PART II: People and their Physical Environment

- ✓ I. Introduction to the Physical Environment
- ✓ II. Earth-Sun Relationship
- III. Earth Systems
  - ✓ A. The Hydrosphere: Oceans
  - ✓ B. The Atmosphere: Weather and Climate
  - ✓ C. The Lithosphere: Geologic Influences/Landscape Developmt
- ➢ IV. Earth Habitat
  - A. Biosphere
  - B. Natural Controls and Cycles
  - C. Human Impact
  - D. Natural Hazards
  - E. Earth Resources

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GEOG 101 Part II People and their Physical Environment

16: Earth Habitat

The Biosphere

Chapter 4

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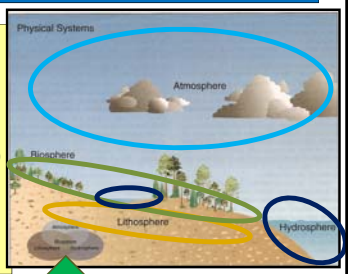
Hunter College Geography

PHYSICAL SYSTEMS

The earth's physical environment is composed of the:

1. Atmosphere (air)
2. Hydrosphere (water)
3. Lithosphere (land)
4. Biosphere (life)



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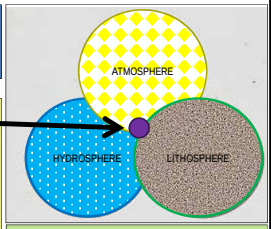
BIOSPHERE

❖ The BIOSPHERE or *"realm of life"* is at the interface of air, land and water.

➢ It is SUN dependent.

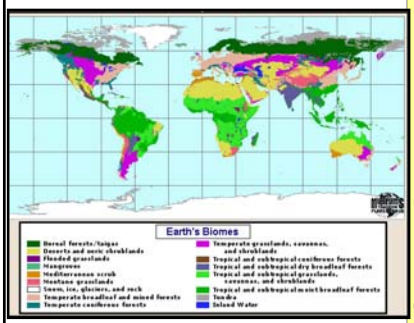
- All lifeform characteristics are a result of variations in the components of the bio-sphere: temperature, moisture, elevation, slope angle.
  - Plants are most sensitive to change because they cannot relocate quickly.



Divisions of the Biosphere

1. **Biome** – geographic divisions or zones
2. **Ecosystem** – area of containing plants and animals dependent on special conditions of the physical environment
3. **Community** – group of interdependent lifeforms living together (habitat)
4. **Population** – number of entities within a habitat (headcount)
5. **Organisms** – specific lifeforms

BIOMES



❖ **BIOMES are zones of life.**

- Also called *eco-regions*, they are areas with a **unique combin-ation** of climate, life forms (flora, fauna, fungi, etc.) and soils.
- Categories are: **fresh water, salt water, desert, forest, grassland and tundra.**
- Each biome has many ecosystems.

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Land Biomes

❖ **Terrestrial** (land) **biomes** vary with temperature and moisture giving us **unique plant and animal communities.**

➢ **Each species has characteristics that allow it to survive within its physical environment.**

➢ The components of biomes have to be preserved, recycled and renewed to avoid reaching **carrying capacity** (maximum life support) and to maintain the **quality of its habitat** (quality varies with conditions).

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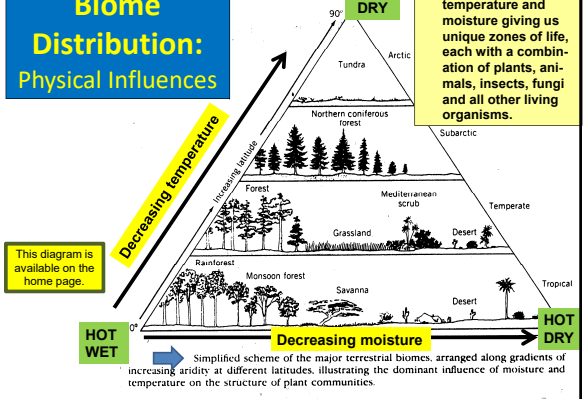
Biome Distribution: Physical Influences



- ✓ Biomes vary with temperature and moisture giving us unique zones of life, each with a combination of plants, animals, insects, fungi and all other living organisms.

This diagram is available on the home page.

Simplified scheme of the major terrestrial biomes, arranged along gradients of increasing aridity at different latitudes, illustrating the dominant influence of moisture and temperature on the structure of plant communities.

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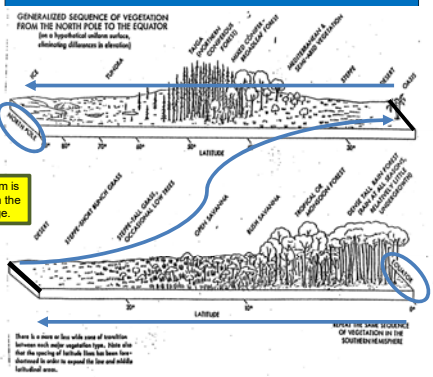
Vegetation Sequence



This diagram is available on the home page.

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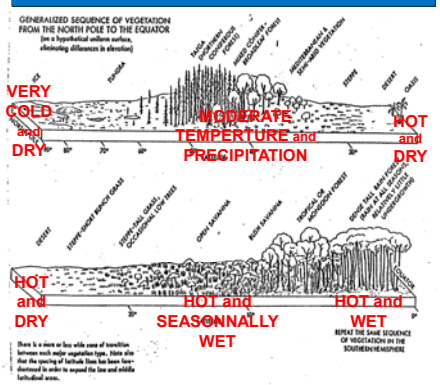
Vegetation Sequence



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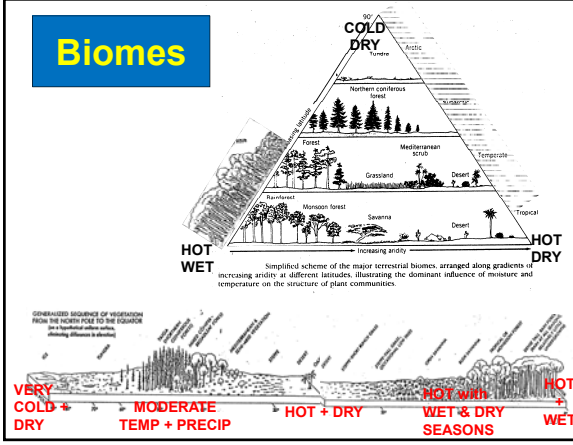
Biomes



Simplified World Map of Animals

Animals and land habitat go hand-in-hand, as do fish with water habitat.

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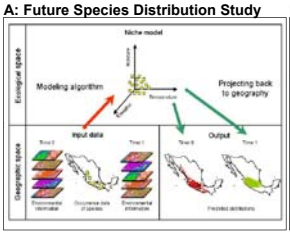
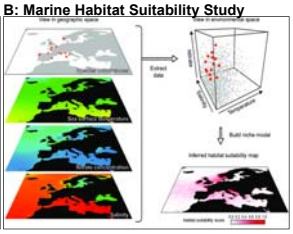
Biome Modeling using GIS

By in-putting data into a GIS, we can create a model based on changing variables. The "What if…?" scenarios can be studied.

A: Future Species Distribution Study



B: Marine Habitat Suitability Study



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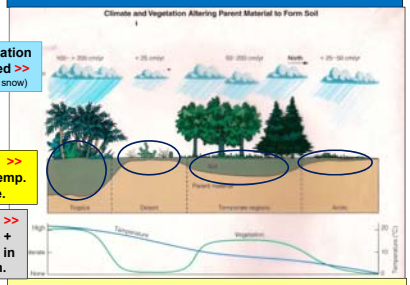
Soil Formation



Soil formation depends on temperature and moisture working on bedrock and organic material over time.

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Climax Vegetation

BIOMES: zones of life that develop in a unique combination of temperature, moisture, soil and sunlight.

❖ **Climax vegetation is the best species for the existing conditions within the biome.**

- When **conditions change**, new species **better suited** for the conditions invade and a **new sequence** of plant growth begins.
  - ➢ **When it stabilizes, climax vegetation is again attained.**
  - ✓ When factors change, the sequence begins again. Nature is always reaction to stimuli.

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Climax Community

❖ **Climax community is a term in ecology describe-ing the combination of lifeforms** (flora/fauna/fungi) **existing undisturbed at a particular location.**

- ✓ The community developed over time in response to a set of physical conditions and has been stabilized.
- ✓ A change in any of the conditions will upset the dynamic, destabilize it and put change into motion.
- ➢ **Examples of disruption** include: global climate change, deforestation, reservoir building, species extinction, wildfire, human interference in life cycles, as killing local predator animals.

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NATURAL CONTROLS and CYCLES

✓ **A. Temperature Controls: rotation** (day and night), **revolution** (the seasons), **cloud cover, and ocean circulation** (surface, deep sea).

✓ **B. Geologic Cycle: plate tectonics, rock cycle, building and gradational forces**

➢ **C. Biogeochemical Cycles**

1. Hydrologic (water) cycle
2. Carbon-Oxygen cycle
3. Nutrient cycle

All these controls and cycles are interrelated.

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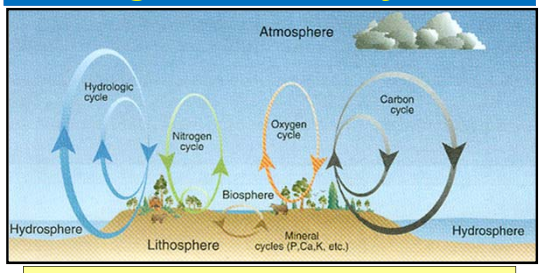
Biogeochemical Cycles



Biogeochemical cycles transfer matter between the atmosphere, hydrosphere, and lithosphere.
The cycles shown here are diagrammatic and therefore simplified.

https://www.youtube.com/watch?v=d70iDxBtnas 5 min **carbon cycle**

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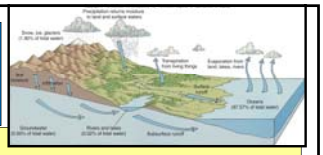
Hydrologic Cycle

https://www.youtube.com/watch?v=al-do-HGuIk
6 min Water Cycle video



1. **Evaporation process** removes water molecules from oceans, lakes, land and biota leaving behind salts and pollutants.
2. **Wind** moves atmospheric moisture around the globe.
3. **Clouds** are created at the **condensation** point.
4. **Precipitation** occurs after saturation is reached; returns water to the earth's surface where it is collected and stored.
5. **Infiltration** soaks it into the ground (percolation).
6. **Runoff** is when water flows over the land.
7. **Water returns** to the oceans, lakes, land and biota to begin the cycle again when it is discharged.

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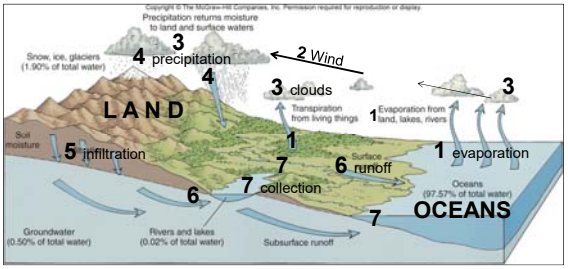
Hydrologic Cycle



88% of all evaporation is from the oceans.
WATER ON LAND: 77% frozen; 22% underground; 1% surface of which only 0.6% is in lakes and rivers.

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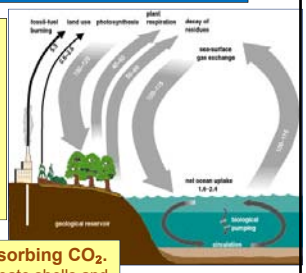
Carbon-Oxygen Cycle

Carbon dioxide (CO_2) is created by respiration, decay and combustion which uses oxygen (O_2) in the process.

❖ **Photosynthesis: removes CO_2 and creates O_2.**



➢ **Oceans play a great role in absorbing CO_2.** Algae and marine life absorb it to create shells and eventually carbonate rocks.
➢ **Human production of CO_2 is *faster* than plants and the oceans can absorb it.**

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Carbon-Oxygen Cycle

NEGATIVE Variables of Human Impact

1. **Deforestation** (decreases absorption of CO_2)
2. **Burning of fossil fuels** (adds more CO_2)
3. **Urbanization** (decreases absorption; adds more CO_2)
4. **Pollution of the ocean surface** (decreases absorption of CO_2)
5. **Global warming** (melting of permafrost/ice pack releases stored CO_2 and other greenhouse gasses therefore adds more CO_2 to the atmosphere)

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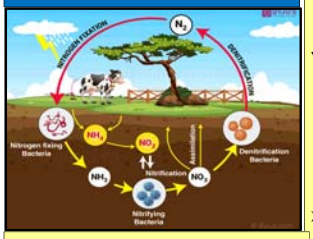
Nitrogen Cycle



For nitrogen (N_2) to be used, it has to be converted into water-soluble compounds, esp. ammonia (NH_3) and nitrate (NO_3). Plants can absorb them with water intake and use them to make chlorophyll (needed for photosynthesis).

❖ **Nitrogen fixation: the process that makes nitrogen usable.** It occurs two ways in nature:
✓ (1) in the soil by the **nitrogen-fixing bacteria** found on certain plant roots; and (2) in the air by **lightning** which converts atmospheric N_2 (via an intense electrostatic discharge) into ammonia and nitrate and returns it to earth with rain or snow.
➢ Manufacturers convert nitrogen gas into ammonia, nitrates and nitrites and incorporate it into nitrogen-rich fertilizers used by farmers to supplement the amount in the soil.
❖ **Denitrification** completes the cycle by converting nitrate (NO_3) back to a gas (N_2).

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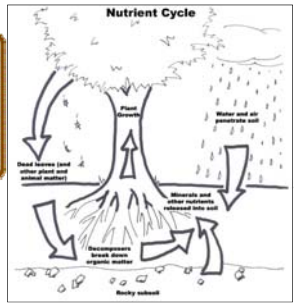
Nutrient Cycle



✓ **Water and temperature dependent.**
➢ **Too dry or too cold slows the process.**

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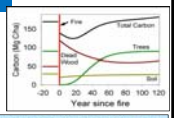
Nutrient Cycle

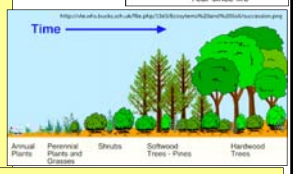
The nutrient cycle adds fertility to the soil. There are 3 aspects of the cycle:

1. **DECOMPOSITION: rotting organic material** (mixes with inorganic material to give a balanced soil).
2. **FIRE: ash residue from burnt vegetation** (ash and vaporized nutrients released into atmosphere mix with rainwater which is absorbed by the soil. NOTE: ash is naturally alkaline and counteracts a higher acidic pH levels in a soil.)
3. **FLOODING: enriched sediment and water** (seasonal flooding leaves behind a layer of organic and inorganic nutrients taken from upstream areas; supplements local nutrients).

Benefits of a Forest Fire

- Nutrient release to soil, esp. when mixed with rainwater.
- Regrowth of remnant roots and seeds
- Allows expansion of neighboring ecosystems (climax vegetation sequence begins)
- Rapid restoration of energy flow and nutrient cycling (exposure to sunlight; thinner atmosphere/lithosphere interface; better water absorption)





Also,
- **Reduces chance of catastrophic fire**
- **Controls insect pests**
- **Controls plants diseases**
- **Adds to biodiversity** (flora and fauna)

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NUTRIENT CYCLE: Human impact

The nutrient cycle has been affected by:
- **Land alternation:** cutting forests, plowing grass-lands, urbanization, suburbanization, roads
- **Dousing forest/grassland fires**
- **Stream alteration:** dam building, dredging, levees
- **Land pollution:** landfills, mining waste, toxic spills
- **Misuse of artificial fertilizers/herbicides:** affect organisms in biosphere (soil); cause water pollution, eutrophication (oxygen depletion in water), adverse effects on life forms (toxicity).

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NEXT

Natural Hazards and Human Impact

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