

# Physical Geography IV of the United States and Canada

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## Physical Geography

The physical landscape (natural environment) sets the stage for human use (cultural landscape).  
We need to be aware of

- ✓ geologic processes (tectonic/gradational)
- ✓ atmospheric processes  
(Any Questions on Weather or Climate?)
- water resources (surface/underground)
- soils (formation/fertility)
- natural vegetation (result of all of above)

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## Definitions

- ❖ **Hydrogeology** – the study of water in relation to the regional or local geology.
- ❖ **Hydrology** – the study of water movement.
- **Surface waters** – water in rivers, streams, and lakes.
- **Groundwater** – water that has been absorbed by the earth and stored beneath the surface.

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## The Hydrologic (Water) Cycle

Key stages of the cycle are:

1. **Evaporation/transpiration**
2. **Condensation** (cloud formation)
3. **Precipitation**
4. **Infiltration** (absorption)
5. **Runoff**
6. **Return to the oceans**

Remember the chief determinant of sea level?

## Watershed

- ❖ **Watershed or drainage basin:** area of land where all surface water flows to the same place.
- **Watershed divide:** separates local drainage basins usually along a ridge line.
- **Continental Divide:** separates oceanic drainage basins.
- North America is divided into **7 major drainage basins** and thousands of smaller, local drainage areas.

Watershed Diagram

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## Continental Divide forms the backbone of North America.

## Drainage Basins of North America

Separates the Atlantic/Arctic drainage from the Pacific drainage.

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## Frozen Great Lakes

**In Feb., 2015 c.85% of the total surface area of the Great Lakes was ice covered.** Second year in a row that over 85% of the lake surface is ice covered.

**PERCENTAGE OF GREAT LAKES COVERED IN ICE (Feb. 2015)**

- Lake Erie: 99%
- Lake Huron: 93%
- Lake Michigan: 63%
- Lake Ontario: 83%
- Lake Superior: 92%
- Great Lakes total: 85%

[https://www.glerl.noaa.gov/res/dq/dts/compete\\_years/](https://www.glerl.noaa.gov/res/dq/dts/compete_years/)

## Frozen Niagara Falls

### 2015

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## GROUNDWATER

❖ **AQUIFER:** a porous water-bearing rock formation through which water moves under the force of both pressure and gravity.

**Typical Cross-Section of the Edwards Aquifer**

Albuquerque, NM

Areas with a dry climate tend to get their water supply from aquifers.

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## GROUNDWATER

Groundwater can be found in cracks and pore spaces underground even when there is no aquifer to contain it.

The upstate terrain is generally hilly and mountainous, with an almost continuous series of hills intersected by numerous valleys. Glacial till covers most of the hillsides and hilltops, and bedrock is usually within 20 feet of the surface. Permeable sand and gravel deposits are often found in the valleys.

New York State Department of Environmental Conservation

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## WATER TABLE

**Water table:** the top of the underground saturated zone.

The level (height) of the water table varies with rates of replenishment and withdrawal.

A **cone of depression** is formed in an area where withdrawal exceeds replenishment

Source: Fayette Co., TEXAS

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## Water Deficiency Landscapes

❖ **Dry Area:** part of the earth's surface where evaporation exceeds precipitation (dry climates of the "B" climate classification) and the receipt of new moisture is meager and unpredictable.

- Categorized as **desert** (BW: arid) and **steppe** (BS: semi-arid).

❖ **Drought:** a naturally occurring decrease in precipitation from the norm.


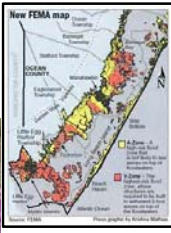
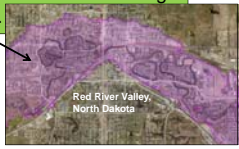
- May have an adverse affect on natural vegetation, agricultural production and domestic water supplies.
- Categorized by length of time without precipitation as **absolute** (no moisture received), **partial** (below normal recordings) and **dry spell** (a short period of time with below normal precipitation).

➢ **DROUGHT MONITOR WEBSITE:** <http://droughtmonitor.unl.edu/>

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## Excess Water Landscapes

- ❖ **Flooding:** when there is too much water to be contained within a channel or depression.
- ❖ **Flood zone:** area that is prone to periodic flooding.
- ❖ **Flood plain:** naturally occurring landform created as flood waters deposit sediment along their banks.

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## Cultural Landscapes Dealing with Water

### TOO MUCH.

- ✓ Flow control dams.
- ✓ Levees and sea walls.
- ✓ Diversion canals to channel excess water away.
- ✓ Flood control/protection projects: deepen and straighten channels, harden levees, raise roads, elevate buildings.
- ✓ Restore wetlands.

### TOO LITTLE.

- ✓ Impound dams with reservoirs.
- ✓ Well digging/drilling.
- ✓ Irrigation technology and resultant patterns.
- ✓ Water diversion projects to bring in water.
- ✓ Conservation programs.

See Chapter 10 in Conzen book.


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## SOILS

- ❖ **SOIL:** the top layer of the earth composed of organic and inorganic material, created over time, as temperature and moisture break down the bedrock.

**Color:** Darker indicates more organic materials.

**Texture:** Influences ability to hold water and air.



From Birdsall et al., *Regional Landscapes of the US&C*, 7th ed.

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## Soils

**The soils of North America vary with:**


- ✓ latitude
- ✓ elevation
- ✓ climate (temp. and moisture)
- ✓ bedrock geology
- ✓ natural vegetation

➤ **Most productive (high nutrient):**

- Mollisols** (mid-latitude grasslands)
- Alfisols** (mid-latitude forests)
- Ultisols** (ample precipitation, long frost-free period)

➤ **Least productive (low nutrient):**

- Aridisols** (arid)
- Spodosols** (cool, moist climates; sandy, acidic)
- Tundra soils** (cold, moist climate)
- Highland soils** (high, rugged terrain)

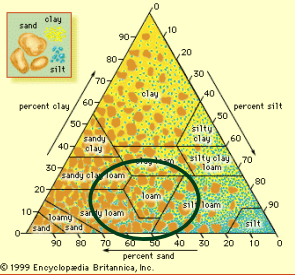


From Birdsall et al., *Regional Landscapes of the US&C*, 7th ed.

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## Soil Texture

**Combination of sand, silt and clay** determines a soil's ability to **hold water and transfer gases** - an important factor in crop production and one of the contributors to the development of the agricultural landscape.



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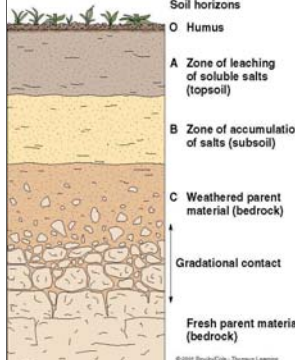
**Loams** have a mix of particle types and hold moisture well.

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## Soil Profile

- ❖ **Soil horizons** are layers of the soil of varying thickness, each with unique characteristics. Taken together they create a "profile."

- ✓ **Thickest** in warm, humid climates and on flat to rolling terrain.
- ✓ **Thinnest** in cold and dry areas and on steep slopes.



© 2007 Brooks/Cole, Thomson Learning


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## Permafrost

Most of Canada and Alaska is underlain by permafrost = approx. 25% of North America.

❖ **PERMAFROST:** permanently frozen subsurface layer of soil associated with the tundra.

- It ranges in thickness from c.3 ft to 1,000 ft.




EXTENT of PERMAFROST Contiguous  
90%  
50%  
10%  
None

NY Times 12/16/2011  
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## Permafrost

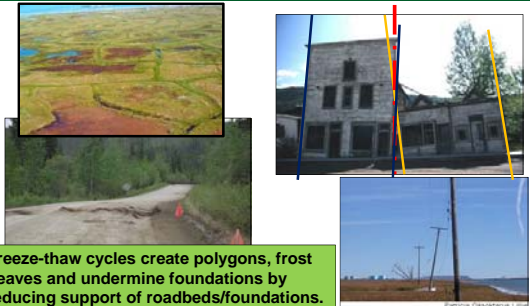
➤ During the summer the surface layer melts (but the sub-surface remains frozen), creating a bog-like environment.

✓ This allows millions of swarming insects to hatch and reproduce. (Beneficial to migratory birds as a food source.)



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## Permafrost Landscapes



Freeze-thaw cycles create polygons, frost heaves and undermine foundations by reducing support of roadbeds/foundations.

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## FROZEN CARBON and GLOBAL WARMING

- Ancient plants (times of global warming) removed carbon from the atmosphere by absorbing carbon dioxide.
- When the plants died (times of global cooling), their stored carbon was trapped and frozen in layers of soil and glacial debris.

➤ These layers of permafrost contain **twice as much carbon as the entire atmosphere!**

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## Permafrost and Carbon

Today carbon escapes when organic material in permafrost thaws and decomposes (A).

Carbon dioxide is released at the surface and methane, a more potent greenhouse gas (B) bubbles up from lakes and wetlands.

Ancient grass and shrubs  
Seasonally frozen soil, silt and debris  
Continually frozen ground

Forest  
Soil  
Permafrost

(A)

"Drunken" forest  
Thaw  
Lake  
Permafrost  
CO<sub>2</sub>thaw  
Methane

NY Times 12/16/2011


A "drunken forest" landscape occurs when the thawed soil layer can no longer anchor the tree roots and the trees tilt in reaction to the forces of wind and gravity.

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## US&C: Natural Vegetation Regions

Major units are:


- Forest**
  - deciduous
  - coniferous
- Grassland**
  - tall grass
  - short grass
- Scrubland**
  - semi-arid (steppe)
  - desert
- Tundra**
  - Arctic
  - alpine



From Birdsall et al., *Regional Landscapes of the US&C*, 7th ed.  
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## TREE LINE

❖ **TREE LINE:** The limit of normal tree growth determined by latitude or altitude or moisture. It marks the edge of the area beyond which it is too cold or too dry for trees to grow.




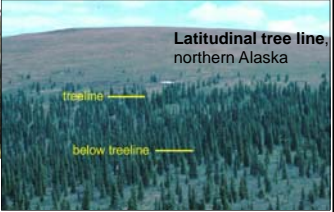
<< Water availability (isohyet) tree line, Coachella Valley, AZ .  
(Note location of trees, grasses and barren slopes.)

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## Tree Line

Alpine (elevation) tree line, Rocky Mts., Colorado

With global warming the tree line will extend upslope and move poleward.

Latitudinal tree line, northern Alaska

tree line ———

below tree line ———

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## Climax Vegetation

❖ Final stage in the plant community succession based on the habitat.

- Populated by the best species for existing conditions.
- Results from stable climate and soil conditions and protection from human disturbance.

➢ **HOWEVER, once conditions change, new species enter and local vegetation evolves until stability returns.**

- ✓ Global climate change creates instability.
- ✓ New landscapes are created as a result.

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## BIOME

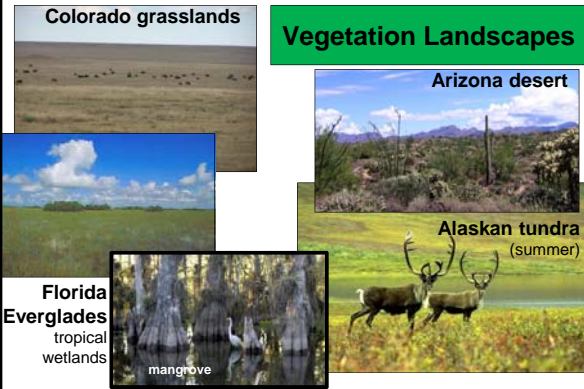
❖ A **biome** (ecoregion) is a zone of life.

- Unique combinations of flora, fauna and soils.
- Influenced by climate and geology.
- Is water and light dependent.
- Variations create subgroups called **ecosystems** which give us unique plant and animal communities.

➢ People are a part of this and their recognition and use of its components helps to create the cultural landscape.

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## Vegetation Landscapes



Colorado grasslands

Arizona desert

Florida Everglades tropical wetlands mangrove

Alaskan tundra (summer)

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## Vegetation Landscapes



Mixed (mainly deciduous) forest of Maine

Hoh rain forest of Washington state

Taiga (coniferous forest) of NWT

Desert at Death Valley, CA

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Deciduous Forest

The deciduous forest is a four-season biome that is dependent on the annual cycle of temperature, moisture and hours of sunlight.

© Barry Atwell  
www.environment.org

Biomes of the U.S. & Canada

[https://www.youtube.com/watch?v=lm1FXIXQQ\\_E](https://www.youtube.com/watch?v=lm1FXIXQQ_E)

<https://www.youtube.com/watch?v=fa29pg6NFs>

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Human Geography  
and the  
Cultural landscape

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