

Pleistocene - the Ice Ages



Sleeping Bear Dunes National Lakeshore

Pleistocene - the Ice Ages

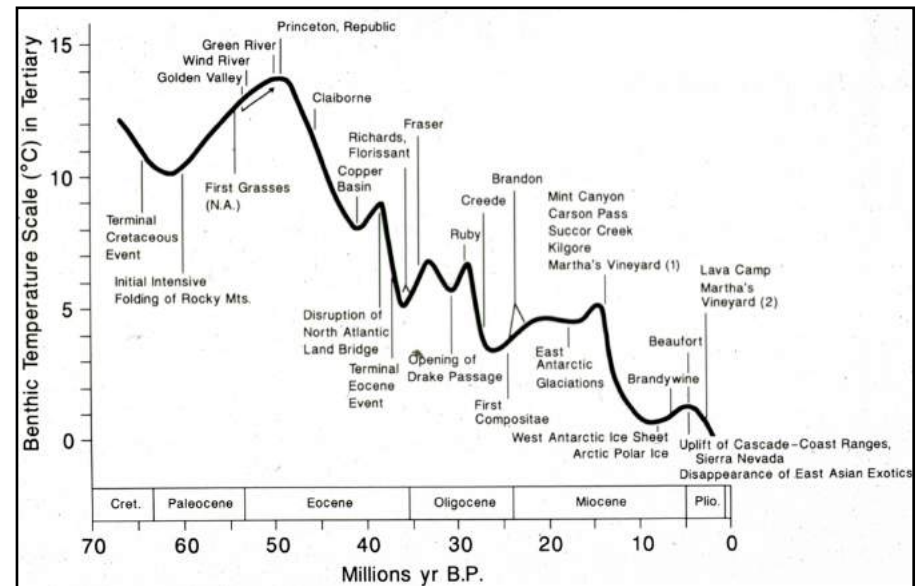
EON	ERA	PERIOD	EPOCH	MYA		
PHANEROZOIC	CENOZOIC	QUATERNARY	RECENT	0.01	← ICE AGE ENDS	
			PLEISTOCENE	1.6	← ICE AGE BEGINS EARLIEST HUMANS	
		TERTIARY	PALEOGENE	PLIOCENE		
				MIOCENE	5.3	
				OLIGOCENE	23.7	
				EOCENE	36.6	← FORMATION OF HIMALAYAS
			NEOGENE	PALEOCENE	57.8	
					66	← DINOSAUR EXTINCTION ROCKY MTS. FORMED
					144	
				208	← FIRST MAMMALS PANGEA BREAK UP FIRST DINOSAURS	
	MESOZOIC	CRETACEOUS				
		JURASSIC				
		TRIASSIC				
		PALEOZOIC	PERMIAN	245		
			PENNSYLVANIAN	286	← FIRST REPTILES	
			MISSISSIPPIAN	320	← FIRST AMPHIBIANS	
			DEVONIAN	360		
	SILURIAN		408			
	ORDOVICIAN		438	← FIRST LAND PLANTS		
CAMBRIAN	505	← FIRST FISH				
PROTEZOIC EON		570				
			← EARLIEST SHELLED ANIMALS			
ARCHEAN EON		2500				
			← EARLIEST FOSSIL RECORDED OF LIFE			
PRECAMBRIAN		3800				
		4600				

- Stage is now set to understand the nature of flora and vegetation of North America and Great Lakes
- Pliocene (end of Tertiary) - most genera had already originated (in palynofloras)
- Flora was in place
- Vegetation units (biomes) already derived

Pleistocene - the Ice Ages

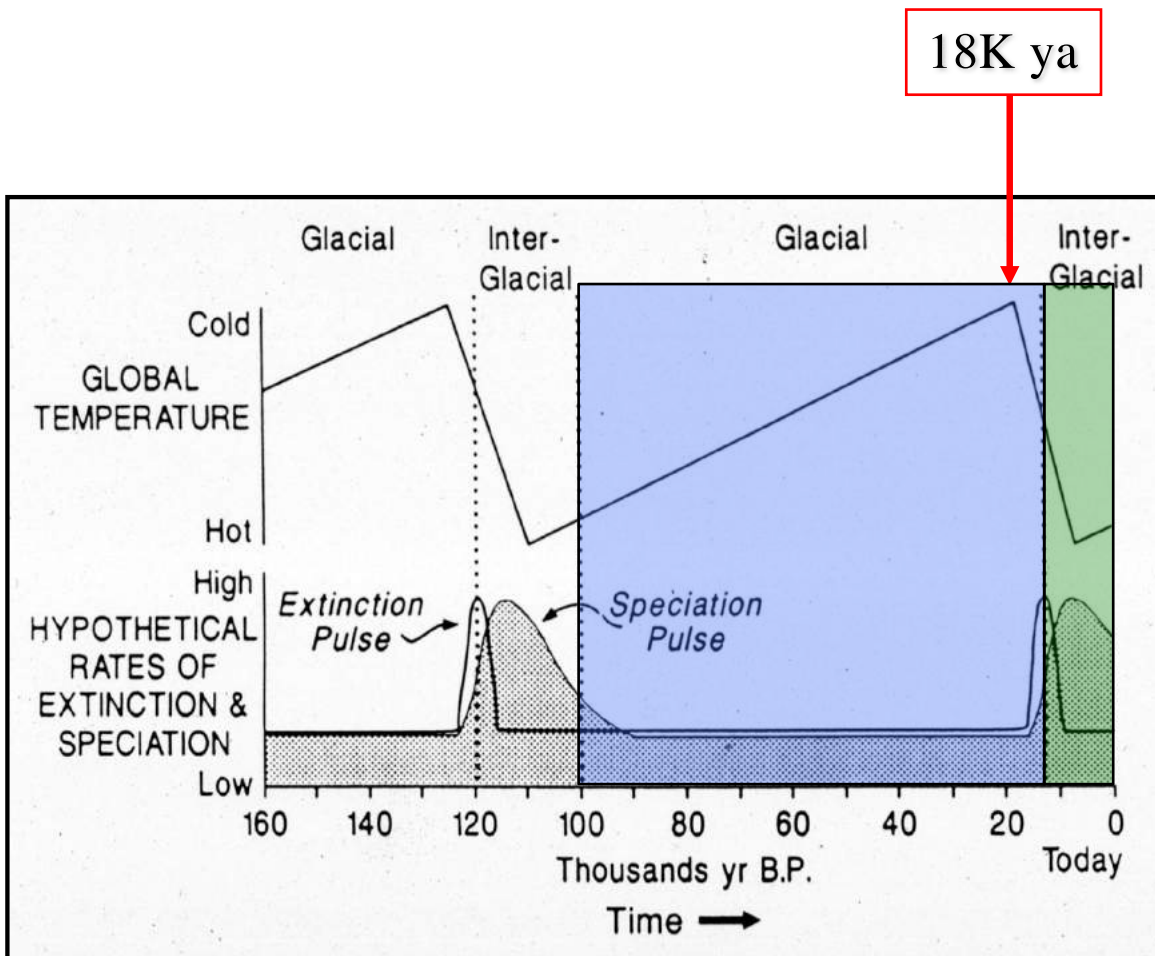


- In the Pleistocene, earth experienced intensification towards climatic cooling
- Culminated with a series of glacial-interglacial cycles
- North American flora and vegetation profoundly influenced by these “ice-age” events



Pleistocene - the Ice Ages

What happened in the Pleistocene?

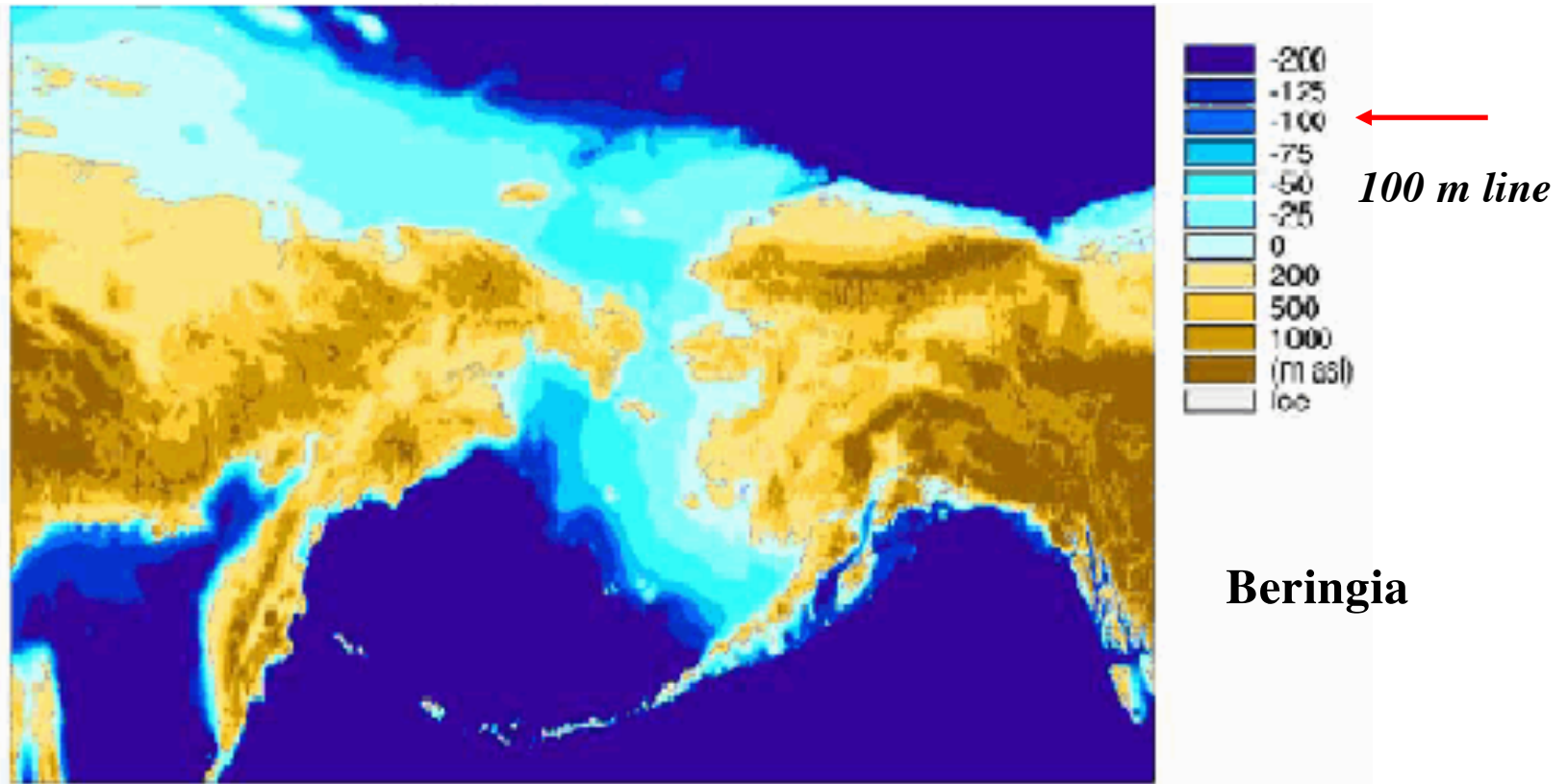


- **Holocene** (Recent) - the present interglacial started ~10,000 ya
- **Wisconsin** - the last glacial (Würm in Europe) occurred between 115,000 ya - 10,000 ya
- Height of Wisconsin glacial activity (most intense) was 18,000 ya - most intense towards the end of the glacial period

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What happened in the Pleistocene?

- up to 100 meter drop in sea level worldwide
- coastal plains become extensive
- continental islands disappeared and land bridges exposed

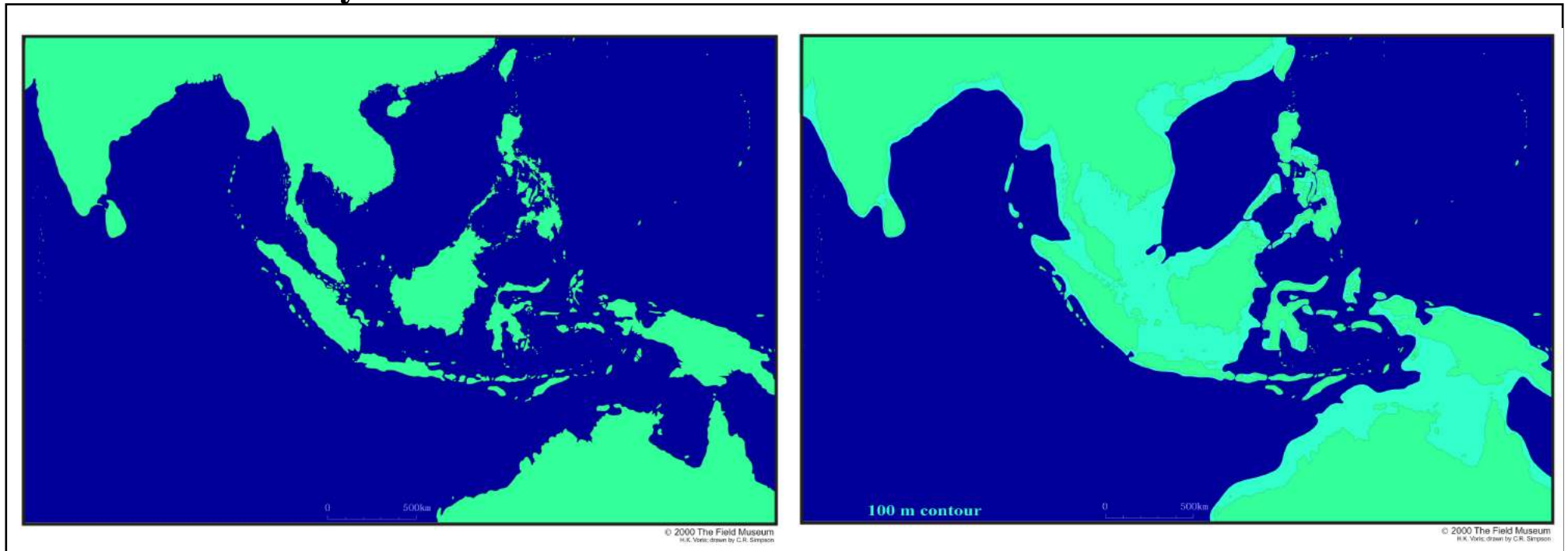


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What happened in the Pleistocene?

- up to 100 meter drop in sea level worldwide
- coastal plains become extensive
- continental islands disappeared and land bridges exposed

Malaysia to Asia & New Guinea and New Caledonia to Australia



Present Level

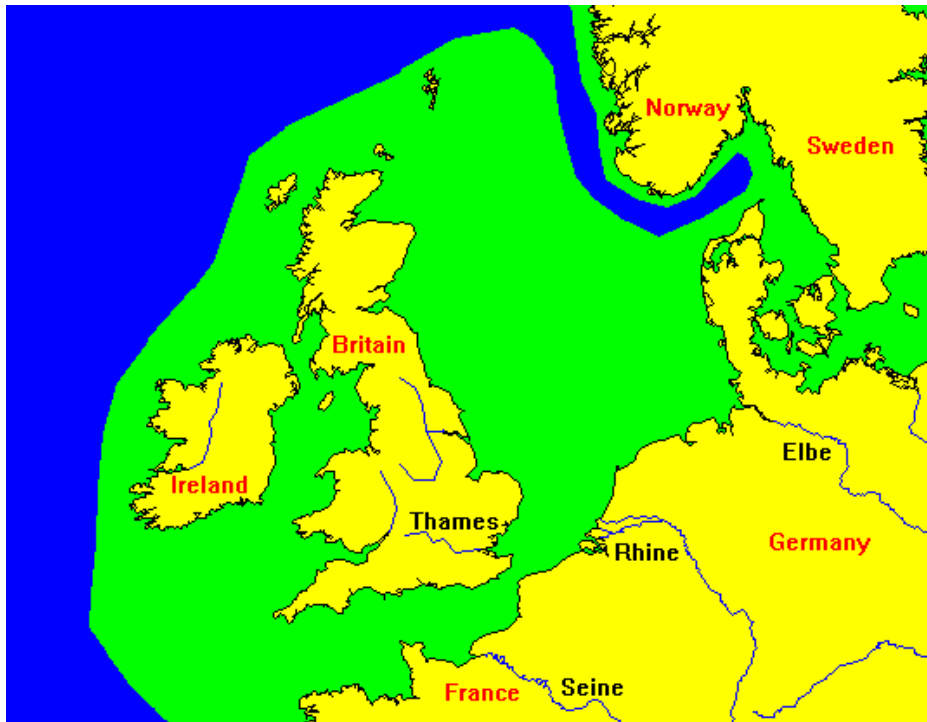
100 m Level

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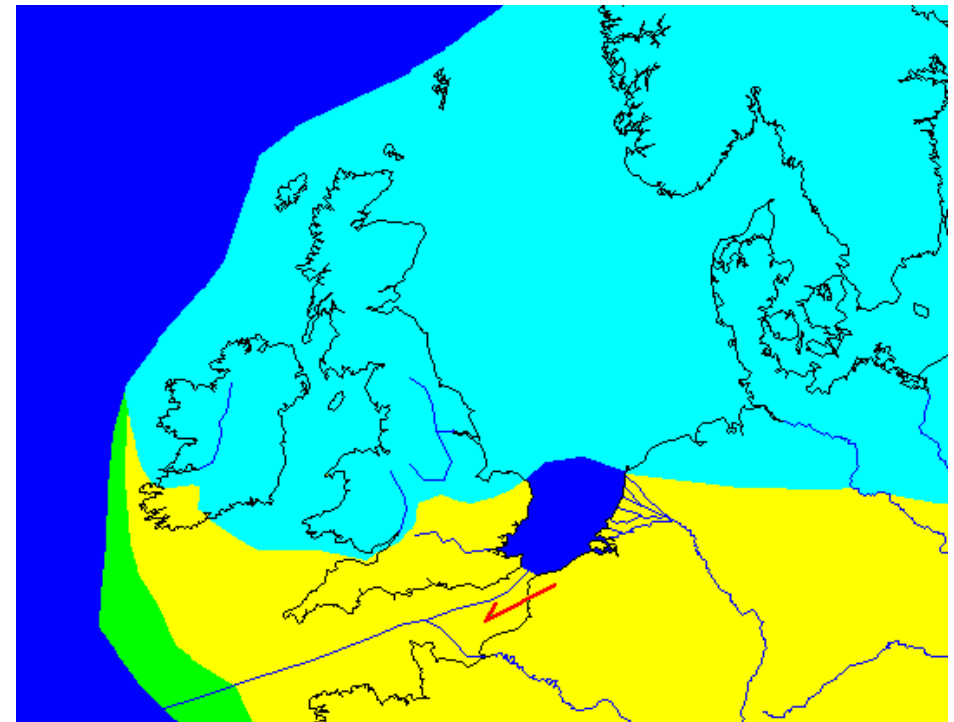
What happened in the Pleistocene?

- up to 100 meter drop in sea level worldwide
- coastal plains become extensive
- continental islands disappeared and land bridges exposed

Great Britain to Europe



Pre-Pleistocene connection



Late Pleistocene English Channel formation

Pleistocene - the Ice Ages

What happened in the Pleistocene?

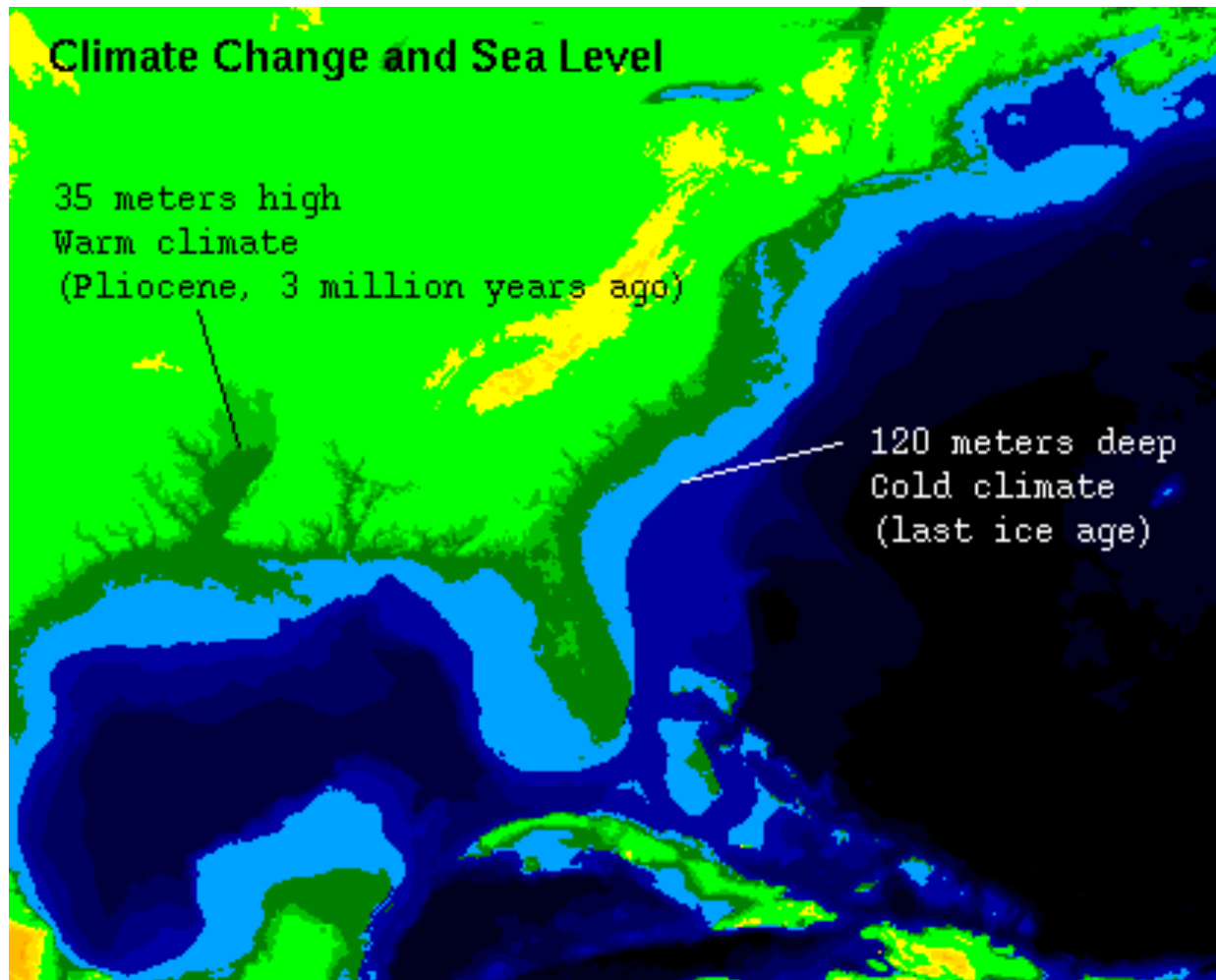
Ice-free Areas in North America

- North America south of glaciers
- Beringia, much of Alaska, Siberia
- Coastal plains, steep coastlines of Pacific northwest
- Wisconsin Driftless Area - never completely surrounded by ice

What was happening south of the glacial maxima?



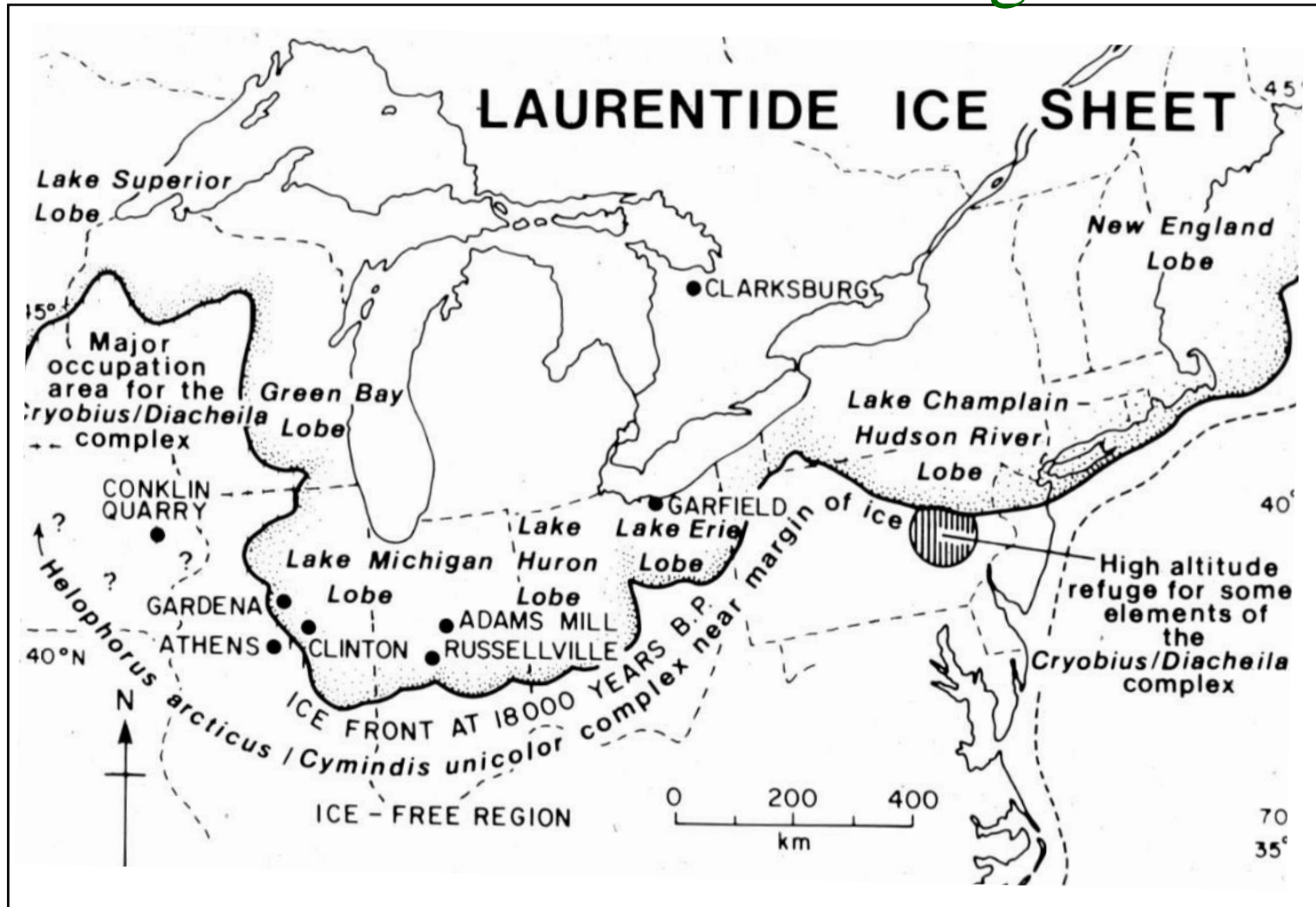
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What was happening south of the glacial maxima?

- **Coastal plain** (extensive) emerges on continental shelf with sea water drop

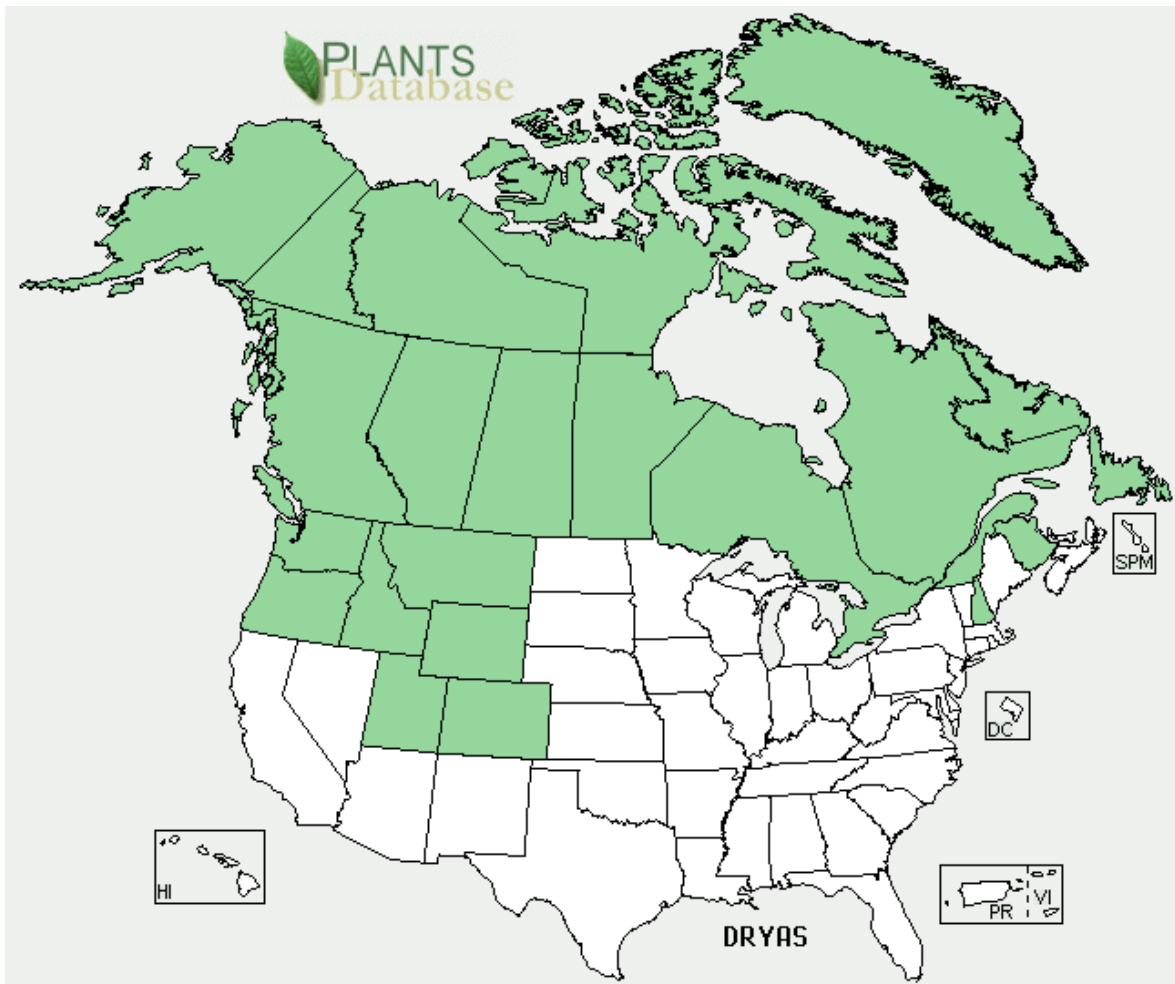
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Wisconsin glaciation reached a climax at 18,000 years ago

Tundra conditions existed at the margins of ice lobes. *Dryas* (Rosaceae), *Helophorus arcticus* (water scavenger beetle), *Cymindis unicolor* (alpine ground beetle)

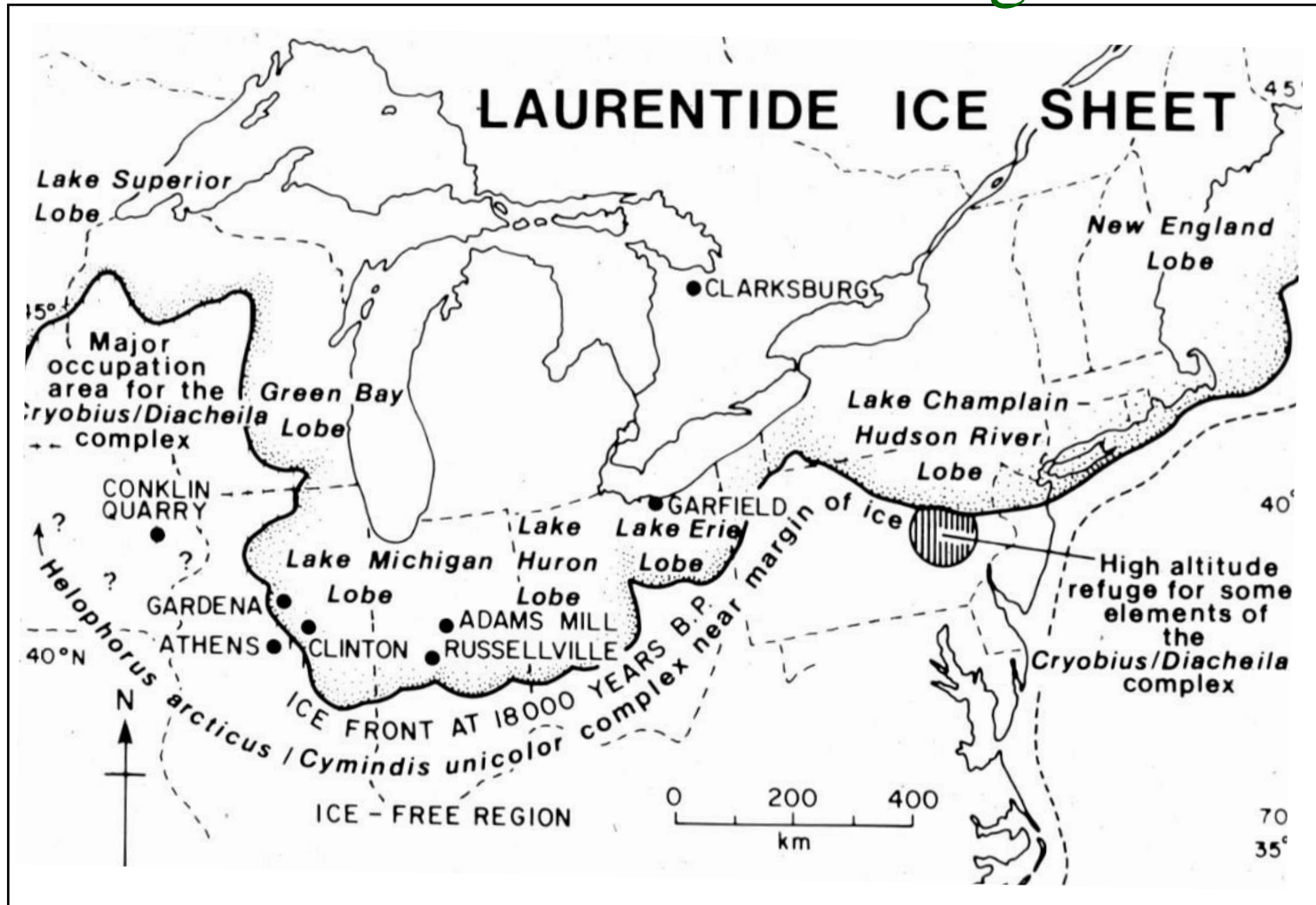
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Dryas

Tundra conditions existed at the margins of ice lobes. *Dryas* (Rosaceae), *Helophorus arcticus* (water scavenger beetle), *Cymindis unicolor* (alpine ground beetle)

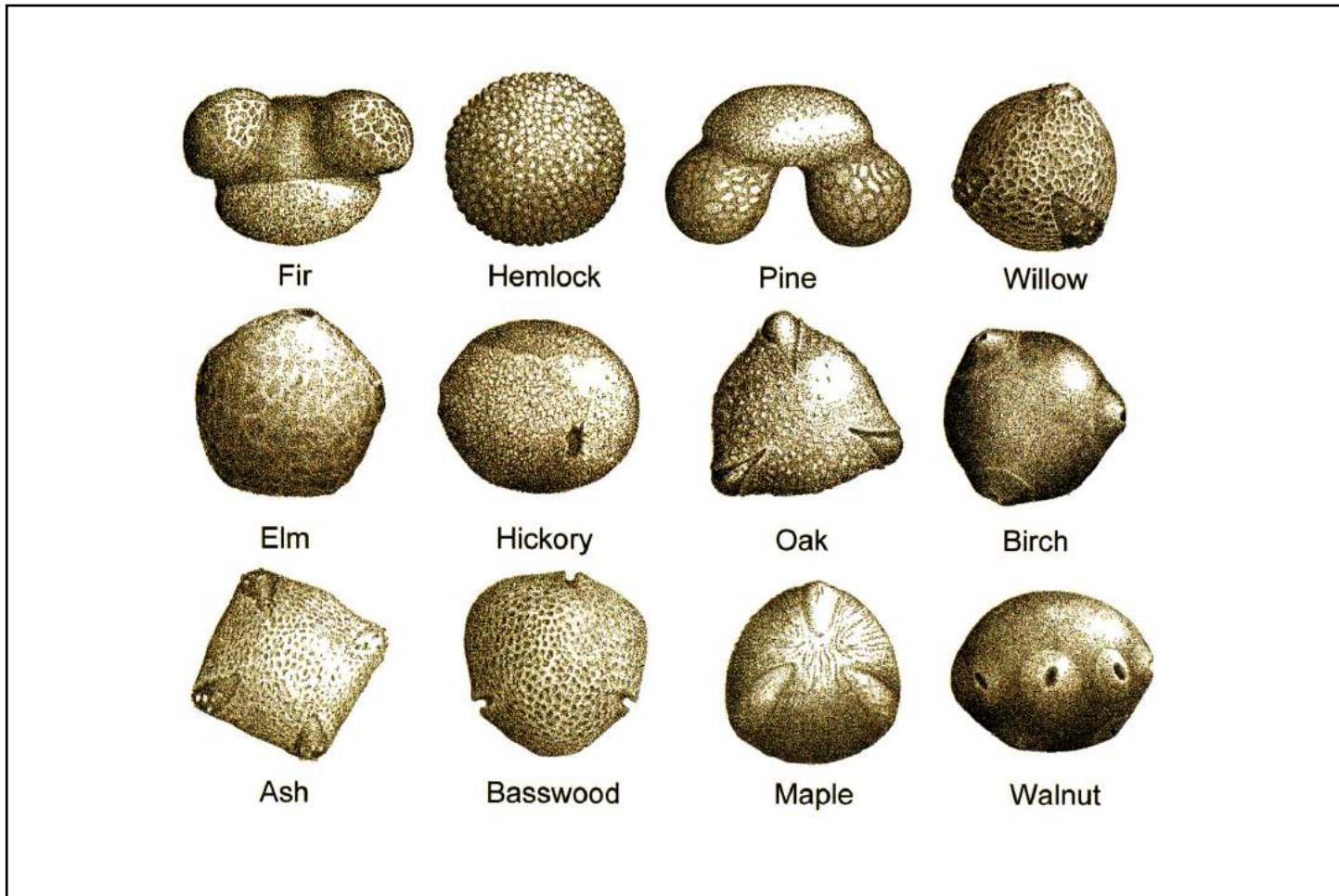
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Wisconsin glaciation reached a climax at 18,000 years ago

Tundra conditions existed at the margins of ice lobes. How do we know what vegetation/flora existed south of the glacial maxima?

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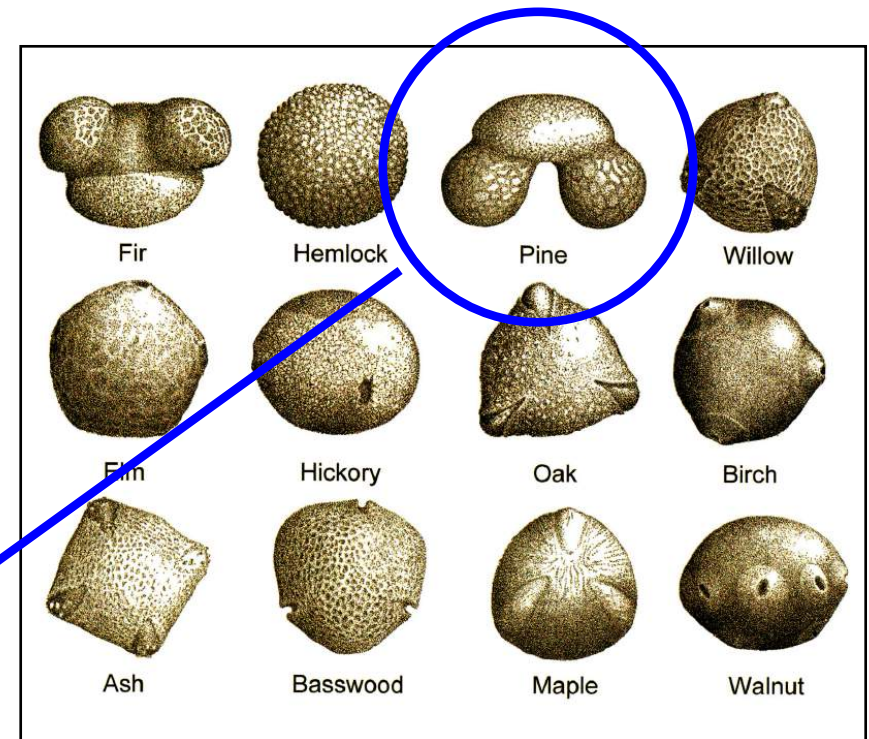


Paleobotanists have been aided by the record of plant remains in lakes and bogs. Pollen (especially from trees) is the single most important record that has been used to identify vegetation/flora at a site and track vegetation changes following ice retreat.

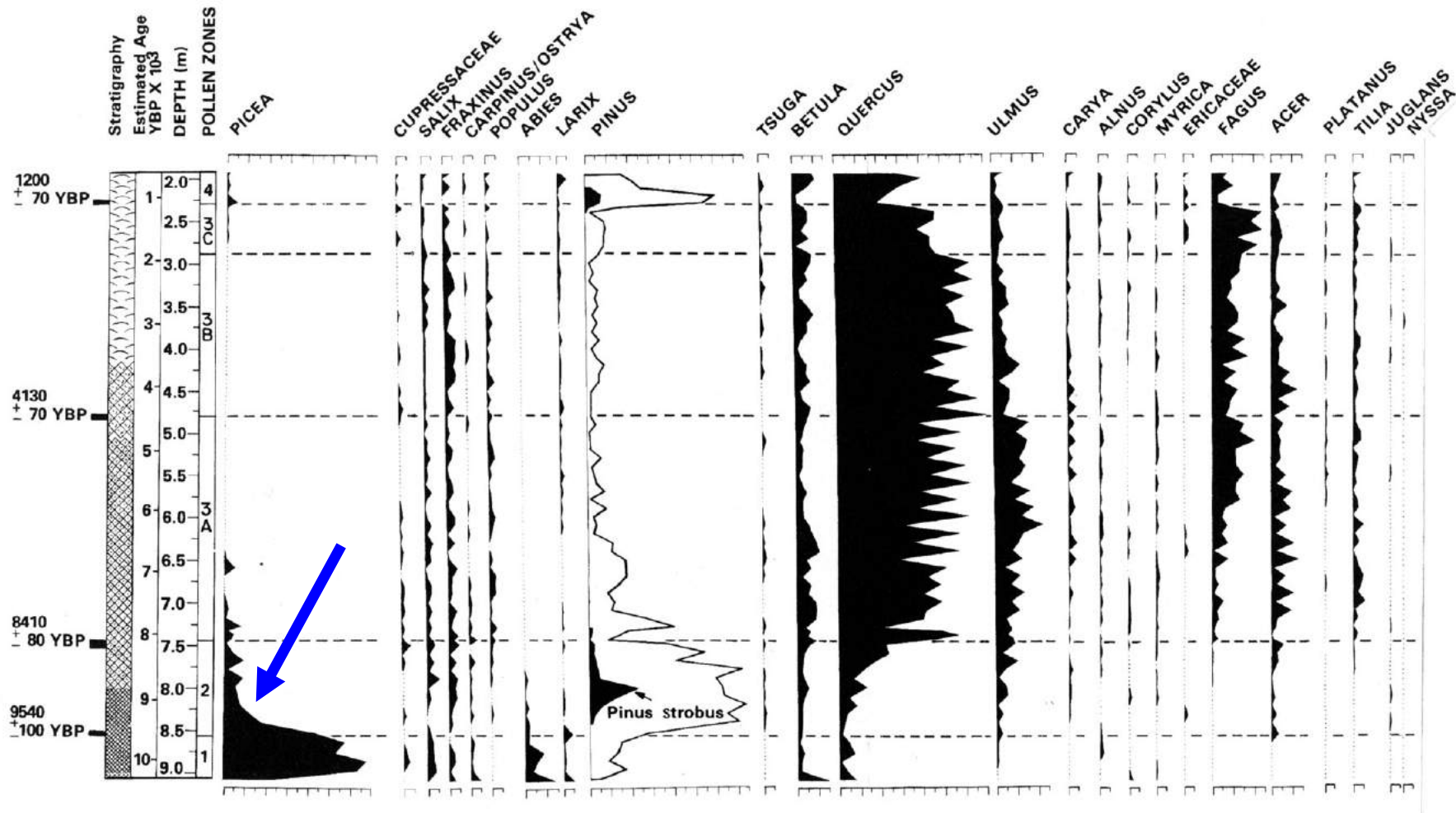
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Yearly deposits accumulate in lake bottoms to be covered by silt in layers, or in bog peat strata



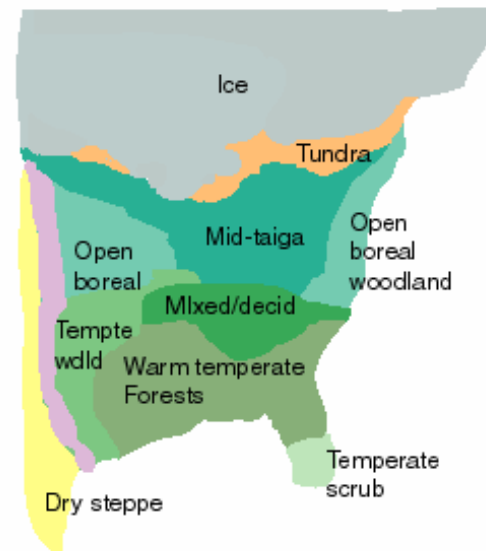
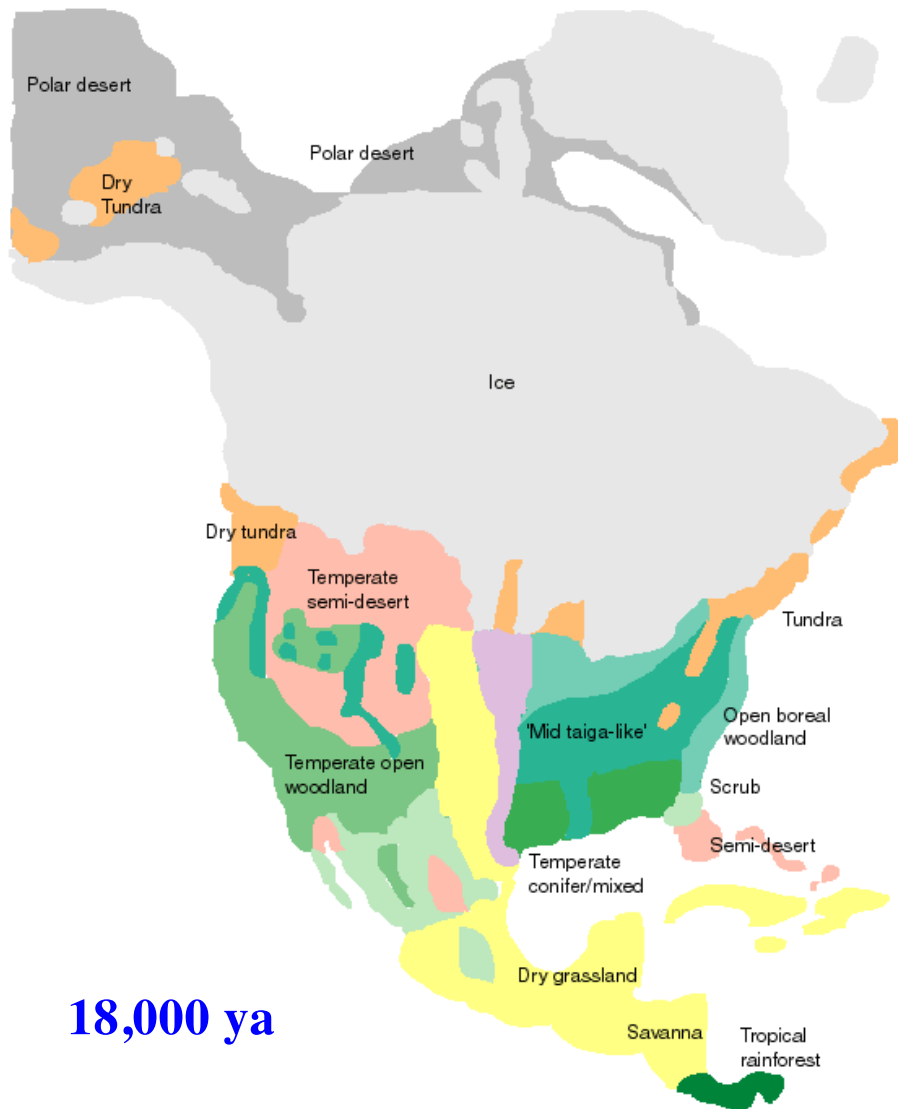
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- Pollen record of White Pond, South Carolina
- Note boreal elements (spruce) early in the record

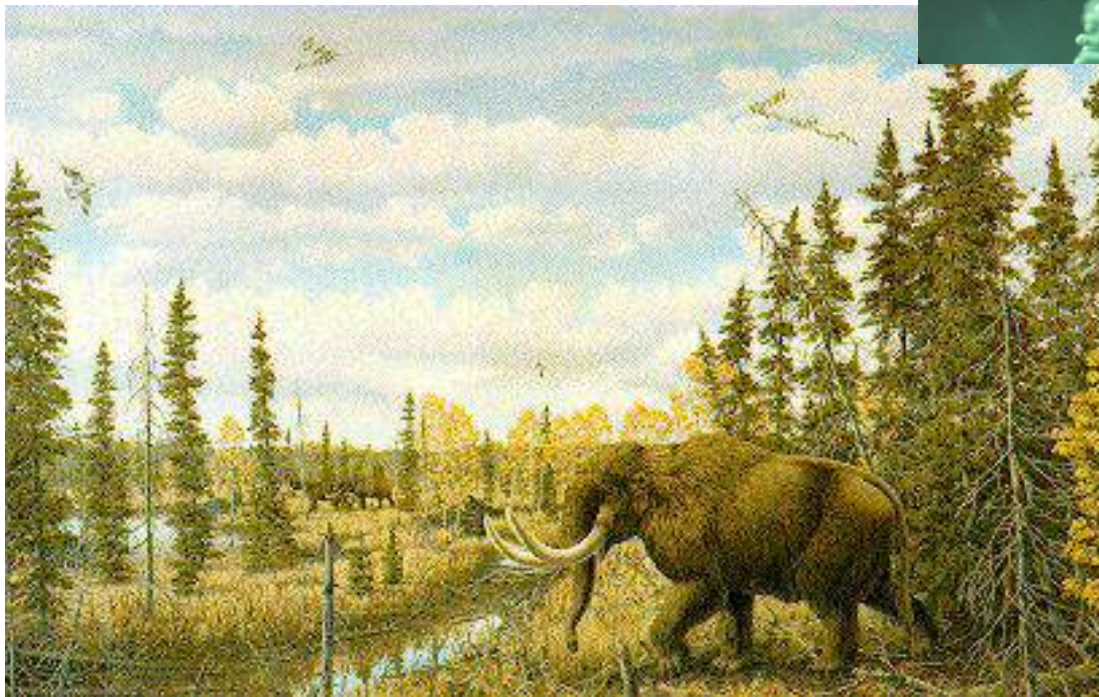
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- Extensive boreal forest zone S to 33° N
- Mixed deciduous forest zone near Gulf
- 18,000 ya harshest conditions; zones were further north earlier



Pleistocene - the Ice Ages

- Much of eastern North America would have looked like this boreal scene



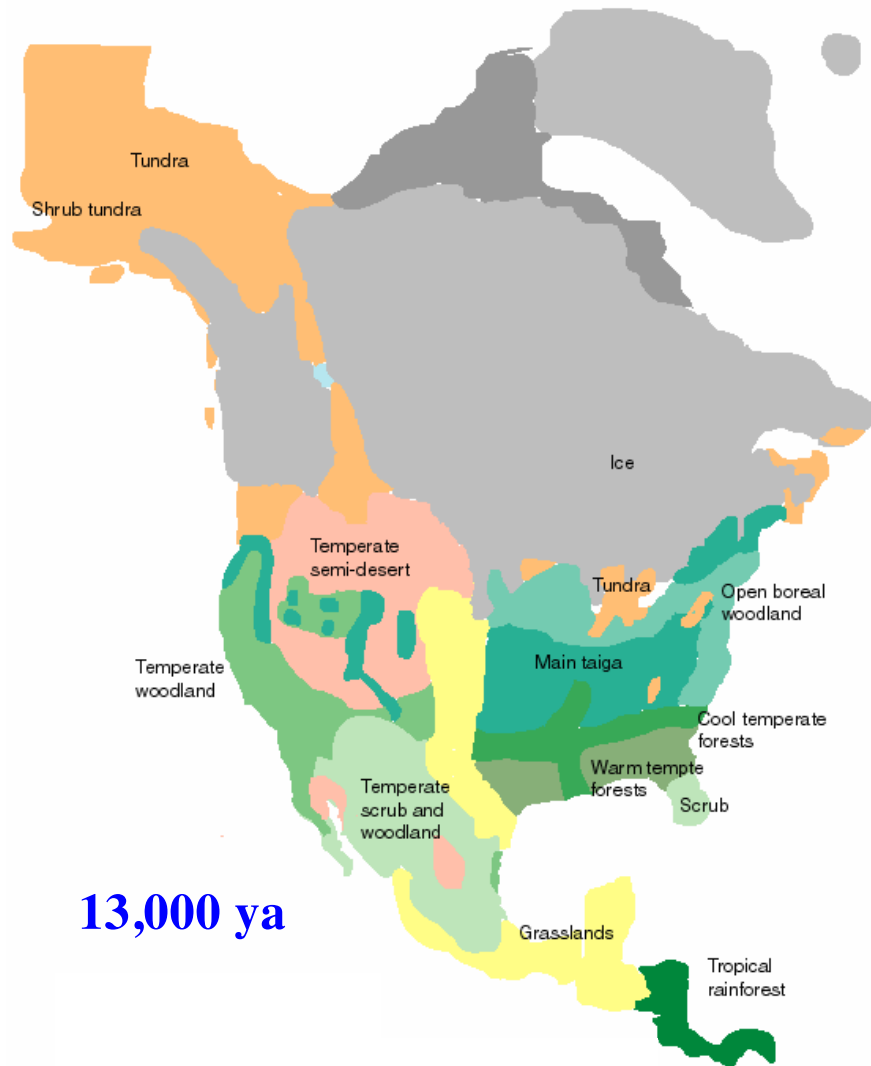
White spruce - *Picea glauca*

Most widespread tree in
North America

Illinois 16K

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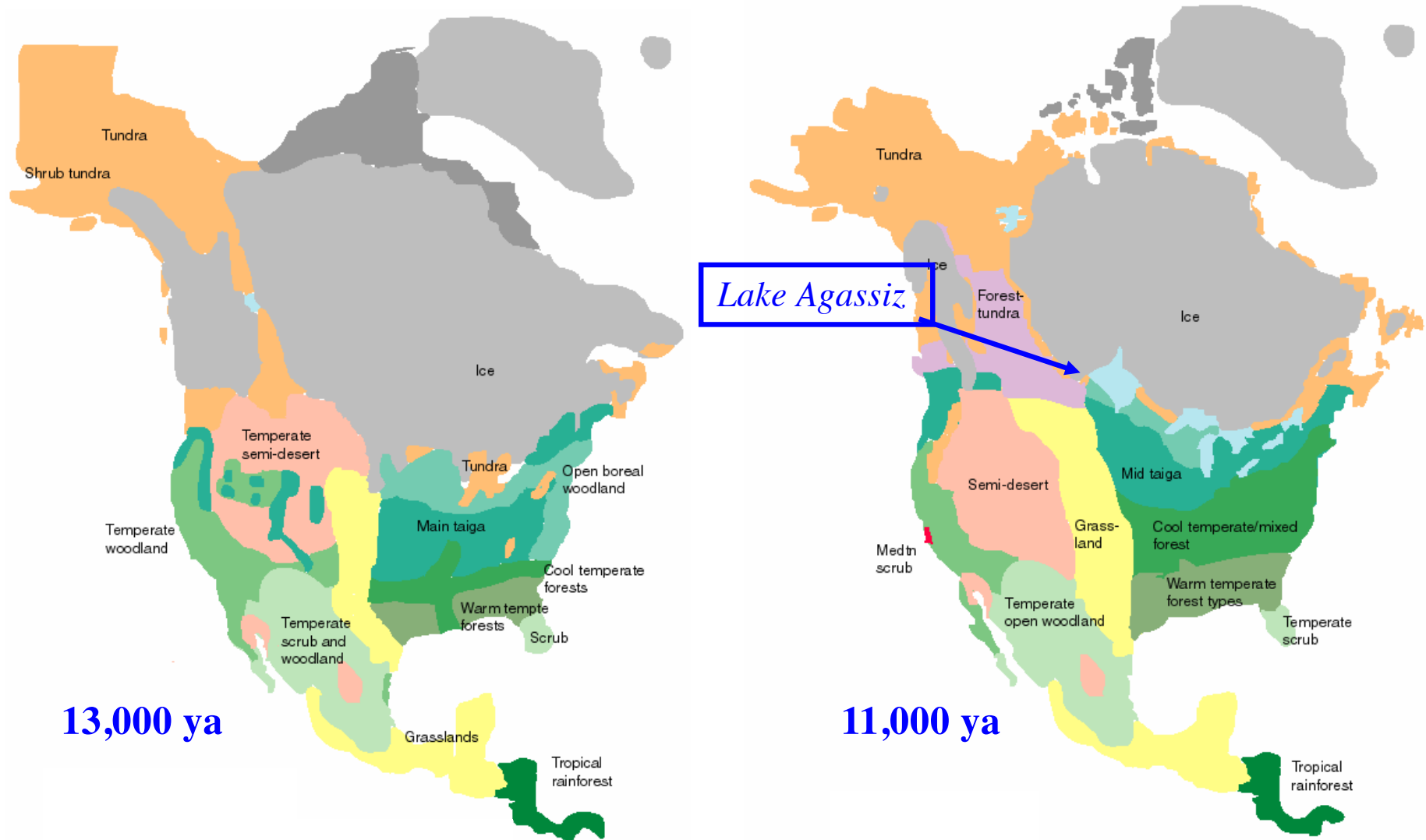
- 14,000 ya ice begins retreat
- Vegetation units move north



Pleistocene - the Ice Ages

- 14,000 ya ice begins retreat
- Vegetation units move north

- Proglacial lakes form
- St. Lawrence Seaway exposed

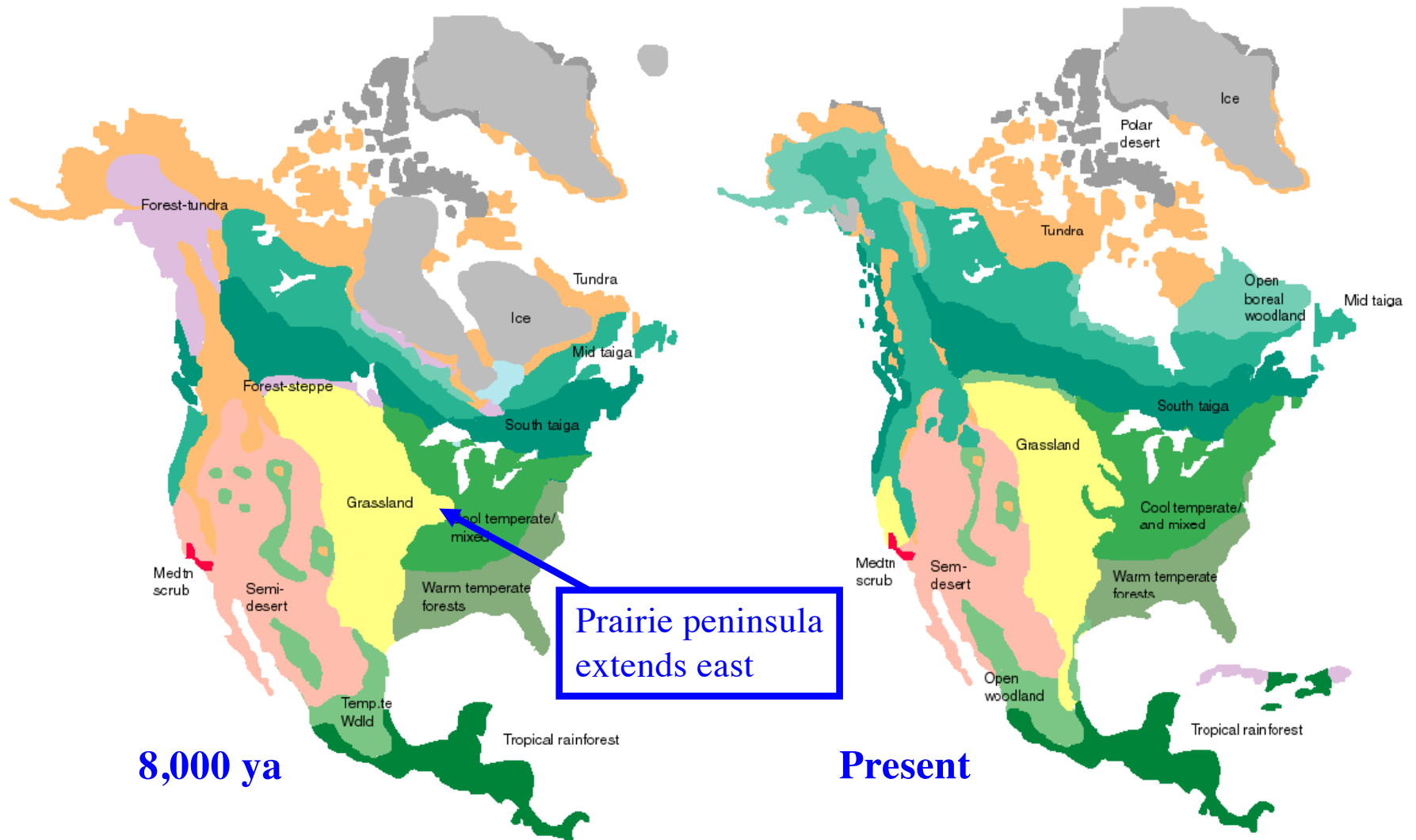


13,000 ya

11,000 ya

Holocene - the Recent Times

- Ice retreats continues into Holocene (10,000 ya)
- Warmest time of Holocene is **Hypsithermal** - 8,500 to 6,000 ya



Holocene - the Recent Times

- With 2/3 of this interglacial completed, earth should be cooling
- Last 100 years the average earth temperature is rising dramatically

Temperature deviation, compared to 1850-1899 average (°C)

