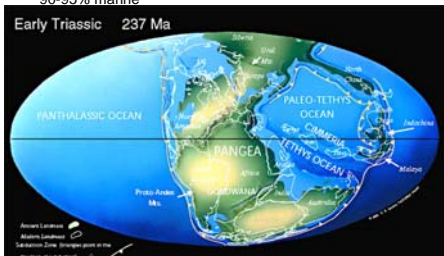
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## Evolution of the Physiogeography & Flora



### F. Pangean Passive Phase (245-210 Ma)

- Alleghenian Mtns erode?
- Mass extinction
  - 70% of terrestrial (incl. of formerly dominant amphibious plants & animals).
  - 90-95% marine




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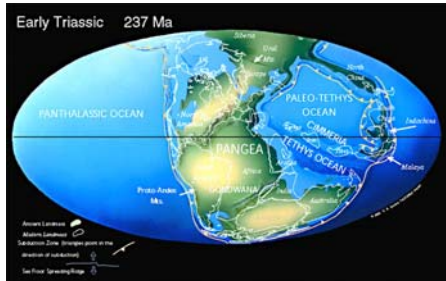
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### Influence on Biota Today?

- Extinction of giant lycopods, horsetails, & ferns.
- Seed plants (with their seeds & pollen) evolve to fill void & expand
- Extinction of dominant amphibians
- Reptiles (with their amniotic sac) evolve to fill void & expand




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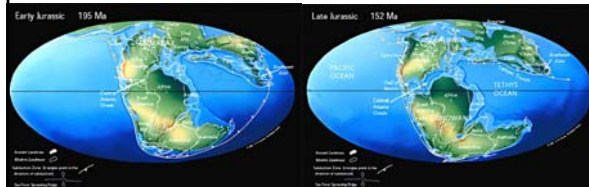
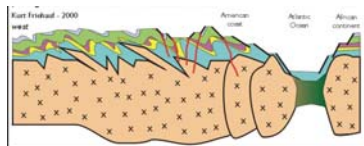
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### G. Mid-Jurassic Rifting Phase

- Jurassic.
- 210 Ma – present.
- Formation of Atlantic.
- Giant reptiles evolve.
- Angiosperms evolve.




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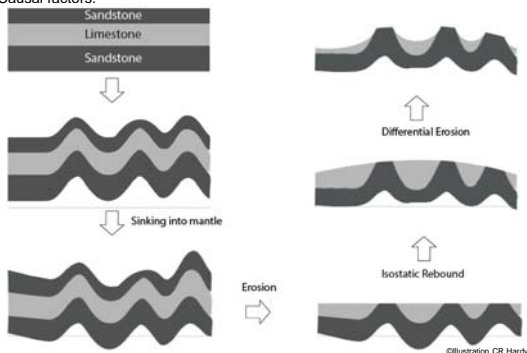
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### H. Isostatic Rebound & Peripheral Bulge

- Ongoing
- Causal factors:




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## H. Isostatic Rebound & Peripheral Bulge

- Ongoing
- Causal factors:
  - Erosion of Alleghenian (ancient).
  - Glacial melt (relatively recent).
  - Formation of Atlantic (ongoing).

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## Future World?



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