

## Ch 2: The Nonhuman World

### Understanding the limits



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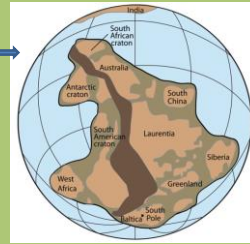
### How did the US and Canada form?

- 4 bill yrs ago
- Shield
- Shield + platform=craton.
- Glaciated, eroded many times over since then
- Bare and gauged, wetlands, lakes
- Heated, pressurized

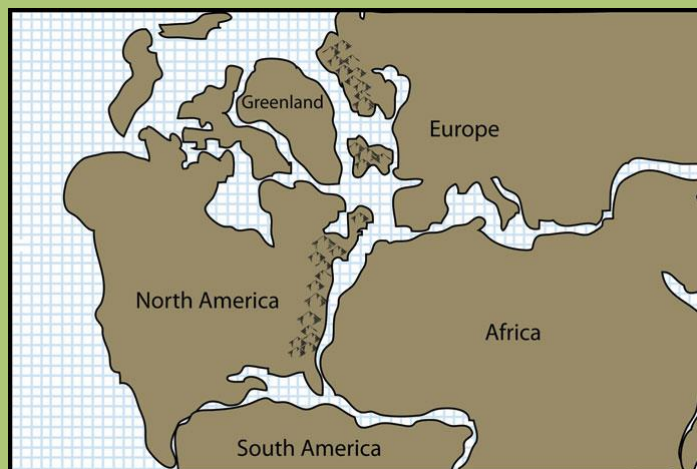


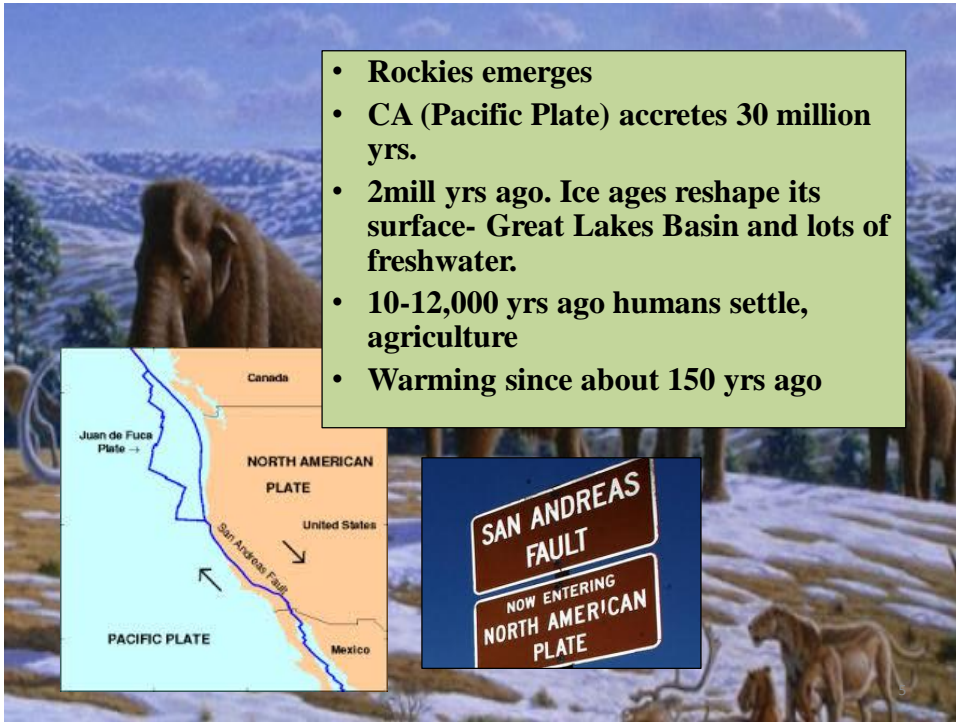
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- **Part of Rodinia**
- **Straddled the equator**
- **Tropical plants are buried and pressurized: oil, coal, gas**
- **CA an island, FLA detaches from Africa, accretes to NA**





200 m.y. ago



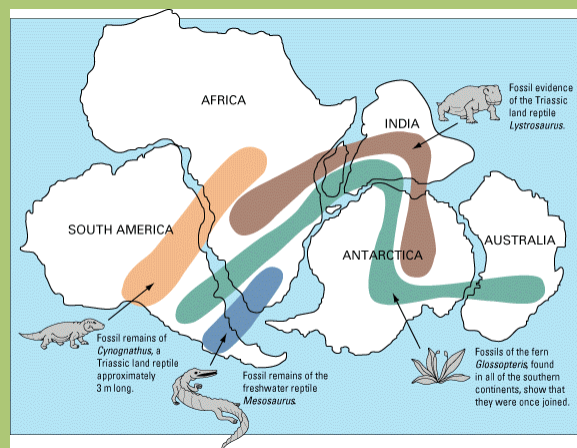


- **Rockies emerges**
- **CA (Pacific Plate) accretes 30 million yrs.**
- **2mill yrs ago. Ice ages reshape its surface- Great Lakes Basin and lots of freshwater.**
- **10-12,000 yrs ago humans settle, agriculture**
- **Warming since about 150 yrs ago**

**SAN ANDREAS FAULT**  
NOW ENTERING NORTH AMERICAN PLATE

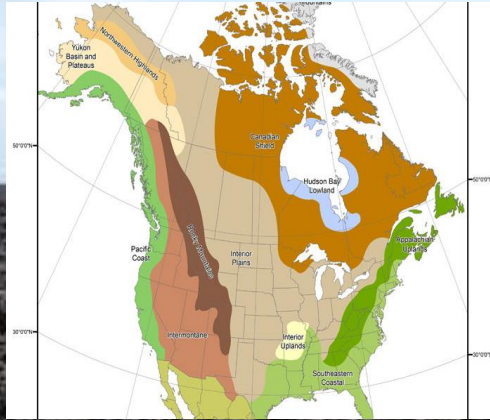
## Fossil remains



Source: USGS

## Physical, chemical, biological actions shape landforms

Endogenic, exogenic forces have shaped landforms



- climate, location
- **Canada (& Alaska):** boreal forests, tundra.  
**US:** temperate conditions
- Lowlands, glacial retreat  
U.S. 50%
- Plateau (1/4 of US)
- Mountains (1/4 of both US/Can.)



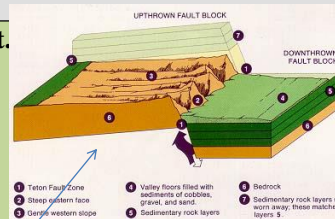
7

## Mountains:

- Oldest = Appalachian 480 million yrs-supercont.
- 65 mill. ago: Rockies, Cascades, Sierras
- Active mountain bldg in Cascades, Hawai'i ...

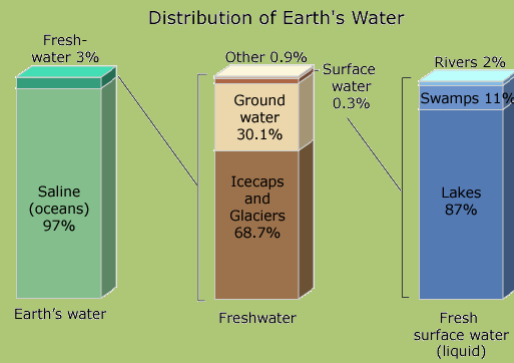
### Mountain types:

- **Folded:** plates collide (Appalachians)
- **Fault-block:** stress fracture (Tetons, CA Sierra Nevada)
- **Dome:** magma pushes (Black Hills)
- **Volcanic:** cones (St Helen) or shield volc. (HA)



8

# Supply of Water Resources



## Water (hydrography):

- Lots of freshwater (25% of world freshwater)
- Watershed (total area) Drainage Basin (Smaller)



Mississippi Watershed

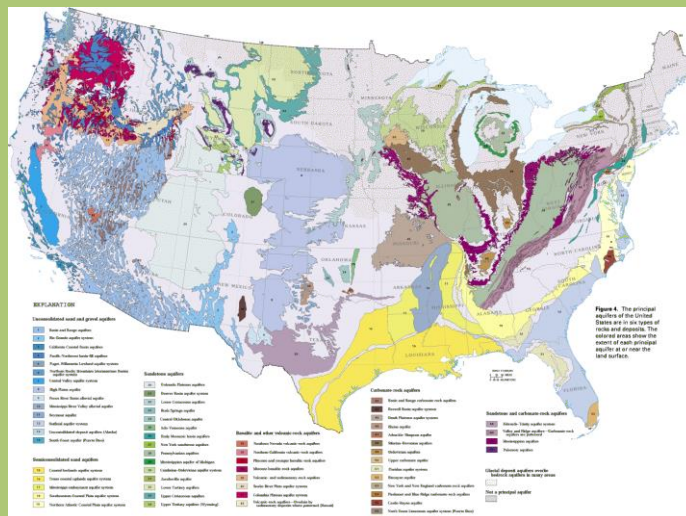


## Lakes: Glacial (most numerous), structural , or artificial.

- **Glacial- Remnants last Ice Age (Great Lakes)**
- **Scouring (Fingers Lakes, NY)**
- **caldera (Crater Lake, OR); fault valleys- Lake Tahoe**
- **Karst (limestone, in sinkholes) in Ozarks, Florida**
- **Artificial lakes by dams. Lake Mead on Nevada-Arizona border. Lake Powell.**

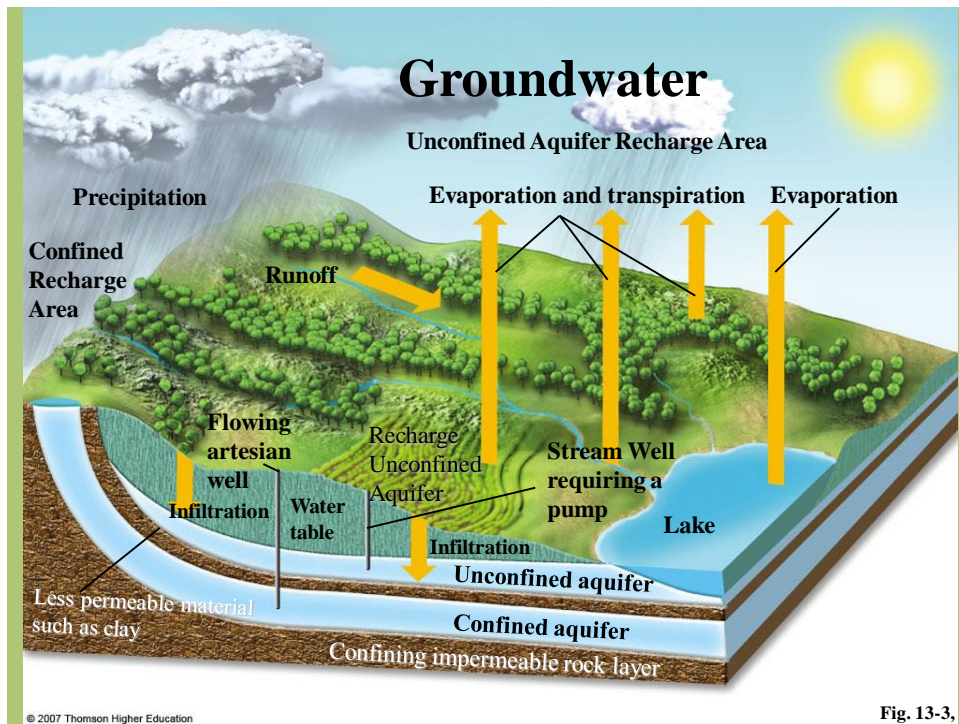


11

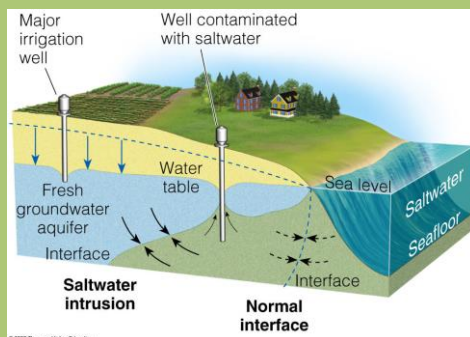


## Groundwater: Aquifers

An aquifer is an underground water soaked layer of rock and sand, which can be accessed by pumping or pressure. Across the Great Plains, thousands of windmills pump water from shallow aquifers, but the Ogallala is more than 200 feet below the surface. Groundwater in deep aquifers is accessed with a well and gasoline pump. Aquifers recharge (replenish) when rainwater seeps down through the soil, but sometimes more water is withdrawn than replenished.



## Other Effects of Groundwater Overpumping- Sea water intrusion



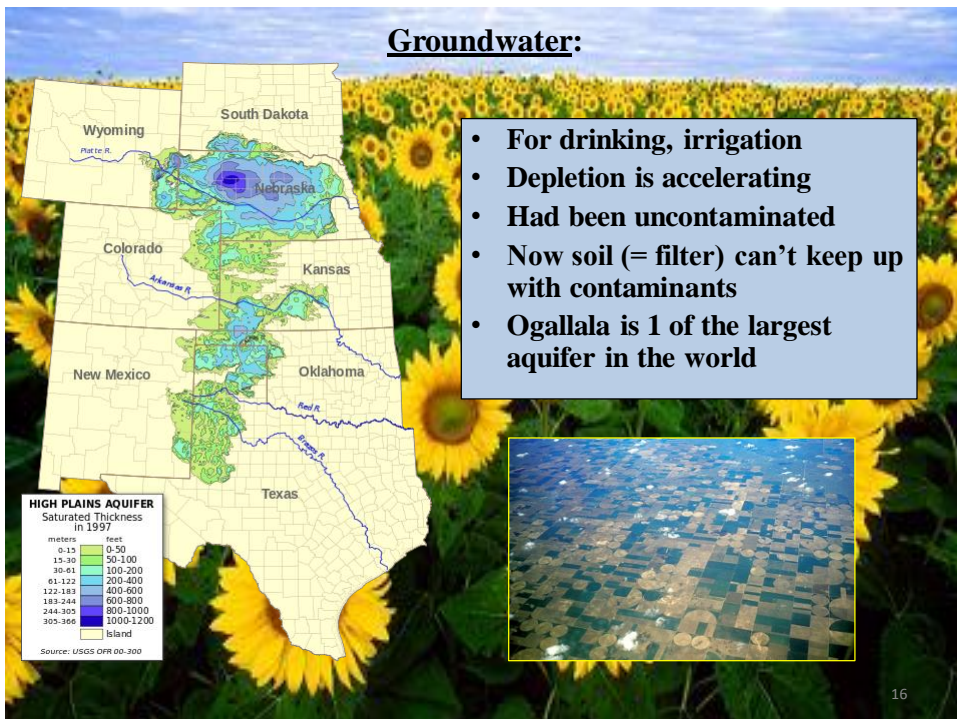
- Groundwater overpumping can cause land to sink, and contaminate freshwater aquifers near coastal areas with saltwater.

## Other Effects of Groundwater Overpumping-subsidence



- Sinkholes
- Chemical contamination.

### Groundwater:

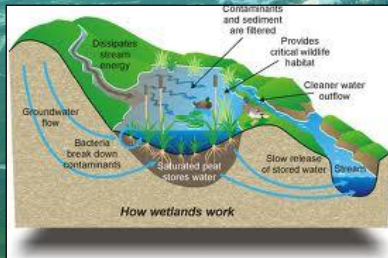


- For drinking, irrigation
- Depletion is accelerating
- Had been uncontaminated
- Now soil (= filter) can't keep up with contaminants
- Ogallala is 1 of the largest aquifer in the world



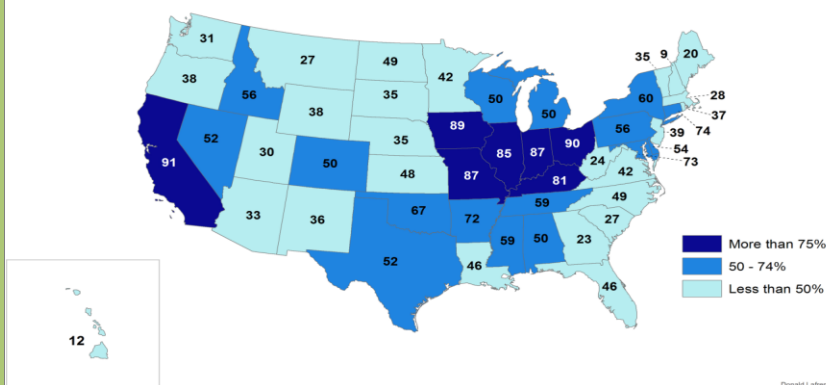
## Wetlands:

- Swamps, bogs, marshes oh my.
- Ecotone, transitional zones, that absorb storm surges, break down pollutants
- But removal of wetlands



## Percentage of Wetlands Acreage Lost, 1780's-1980's

Twenty-two states have lost at least 50 percent of their original wetlands. Seven states – Indiana, Illinois, Missouri, Kentucky, Iowa, California, and Ohio – have lost over 80 percent of their original wetlands. Since the 1970's the most extensive losses of wetlands have been in Louisiana, Mississippi, Arkansas, Florida, South Carolina, and North Carolina



## Wetlands lost

Most states have lost a majority of their wetlands. California has lost 91 percent of its limited wetlands; in the wetland rich Great Lakes states 50 to 90 percent are drained.

## Wetlands (Box 2.2)

- Swamps- Saturated soils during growing season.- Shrubs and trees-more open area
- Marsh- shallow water, cattails and water lilies
- Bogs-Lake bottoms- slow decaying plants low in nutrients- moss and shrubs (Michigan, Quebec)
- Pecosins-Mid Atlantic Coastline Plain- North Carolina-Hilly areas- shrubs
- Bayous- Gulf Coastal Region- Slow moving water- river or creek
- Fens- Groundwater fed- grasses, wildflowers

19



**North American Pleistocene glaciations covered and reshaped the landscape from Canada south through the Central Lowlands.**

For example the Ohio and Missouri River systems were formed as the glaciers melted. Today their channels roughly mark the southern extent of the ice sheets

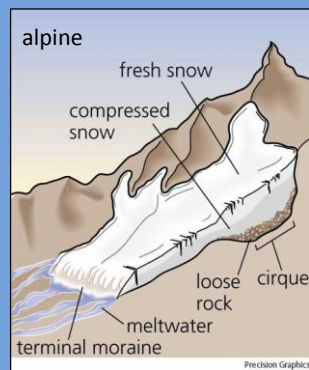
# Glaciers



21

## Glaciers

continental



Columbia Ice Field in Jasper

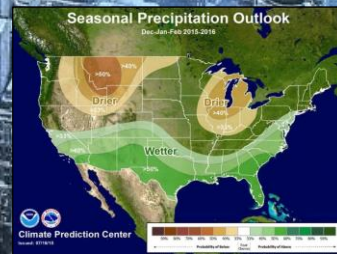
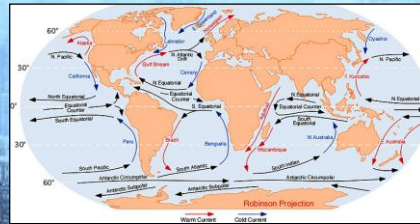
moraine

lateral

End or terminal

## Climate depends on ...

- Latitude
- Altitude
- Proximity to water, warm/cool sea currents
- It takes longer for water to heat and cool than for land to do so
- Also topography



## Weather and Climate

- Weather – short-term atmospheric conditions for a specific area
- Climate – aggregate long-term weather conditions

4 elements

**TABLE 3-1 The Elements and Controls of Weather and Climate**

Elements of Weather and Climate	Controls of Weather and Climate
Temperature	Latitude
Pressure	Distribution of land and water
Wind	General circulation of the atmosphere
Moisture content	General circulation of the oceans
	Altitude
	Topographic barriers
	Storms

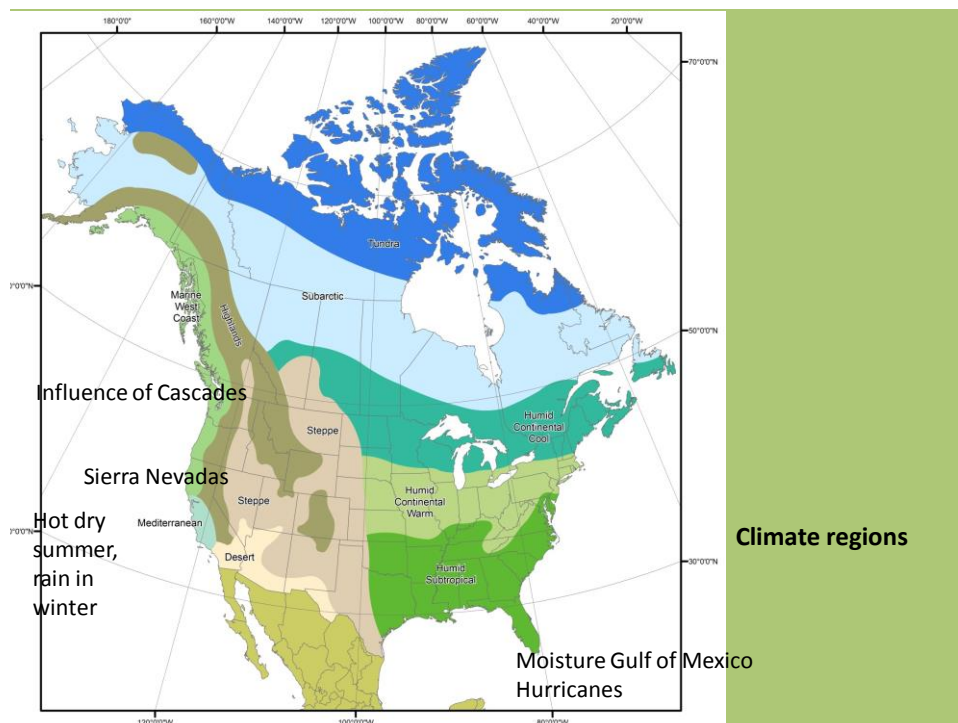
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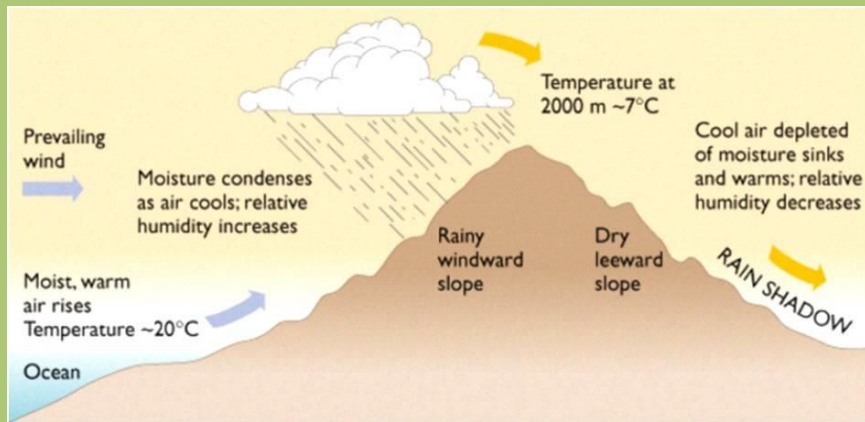


# Climate

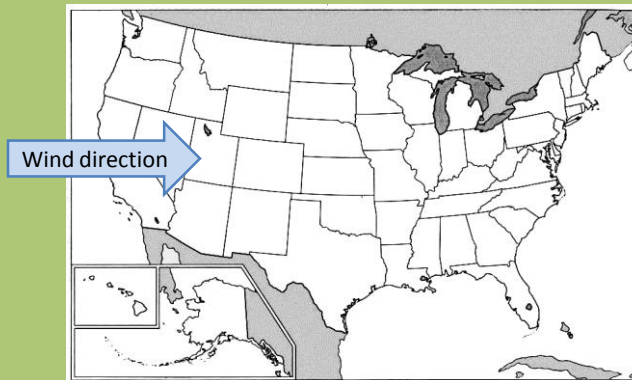
- U.S. temperate zone.
- North of 38<sup>th</sup> parallel 4 season climate.
- Most of Canada north of 49<sup>th</sup>
- Why is Canada colder
  - West Mountains block oceanic warmth
  - Lack the warm ocean current that Europe enjoys.

25





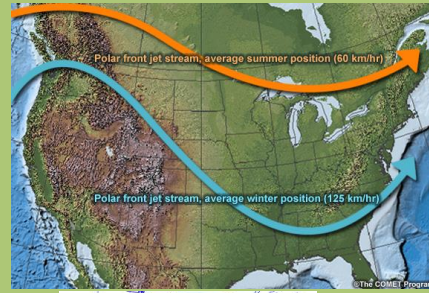
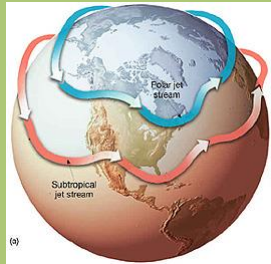
### Orographic Precipitation



### Wind and Precipitation Patterns

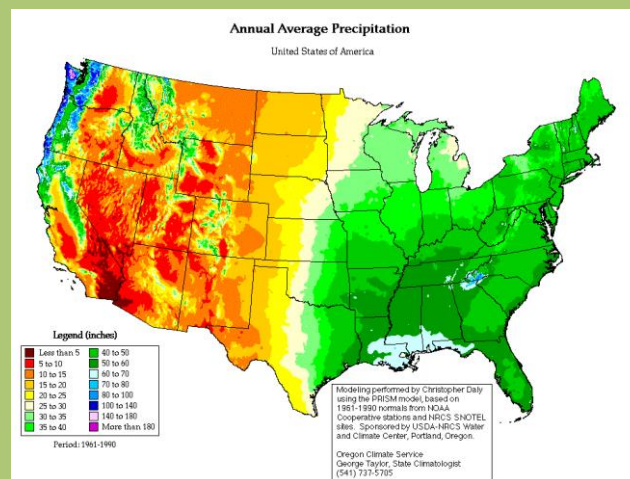
Wind patterns across the United States and Canada blow from the west and carry weather systems from the West Coast to the East.

# Climate



29

## 100<sup>th</sup> Meridian



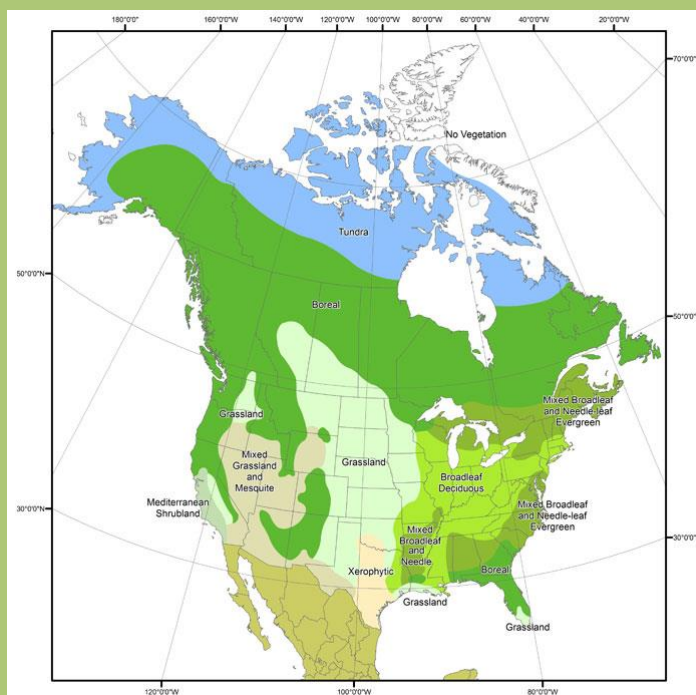
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### 100<sup>th</sup> Meridian

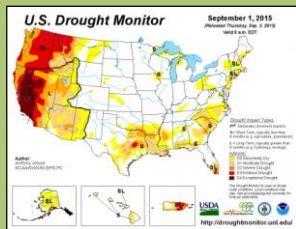
Cal= Calcium and lime rich

Fer=Aluminum and Iron rich.



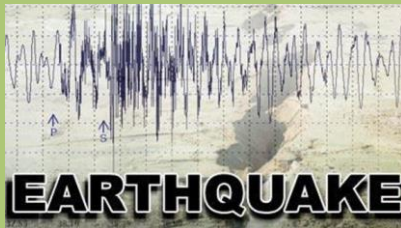


# Natural Hazards

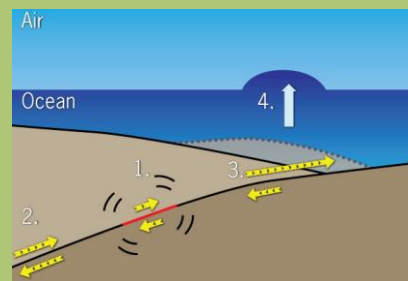


33

# Natural Hazards



Landslide



Tsunamis

34

## Natural hazards

- Radical disruptions, may be growing in magnitude due to climate change

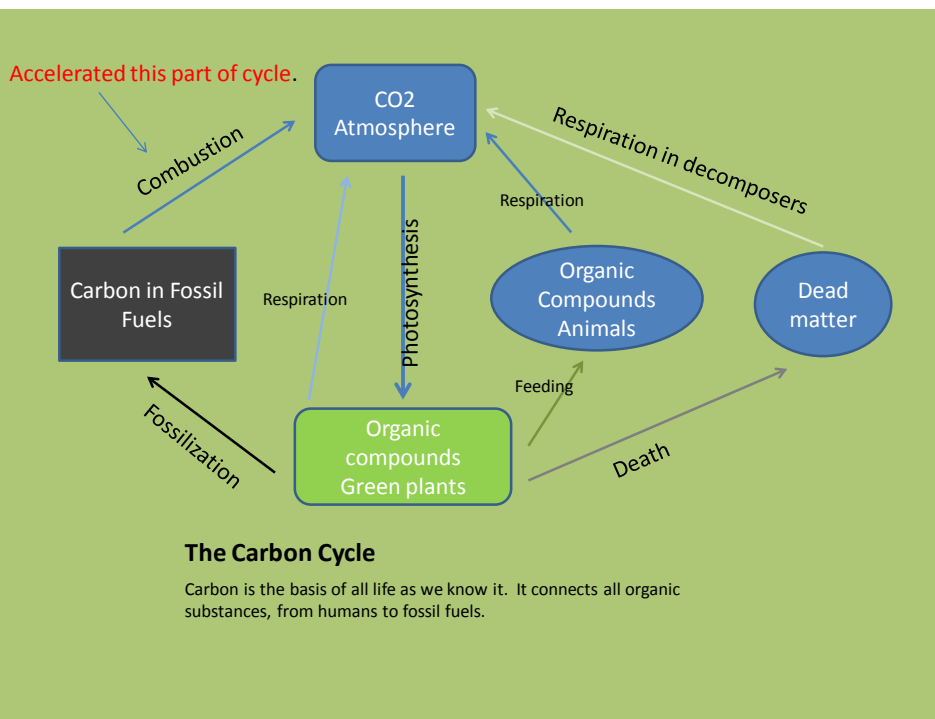
Incl: drought, fires, severe storms, earthquakes, tsunamis, sea level rise ...

More vulnerability:  
more people live on  
coasts, material losses  
are more costly than in  
the past

Add to this pop increase,  
surpassing 'carrying capacity'

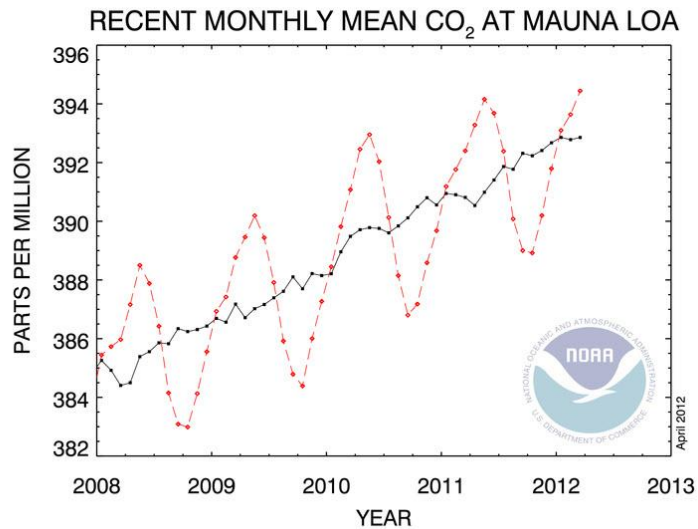


35



## Recent Mauna Loa CO<sub>2</sub>

March 2012: 394.45 ppm  
March 2011: 392.40 ppm



## Climate change

- Feedback loops
  - Methane in swamps- Russia
- Solutions
  - Carbon sequestration- Done in agriculture and forest soils in US and Canada.
    - Saskatchewan- oil recovery
    - Ocean? Acidic
  - Cut use of fossil fuels.

## Global Climate Change (GCC)

- **Unintended Consequence**
- **Sea Level rise expected- Atlantic and Gulf coasts.**
  - 22,000 square miles
  - New York, Washington D. C. Miami, New Orleans
- **Pacific- San Francisco Bay and Puget Sound.**



39

## Sustainability

- **Destruction is tied to an econ. system that does not hold the polluter accountable for environmental degradation**
- **Is Canada more 'green' than the USA?**

