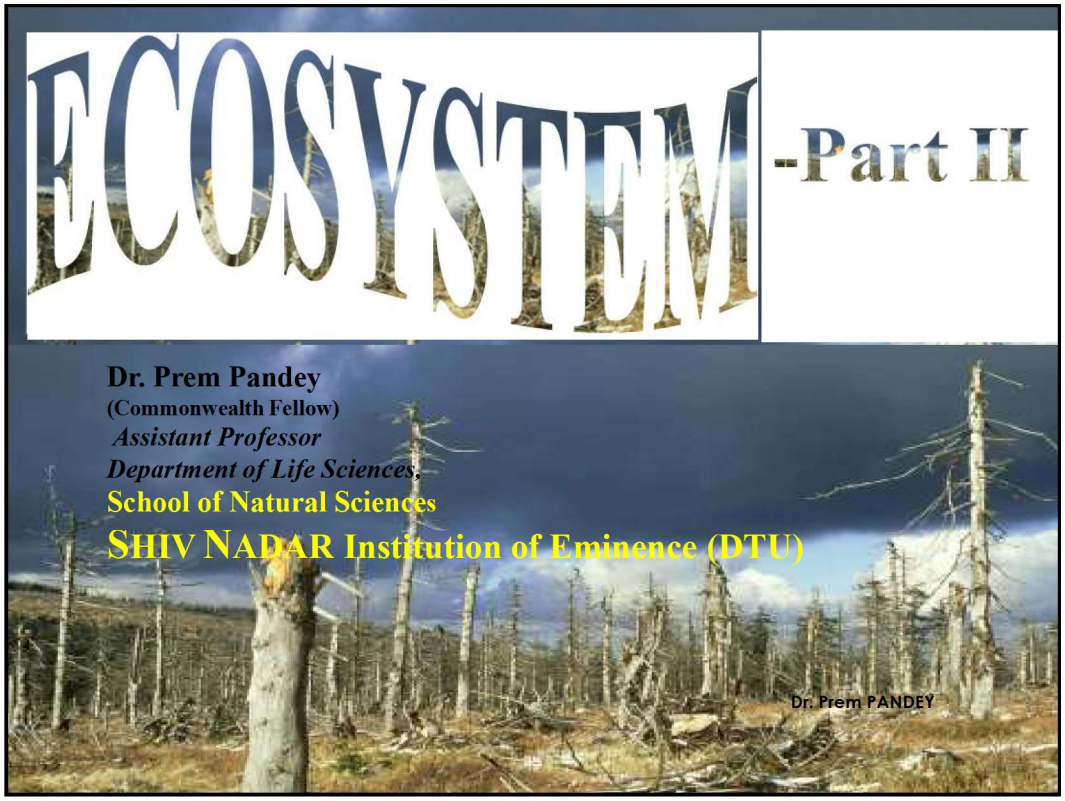
ECOSYSTEM
-Part II
Dr. Prem Pandey
(Commonwealth Fellow)
Assistant Professor
Department of Life Sciences,
School of Natural Sciences
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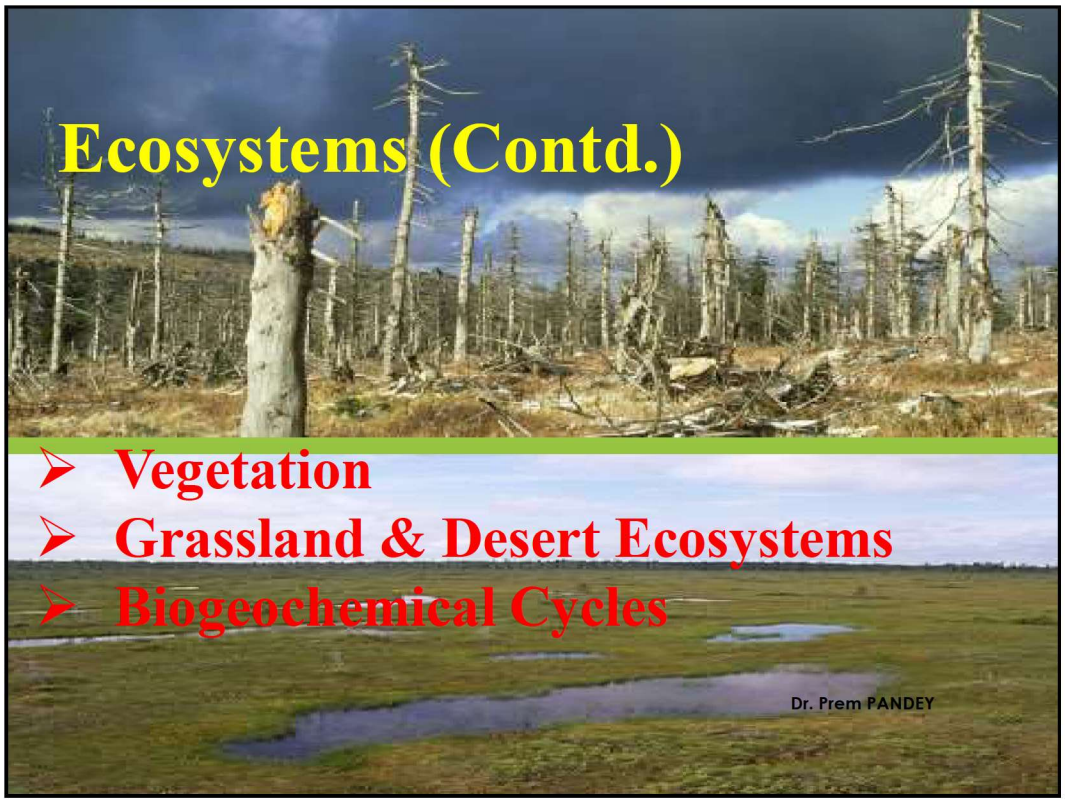
Dr. Prem PANDEY


Ecosystems (Contd.)
Vegetation
Grassland & Desert Ecosystems
Biogeochemical Cycles
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1. Vegetation

- **Vegetation** is an assemblage of plant species and the ground cover they provide in a given area.
- It is a general term, without specific reference to particular **taxa, for life forms, structure, spatial extent**, or any other specific botanical or geographic characteristics.
  - Vegetation types – Forest, grassland, etc.
- Perhaps the closest synonym of vegetation is ***plant community***, but *vegetation* can, and often does, refer to a wider range of *spatial scales* than that term does, including ***scales as large as the global.***
- It is broader than the term "***Flora***" which refers to **species composition**

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Vegetation

- **The vegetation type is defined by:**
  1. **Characteristic *of dominant species*, or**
  2. **a common aspect of the assemblage,**
     - **such as an elevation range or environmental commonality.**
- Evergreen forests of Western Ghats, Coastal mangroves, Desert plants, Roadside weed patches, Wheat fields, Cultivated gardens and lawns; all are encompassed by the term *vegetation*.
- The contemporary use of *vegetation* approximates that of ecologist ***Frederic Clements***' term "earth cover", an expression still used by the Bureau of Land Management, USA.

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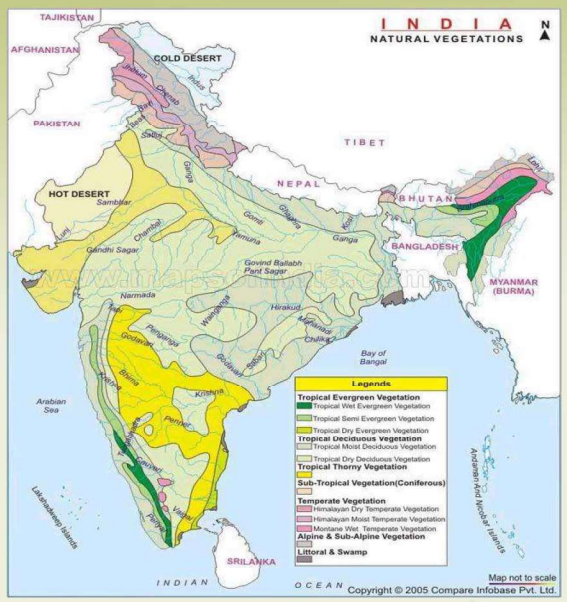
Natural Vegetation of INDIA



Natural vegetation refers to plant life undisturbed by humans in its growth and which is controlled by the ***climatic conditions*** of that region.

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Ecosystems

4. Grasslands

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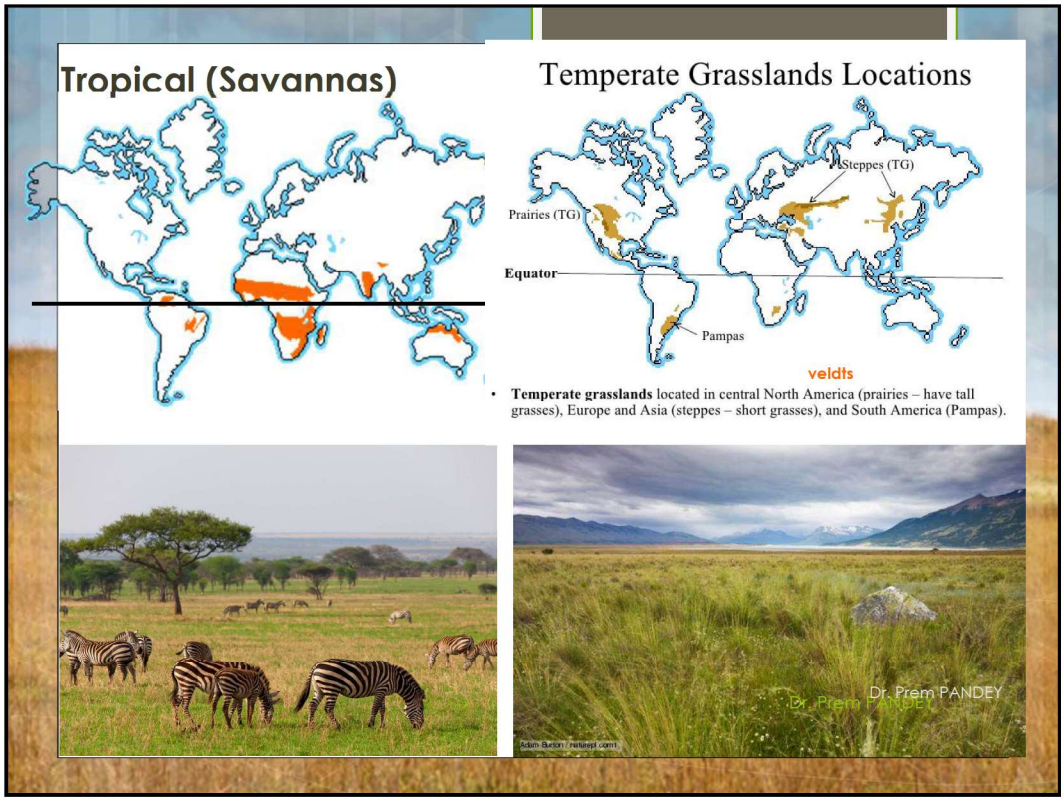
4. Grasslands

An area, as a prairie, in which the natural vegetation consists largely of perennial grasses, characteristic of sub-humid and semiarid climates.

- Warm or seasonal temperatures.
- Moderate or seasonal precipitation.
- Moderate net primary productivity.



Tropical Grasslands (Savannas)

- Precipitation 90-150cm/year
- Open, widely spaced trees, seasonal rainfall
- Parts of Africa, South America & Australia
- A savanna is a rolling grassland scattered with shrubs and isolated trees, which can be found between a tropical rainforest and desert biome.
- Not enough rain falls on a savanna to support forests.
- Savannas are also known as tropical grasslands.

Temperate Grasslands

- **Precipitation: 10-60cm/year**
- **Rich soil; shorts dense grasses sometimes may be tall.**
- **Central North America; Central Asia**

Temperate grasslands are located north of the Tropic of Cancer (23.5 degrees North) and south of the Tropic of Capricorn (23.5 degrees South).

- **The major temperate grasslands include,**
  - **the veldts of Africa,**
  - **the pampas of South America,**
  - **the steppes of Eurasia, and**
  - **Prairies- the plains of North America**

It is the soil that makes the temperate grasslands such an integral part of human society. It is unusually rich and fertile, it is also deep.

The world's most fertile soil is found in the eastern prairies of the U.S., the pampas of South America, and the steppes of Ukraine and Russia.

Grasslands Ecosystems

- *Tropical Grasslands* – Africa, some parts of India
  - Warmer and wetter climate than temperate
  - Dry and wet seasons
  - More pronounced seasonal drought.
- T*emperate*- huge temperate prairies
  - Cold winters and warm summers
  - Grasses have interconnected root systems
  - Well-suited to agriculture due to rich soils.
  - Short grass prairies, which are drier and more drought-resistant
  - Temperate moist grasslands

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Scrub Grasslands

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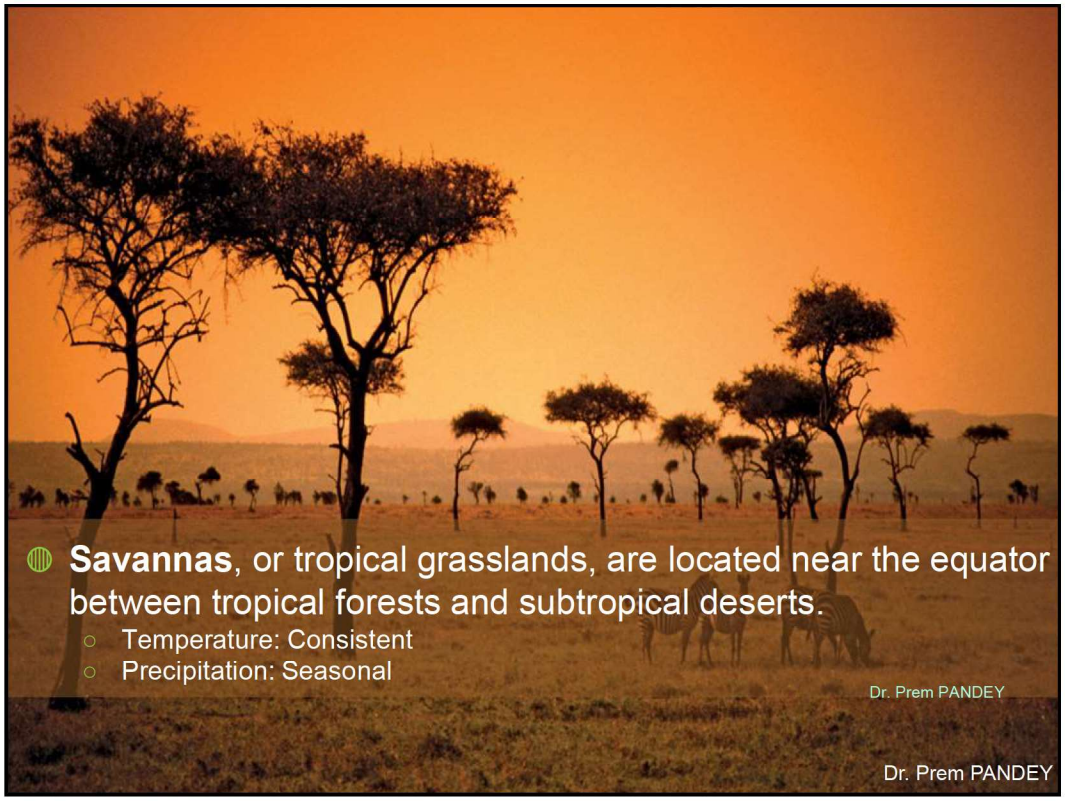
Savannas, or tropical grasslands, are located near the equator between tropical forests and subtropical deserts.
Temperature: Consistent
Precipitation: Seasonal
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Prairies, or temperate grasslands, are found in midlatitudes.
Temperature: Seasonal
Precipitation: Moderate
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Tundras, or polar grasslands, have short growing seasons and permanently frozen soil called **permafrost**.
Temperature: Consistently cold
Precipitation: Moderate
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Flooded grasslands: areas that are covered in water year-round and have many plants that grow in water. Water birds migrate to these areas, and some are permanent residents.
Some globally outstanding flooded savannas and grasslands include:
Everglades: ***The world's largest rain-fed flooded grassland***, covering 7,800 square miles (20,000 square kilometers). The Everglades is home to many species of plants, birds, and fish.
Pantanal: A flooded savanna in South America.
Saharan flooded savannas: A flooded savanna.
Zambezian flooded savannas: A flooded savanna in Angola, Botswana, Democratic Republic of Congo, Malawi, Mozambique, Tanzania, and Zambia.
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Sudd: Africa's largest wetland and one of the world's largest tropical wetlands.
.
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Flooded grasslands and tropical grasslands differ in a number of ways, including:

- Flooding: Flooded grasslands are periodically or seasonally flooded with fresh or brackish water, while tropical grasslands are warm year-round.
- Vegetation: Flooded grasslands are characterized by an abundance of grasses, while tropical grasslands have short plants, shrubs, and small trees.
- **Wildlife:** Flooded grasslands support many plants and animals, including large congregations of migratory and resident waterbirds. Tropical grasslands are home to elephants, giraffes, lions, cheetahs, zebras, and other species
- Location: Flooded grasslands are found mostly in the tropics and subtropics, while tropical grasslands are also called savannas and are found in warm to hot climates.
  - Examples-
  - The Everglades, Pantanal, and Esteros del Ibera are examples of flooded grasslands, while the African savanna is an example of a tropical grassland.

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Adaptations of Grassland Plants

- **Prairie plants have deep and complex root structures that allow them to recover from drought, wildfire, cold winters, and grazing animals.**
- **Tundra plants are low-lying due to permafrost and mature rapidly in the short growing season.**

Missouri Goldenrod, *Solidago missouriensis*

Compass Plant, *Silphium laciniatum*

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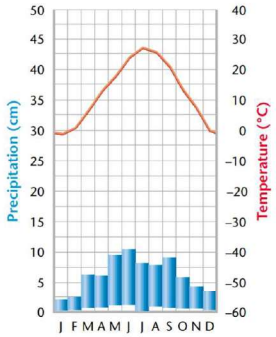
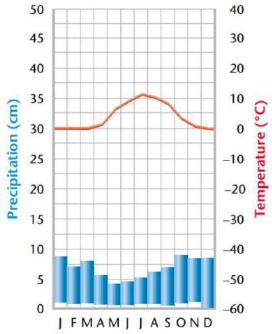
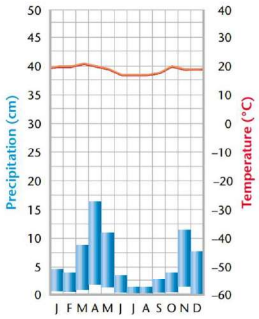
Identify the Type of grassland present in each climatograph: Temperature, Tropical or Polar



Seasonal **temp**eratures
Moderate rainfall



Seasonal temperatures
Moderate precipitation



Warm temperatures
Seasonal precipitation

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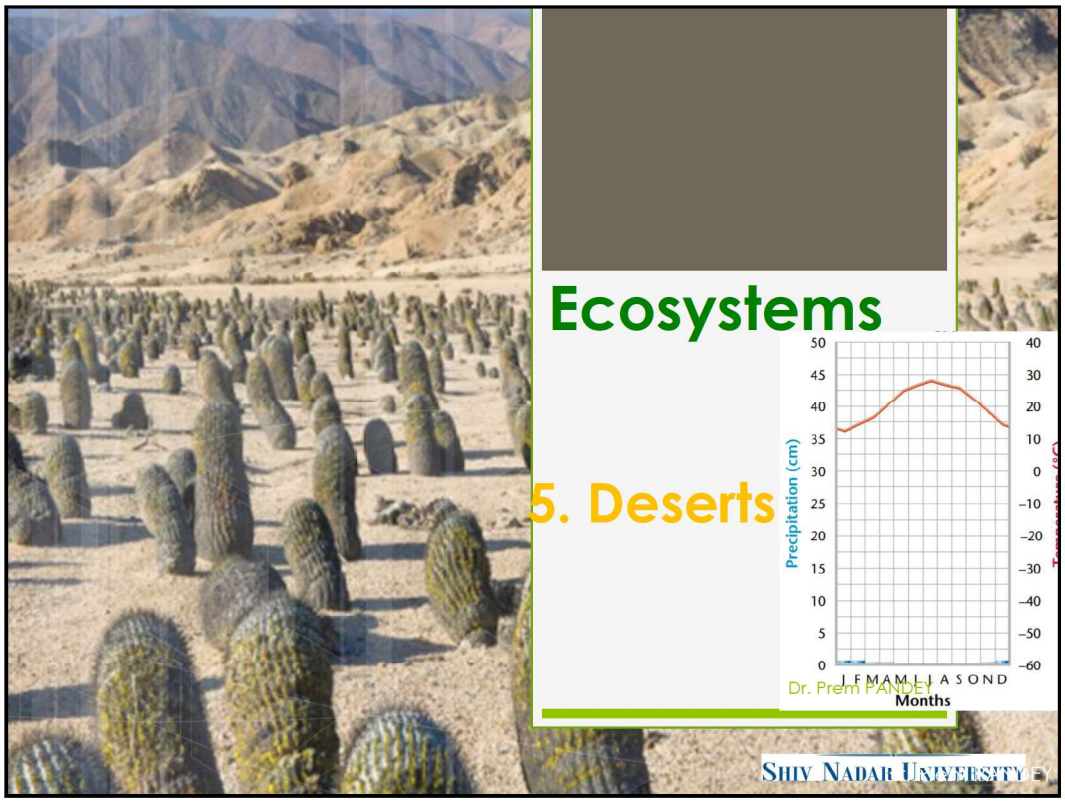

5. Deserts

- A desert is a barren area of landscape where little precipitation occurs and consequently living conditions are hostile for plant and animal life.
- The lack of vegetation exposes the unprotected surface of the ground to the processes of denudation. About one third of the land surface of the world is arid or semi-arid.
- Parts of Africa, Asia(India), Australia, North America

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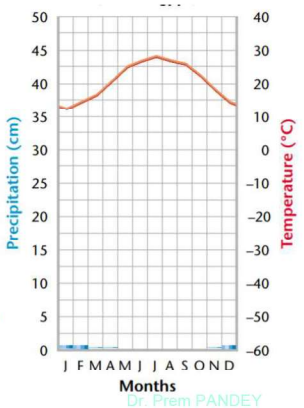
5. Deserts

Low precipitation (20cm/year)
High temperatures.

Lowest net primary productivity of all ecosystems.

Dry, sparse vegetation; scattered grasses



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5. Desert Ecosystem

- Deserts cover about one fifth of the Earth's surface.
  - rainfall is less than 20 cm/year.
- Although most deserts, such as:
  - the Sahara of North Africa
  - the deserts of the southwestern U.S., Mexico,
  - Australia, occur at low latitudes,
  - Another kind of desert, cold deserts,
    - occur in the basin and mountain range area of Utah
    - Nevada and in parts of western Asia -Ladakh, Lahaul Spiti in India.

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Deserts

- Desert biomes can be classified according to several characteristics.

There are four major types of deserts:

- Hot and Dry
- Semiarid
- Coastal
- Cold

- Ladakh in India is a cold desert that lies in the Great Himalayas on the eastern side of Jammu and Kashmir. It is also known as Khapa-chan, which means snow land. Ladakh is enclosed by the Ladakh Range and the Karakoram Range in the north, and the Zanskar Mountains and the Great Himalayas in the south.
- Lahaul Spiti Valley

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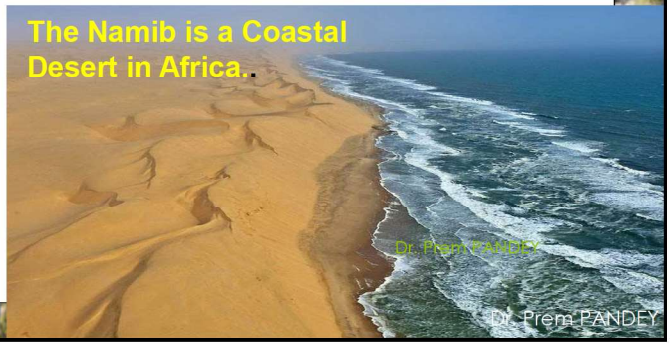
Cold Desert - Ladakh

Coastal desert- Atlantic and Namib

- The Atlantic is the westernmost eco-region in the Sahara Desert of North Africa.
- It occupies a narrow strip along the Atlantic coast.
- the more frequent fog and haze generated offshore by the cool Canary Current provides sufficient moisture to sustain a variety of lichens, succulents, and shrubs.



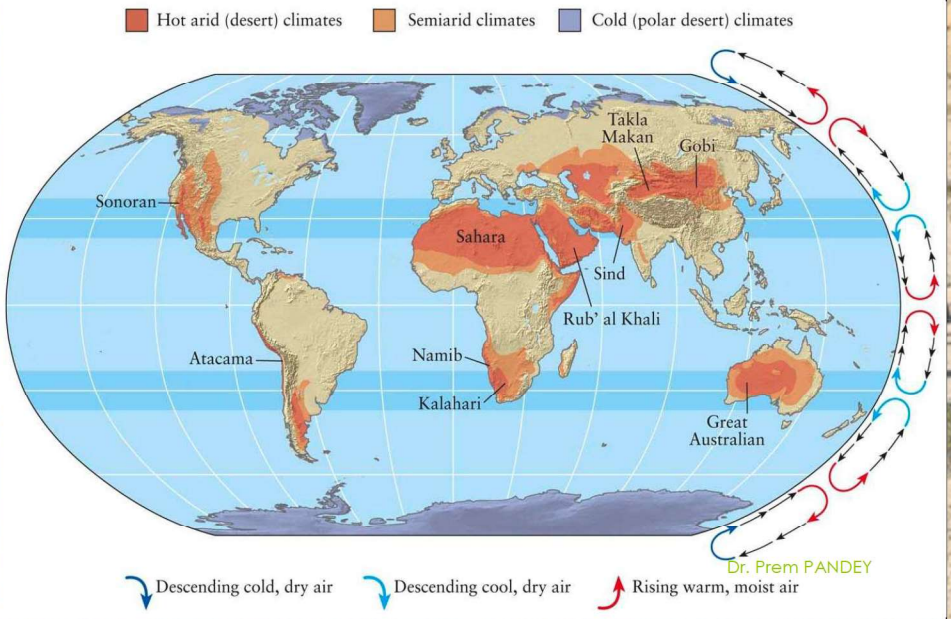
Deserts

- **Desert:** low-precipitation extreme (< 200 mm)
  - **Subtropical:** in the two subtropical dry belts- Gobi,
  - **Tropical:** Sahara, Thar
  - **Continental interior:** far from any water source
  - **Rain shadow:** where mountains create a barrier
  - **Coastal:** western coast of US, Eastern Africa
  - **Polar/Cold: low** precipitation due to cold sinking air;Lahaul Spiti in HP
- Plant cover is sparse in all five types, but adapted to dry conditions, lack of water, stress.

Deserts

- **Drought**
  - A region experiencing **below-average rainfall** for an extended period
    - Often with emphasis on affected water supply or harvests
  - **Semi-arid areas** adjacent to deserts are highly **susceptible** to drought
  - ***Desertification***
  - The prevailing desertic conditions into adjacent areas is called **desertification. Arid and semi-arid regions experiencing desert conditions.**
    - Due to natural causes (drought)
    - Overgrazing and poor land-use practices

Deserts



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Distribution of Deserts

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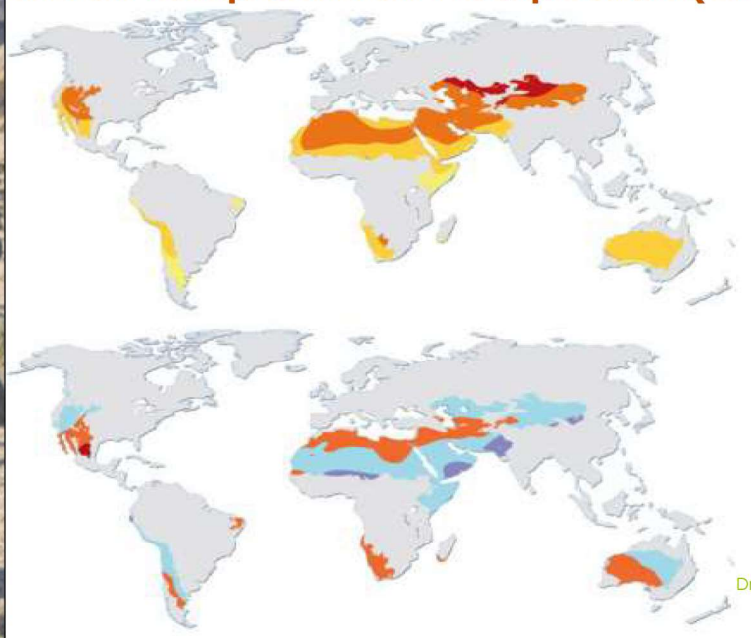
Mean Temp & Mean Precipitation (DESERTS)



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Sources: IPCC 3rd assessment Synthesis Report, 2001

Deserts of the world

Human interference has caused an expansion of the desert areas, called desertification, which directly affects 250 million people worldwide.

The world's biggest desert areas:

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SOURCES: Food and Agriculture Organization of the U.N. (FAO), World Resource Institut, Encyclopædia Britannica, Harenberg Lexikon

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Cold Desert- Ladakh

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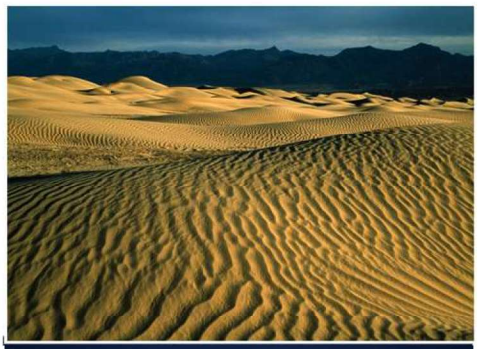
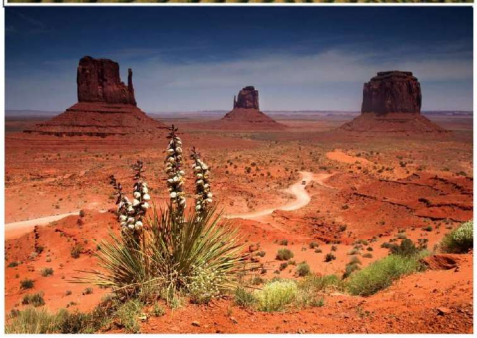
Arizona and California (US)



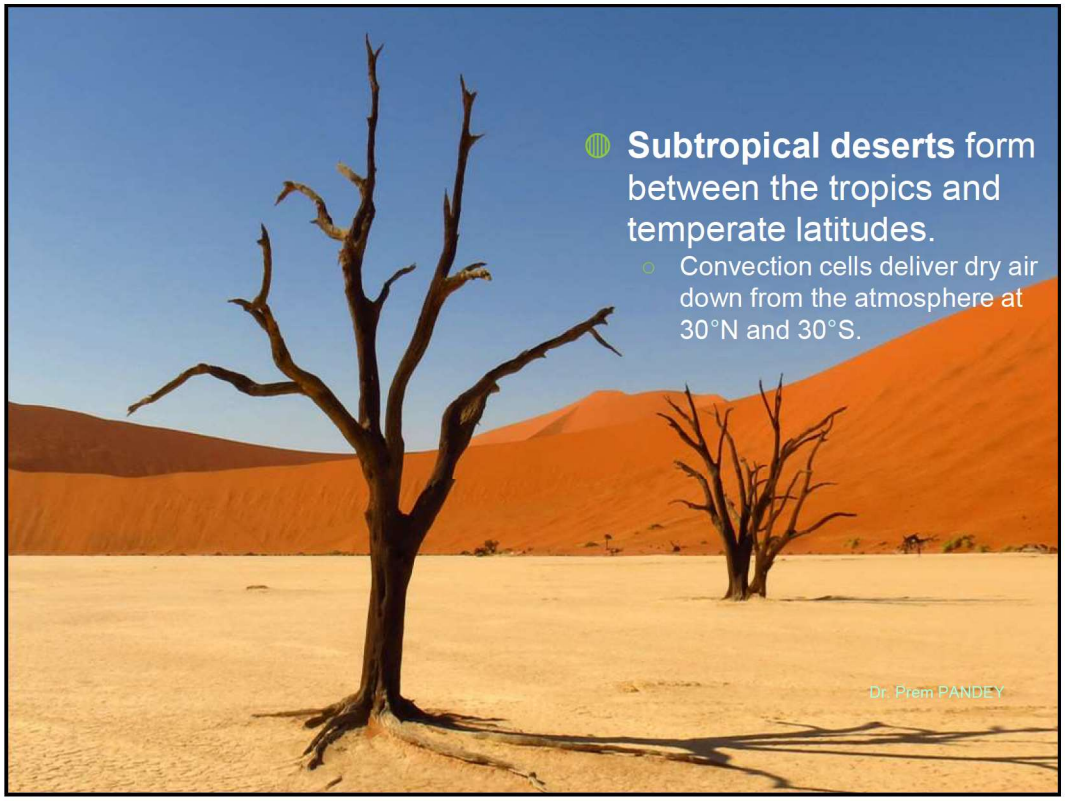


Sahara (Africa)

India-Jodhpur -Jaisalmer

Desert- Saudi Arabia

Thar Desert Jaisalmer- sand dunes


Subtropical deserts form between the tropics and temperate latitudes.
Convection cells deliver dry air down from the atmosphere at 30°N and 30°S.
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Rain-shadow deserts are found on the leeward side of mountain ranges.
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Temperate deserts have seasonal temperature variations.
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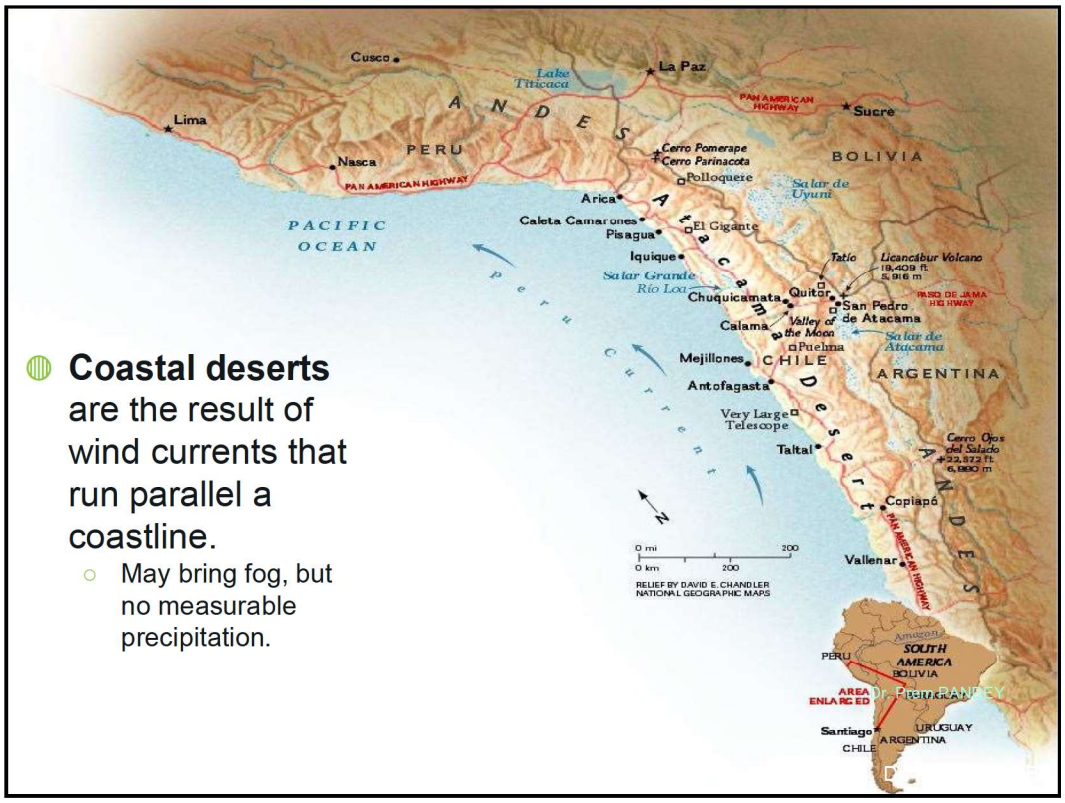
Coastal deserts are the result of wind currents that run parallel a coastline.
May bring fog, but no measurable precipitation.
Cusco
La Paz
Lake Titicaca
Lima
Sucre
PERU
BOLIVIA
Nasca
Cerro Pomerape
Cerro Parinacota
Polloquere
Salar de Uyuni
Arica
Caleta Camarones
Pisagua
El Gigante
PACIFIC OCEAN
Iquique
Salar Grande
Río Loa
Tatio
Licancábur Volcano
Quitor
Chuquicamata
San Pedro de Atacama
Calama
Valley of the Moon
Salar de Atacama
Ptielma
Mejillones
CHILE
ARGENTINA
Antofagasta
Very Large Telescope
Taltal
Cerro Ojos del Salado
Copiapó
Vallenar
RELIEF BY DAVID E. CHANDLER
NATIONAL GEOGRAPHIC MAPS
Amazon
SOUTH AMERICA
BOLIVIA
Santiago
URUGUAY
ARGENTINA
CHILE
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Polar deserts are consistently cold and dry.
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Adaptations of desert organisms:
Ability to store water (e.g. succulents) or fat (e.g. camels).
Reduced growth rate and/or herd size.
Spikes and camouflage for defense.
Energy conservation (dormancy, cold-blooded)
Deep taproots
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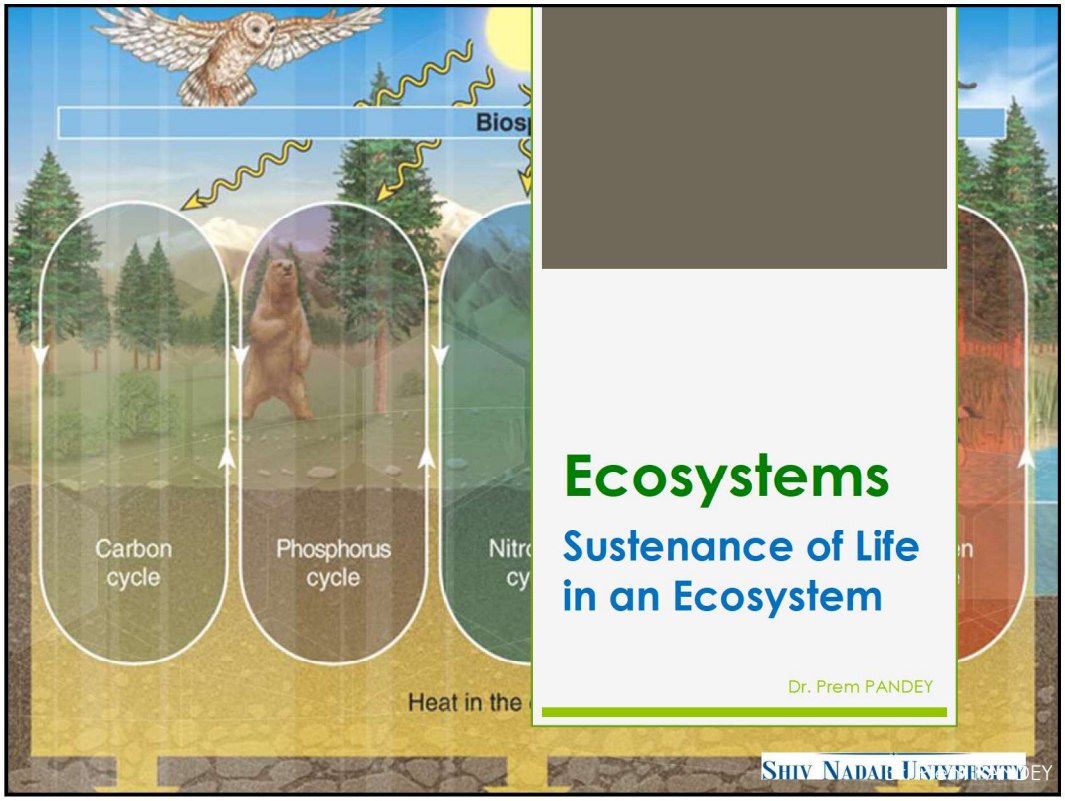
Watch this clip of the Namib coastal desert., Unique ecosystem

Watched the previous clip of the Namib desert.

- **What type of desert is it?**
- **What is a behavioral adaptation present in each of the three animals shown?**
- **What is the advantage of living in a zone of stress instead of the savanna?**



Ecosystems

Sustenance of Life in an Ecosystem

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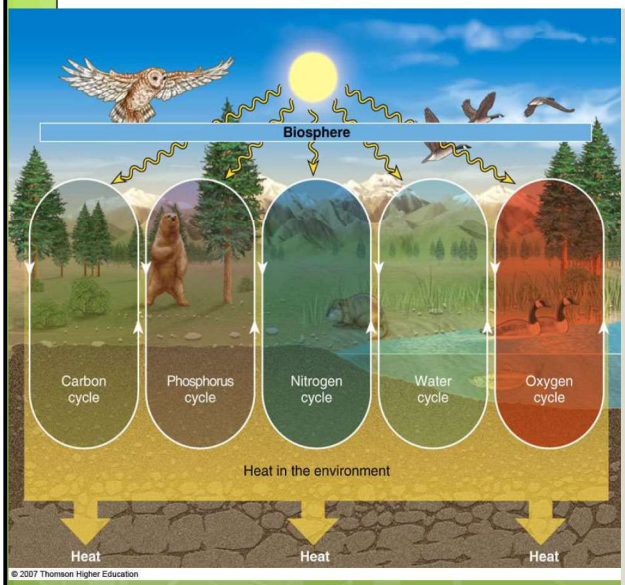
What Sustains Life on Earth?



- ***Solar energy***,
- ***the cycling of matter in Biosphere,*** **and**
- ***gravity***

sustain the earth's life.

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Matter Cycles

The Earth is a **closed system** to matter.

There is **no waste** in nature.

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"Biogeochemical"

- The term "biogeochemical" tells us that biological, geological and chemical factors are all involved.
- The circulation of chemical nutrients like carbon, oxygen, nitrogen, phosphorus, sulphur, phosphorus, Nitrogen, calcium, and water, etc. through the biological and physical means is known as biogeochemical cycle.
- Elements, chemical compounds, and other forms of matter are passed from one organism to another and from one part of the biosphere to another through biogeochemical cycles.

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"BIOGEOCHEMICAL"

- In effect, the element is recycled.
- Although in some cycles there may be places (called *reservoirs*) where the element is accumulated or held for a short or long period of time, such as:
  - an ocean or lake for water, and
  - ocean and trees for carbon.

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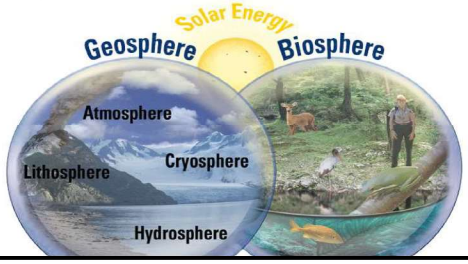
BIOGEOCHEMICAL CYCLE

- In Earth science, a biogeochemical cycle or substance turnover or cycling of substances is a pathway by which a chemical substance moves through both biotic (biosphere) and abiotic – geosphere (lithosphere, atmosphere, and hydrosphere) components of Earth.
- A biogeochemical cycle is the complete pathway that a chemical element follows through the Earth system
- A cycle is a series of change which comes back to the starting point and which can be repeated.



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CYCLES IN NATURE

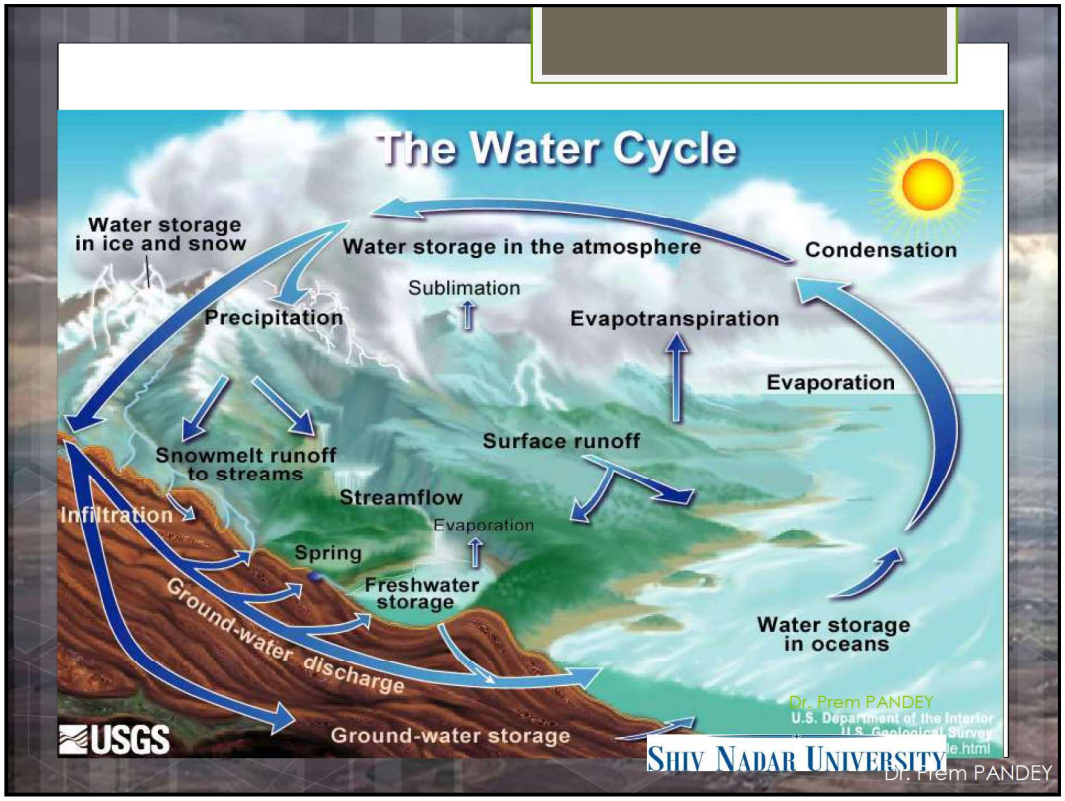
- The Hydrologic Cycle
- Carbon Cycle / Oxygen Cycle
- Nitrogen Cycle
- Sulfur Cycle
- Phosphorus Cycle

BIOGEOCHEMICAL CYCLE

- Water, for example, is always recycled through the water cycle, as shown in the diagram.

The water undergoes

- evaporation,
- condensation, and
- precipitation, falling back to Earth.


The Water Cycle
Water storage in ice and snow
Water storage in the atmosphere
Condensation
Sublimation
Precipitation
Evapotranspiration
Evaporation
Surface runoff
Snowmelt runoff to streams
Streamflow
Infiltration
Evaporation
Spring
Freshwater storage
Ground-water discharge
Water storage in oceans
USGS
Ground-water storage
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U.S. Department of the Interior
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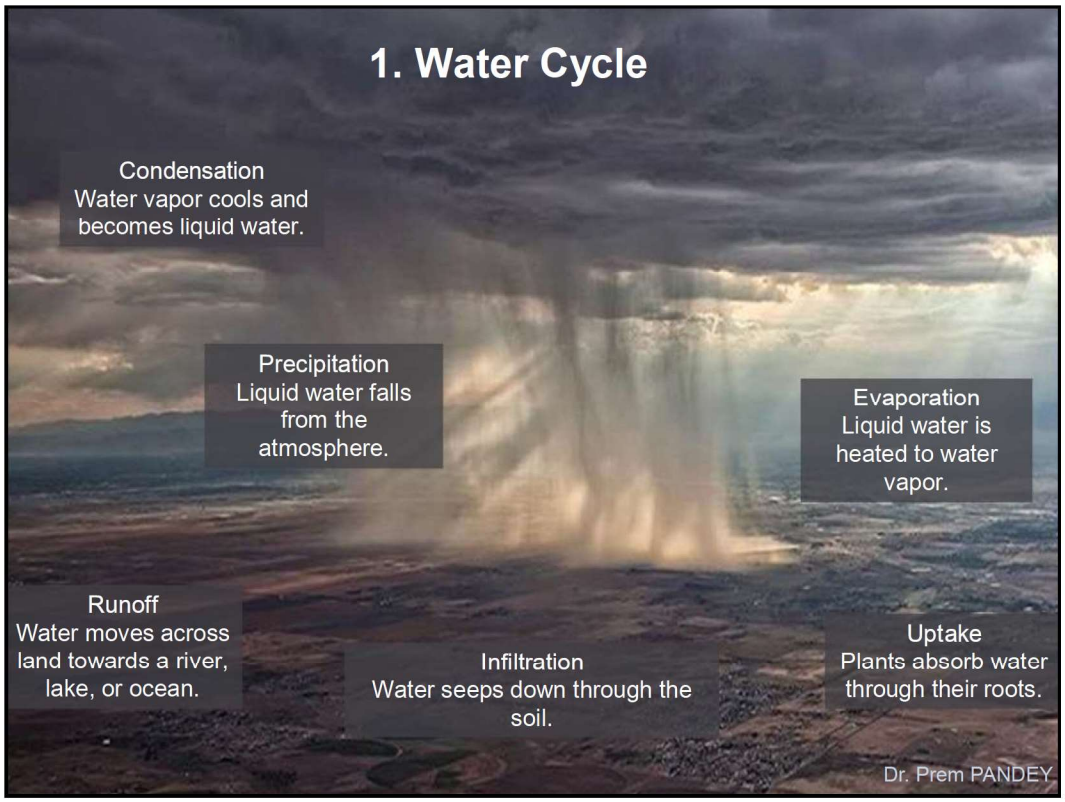
1. Water Cycle
Condensation
Water vapor cools and becomes liquid water.
Precipitation
Liquid water falls from the atmosphere.
Evaporation
Liquid water is heated to water vapor.
Runoff
Water moves across land towards a river, lake, or ocean.
Infiltration
Water seeps down through the soil.
Uptake
Plants absorb water through their roots.
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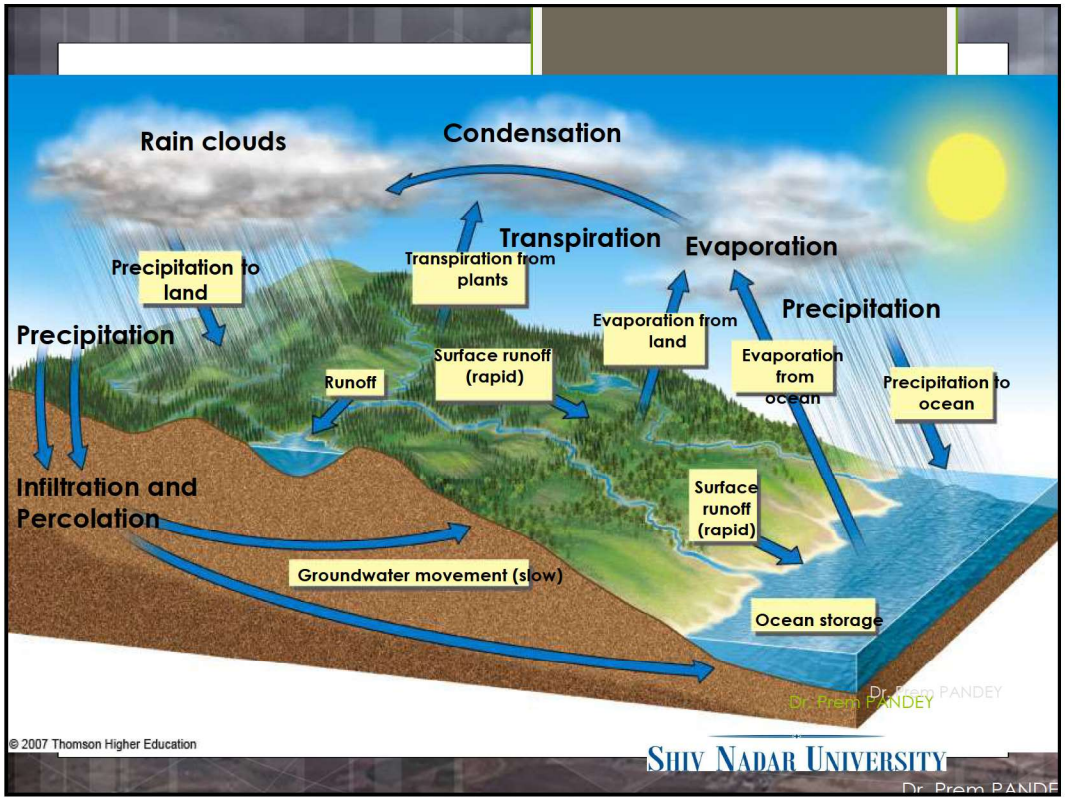
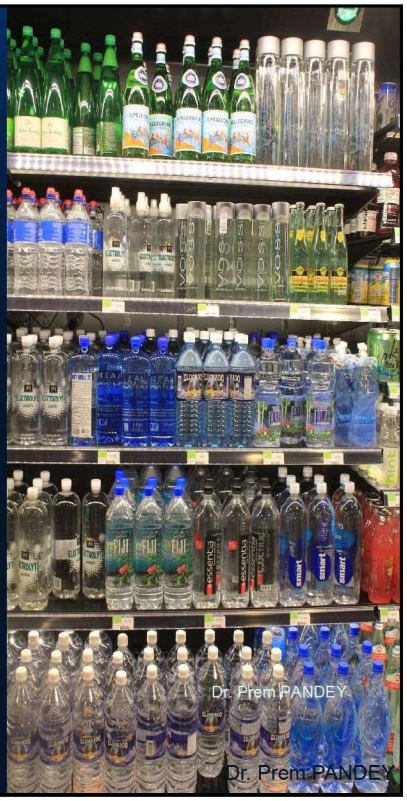


"So all the water on Earth - the water in your BISLERY bottle, the water in your glass of water, the water you use to boil a pot of spaghetti - all that water is 4.3 or 4.4 billion years old.

…all the water we've got right now *has been used over and over again.*

Every drink of water you take, every pot of coffee you make is dinosaur pee, because it's all been through the kidneys of a Tyrannosaurus Rex or an Apatosaurus many, many times, *because all the water we have is all the water we have ever had."*

- Charles Fishman, The Big Thirst

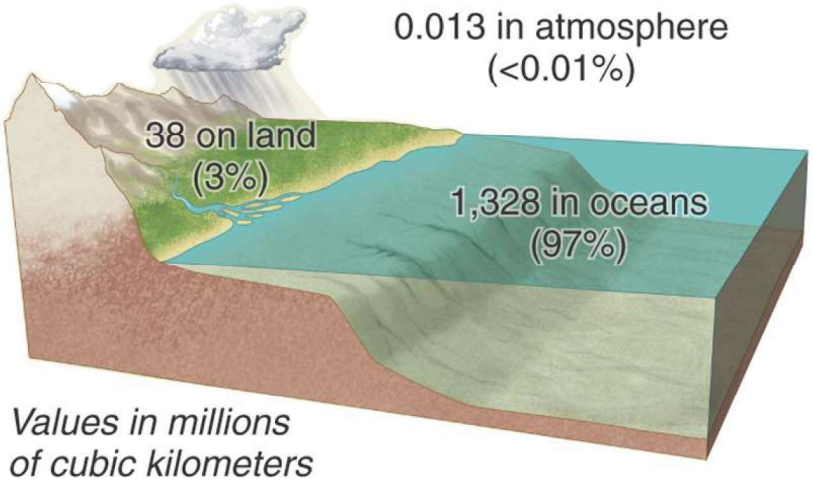


The Hydrologic Cycle

- Water moves in and around the earth system, changing from one physical state (liquid, solid, vapor) to another, in a process called the hydrologic cycle.

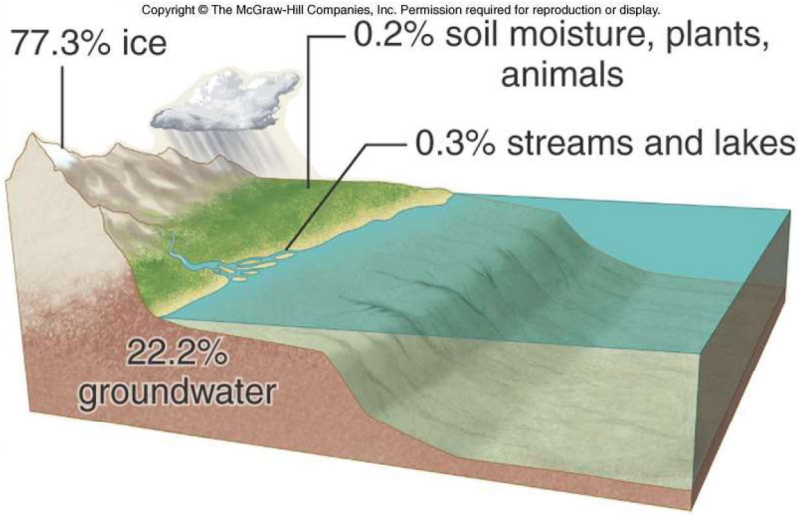
- The majority of precipitation re-enters the atmosphere as water vapor through evaporation.
- Water vapor can enter the air when it released from plants through transpiration.

The Hydrologic Cycle



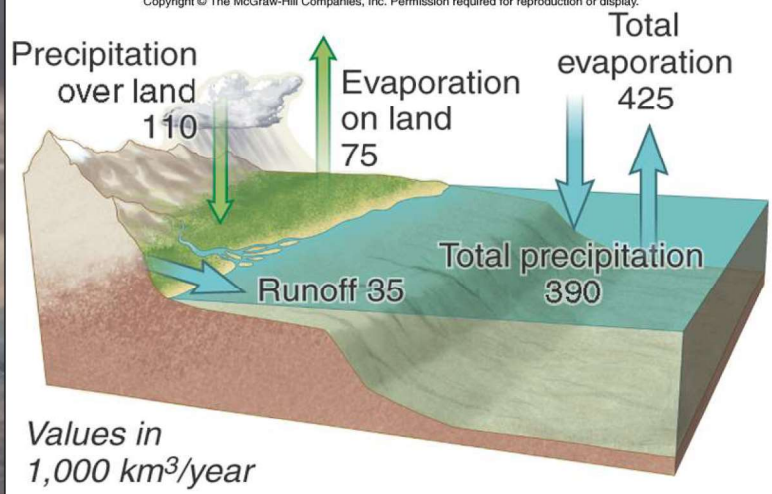
a. The vast majority of Earth's water is in the oceans (97%) with only about 3% on land.

The Hydrologic Cycle



b. Most of the water on land is stored in ice or groundwater.

The Hydrologic Cycle



c. Land receives more moisture by precipitation than it supplies by evaporation. The balance comes from evaporation from the oceans. This excess water is returned to oceans via surface streams.

The Hydrologic Cycle

Regardless of where or how they start, streams:

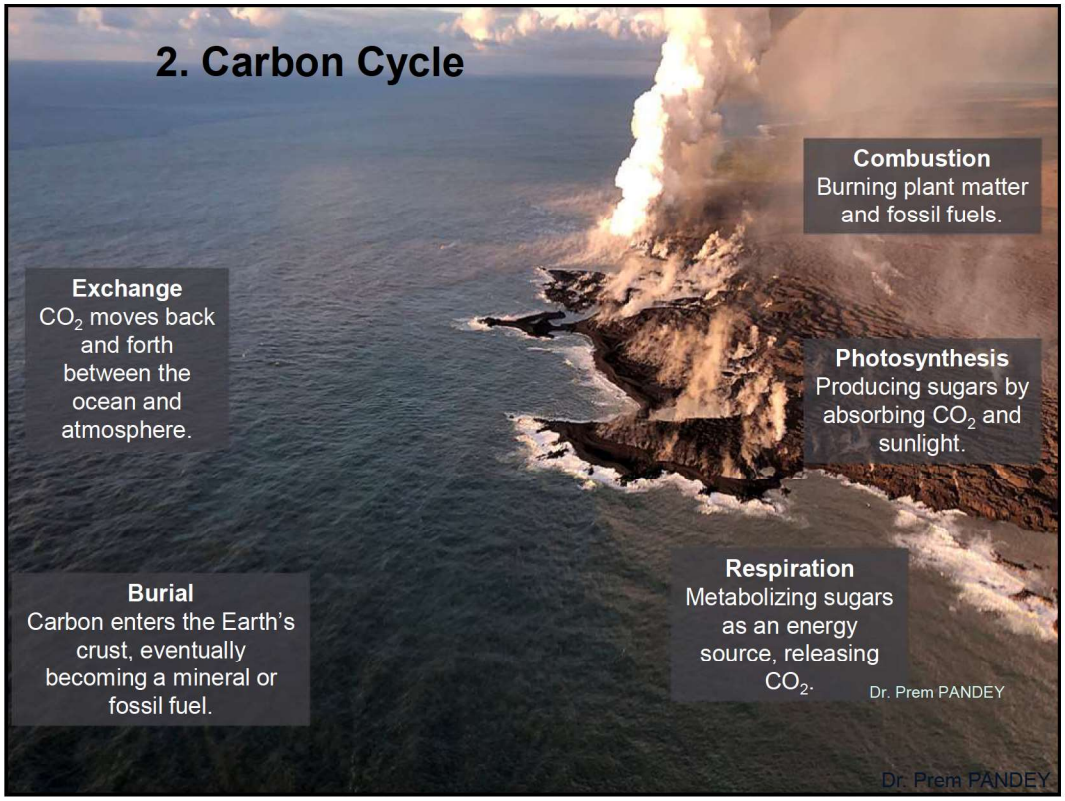
- flow down slope.

- often join other streams to form a network.

-empty into another body of water (another stream, a lake, an ocean, a reservoir, a wetland).

-This lowest point to which a stream flows is called the *base level.*

2.Carbon Cycle



2. Carbon Cycle

- The series of processes by which carbon compounds are inter converted in the environment, involving the incorporation of carbon dioxide into living tissue by photosynthesis and its return to the atmosphere through
  - respiration,
  - the decay of dead organisms,
  - and the burning of fossil fuels.

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Carbon dioxide-carbon cycle

- Carbon dioxide is an atmospheric constituent that plays several vital roles in the environment.
- It is a greenhouse gas that traps infrared radiation heat in the atmosphere.
- It plays a crucial role in the weathering of rocks.
- It is the carbon source for plants.
- It is stored in biomass, organic matter in sediments, and in carbonate rocks like limestone.

Photosynthesis and Carbon Cycle

- *Photosynthesis*
- Plants and photosynthetic algae and bacteria use energy from sunlight to combine carbon dioxide (C02) from the atmosphere with water (H2O) to form carbohydrates.
- These carbohydrates store energy.
- Oxygen (O2) is a by-product that is released into the atmosphere.
- This process is known as photosynthesis.
- carbon dioxide + water + sunlight -> carbohydrate + oxygen

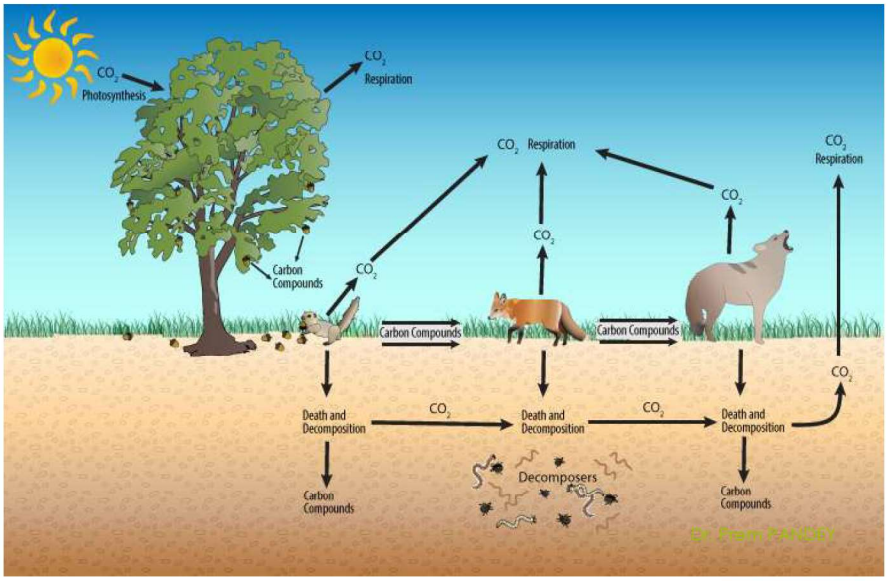
Respiration and Carbon cycle

Respiration

- Plants (and photosynthetic algae and bacteria) then use some of the stored carbohydrates as an energy source to carry out their life functions. Some of the carbohydrates remain as biomass (the bulk of the plant, etc.).
- Consumers such as animals, fungi, and bacteria get their energy from this excess biomass either while living or dead and decaying.
- Oxygen from the atmosphere is combined with carbohydrates to liberate the stored energy.
- Water and carbon dioxide are by-products.

[oxygen + carbohydrate -> energy + water + carbon dioxide]

Carbon Cycle in Forest



3. Oxygen Cycle

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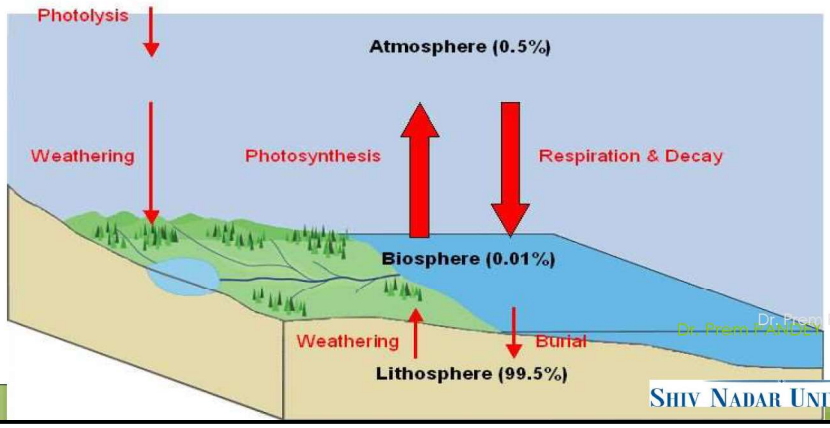
Oxygen Cycle

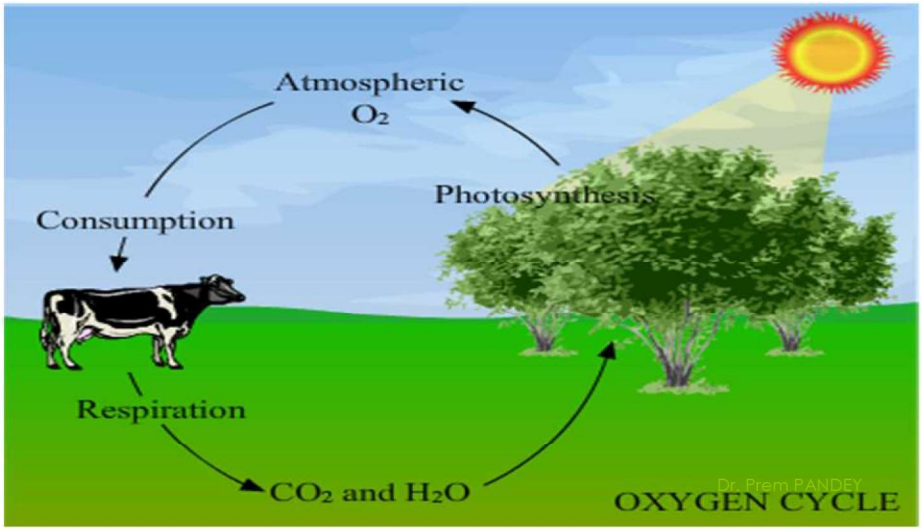
The oxygen cycle is the bio-geochemical cycle that describes the movement of oxygen within its three main reservoirs:

the atmosphere, the total content of biological matter within the biosphere, and the lithosphere (Earth's crust).

Oxygen Cycle Reservoirs & Flux



Oxygen Cycle in Nature



Oxygen Cycle

The largest reservoir of Earth's oxygen is within the crust and mantle (99.5%). Free oxygen in the biosphere (0.01%) and atmosphere (0.36%). The main source of atmospheric free oxygen is photosynthesis, which produces sugars and free oxygen from carbon dioxide and water:

$$6\ CO_2 + 6H_2O + \text{energy} \longrightarrow C_6H_{12}O_6 + 6\ O_2$$

Photosynthesizing organisms include the plant life of the land areas as well as the phytoplankton of the oceans. An additional source of atmospheric free oxygen comes from photolysis, whereby high energy ultraviolet radiation breaks down atmospheric water and nitrous oxide into component atoms. The free H and N atoms escape into space leaving O_2 in the atmosphere:

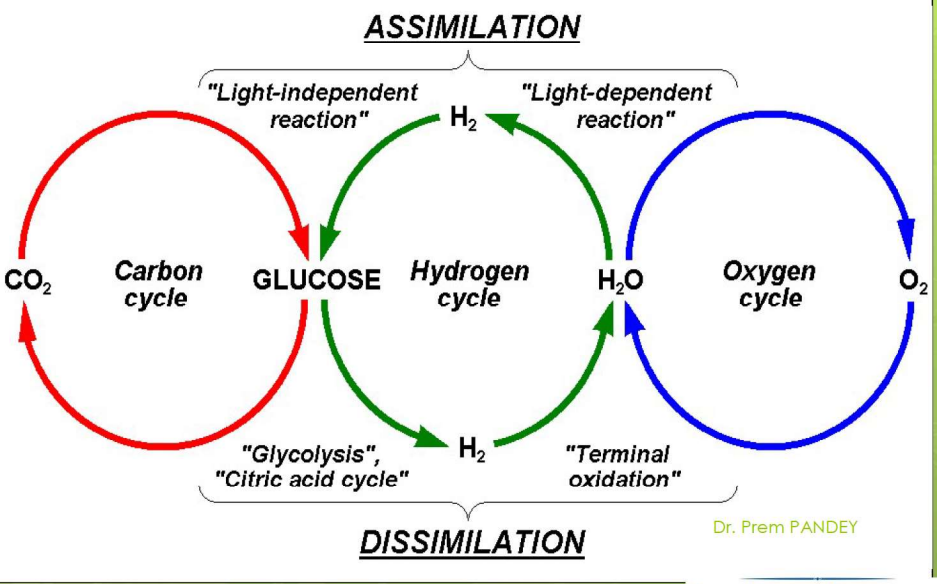
$$2\ H_2O + \text{energy} \longrightarrow 4\ H + O_2$$

$$2\ N_2O + \text{energy} \longrightarrow 4\ N + O_2$$

The main way free oxygen is lost from the atmosphere is via respiration and decay, mechanisms in which animal life and bacteria consume oxygen and release carbon dioxide. The lithosphere also consumes free oxygen via chemical weathering and surface reactions. An example of surface weathering chemistry is formation of iron-oxides:

$$4\ FeO + O_2 \longrightarrow 2\ Fe_2O_3$$

Interconnection between carbon, hydrogen and oxygen cycle in metabolism of photosynthesizing plants



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4. Nitrogen Cycle

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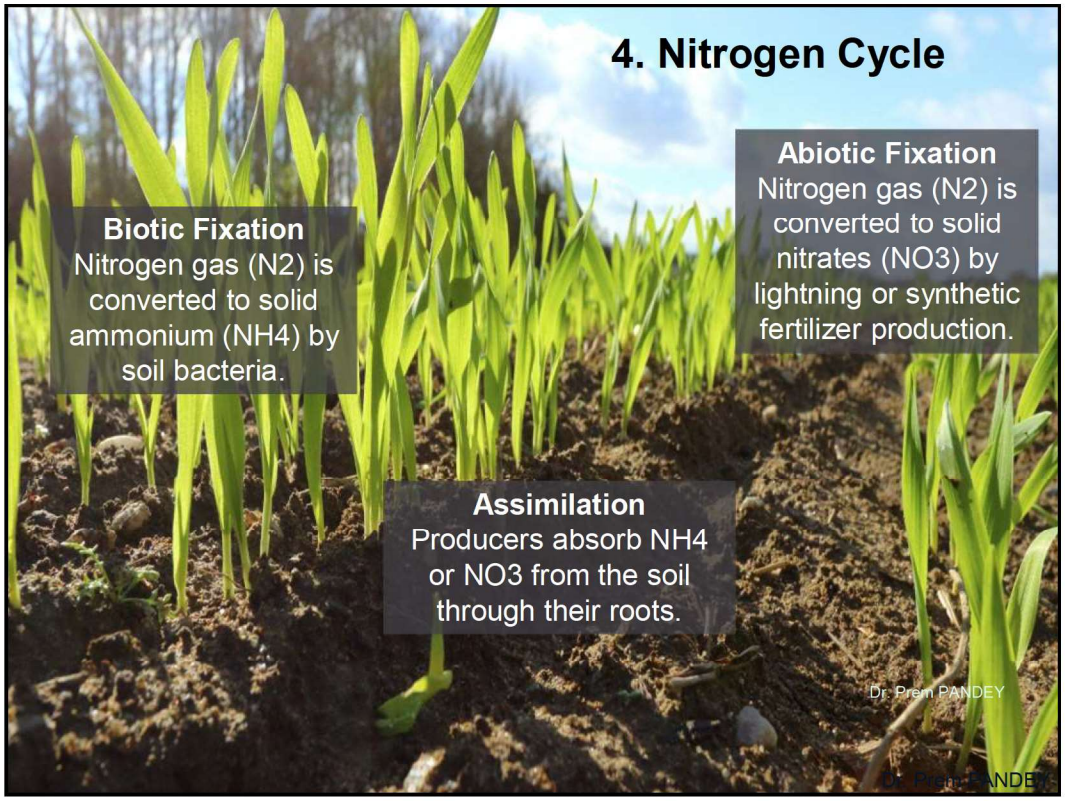
4. Nitrogen Cycle
Biotic Fixation
Nitrogen gas (N2) is converted to solid ammonium (NH4) by soil bacteria.
Abiotic Fixation
Nitrogen gas (N2) is converted to solid nitrates (NO3) by lightning or synthetic fertilizer production.
Assimilation
Producers absorb NH4 or NO3 from the soil through their roots.
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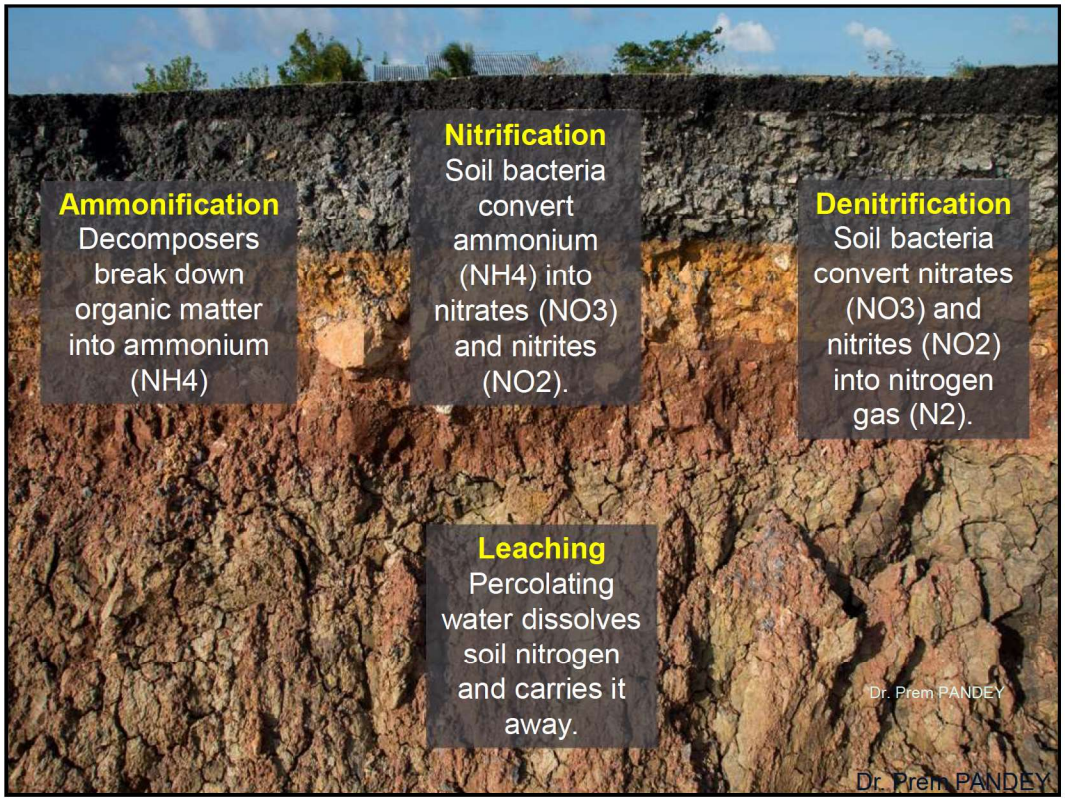
Ammonification
Decomposers break down organic matter into ammonium (NH4)
Nitrification
Soil bacteria convert ammonium (NH4) into nitrates (NO3) and nitrites (NO2).
Denitrification
Soil bacteria convert nitrates (NO3) and nitrites (NO2) into nitrogen gas (N2).
Leaching
Percolating water dissolves soil nitrogen and carries it away.
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Nitrogen Cycle

The nitrogen cycle is the process by which nitrogen is converted in various chemical forms through both biological and physical processes.

Such processes include fixation, ammonification, nitrification, and de-nitrification.

Atmospheric nitrogen (78%) has limited availability for biological use.

The nitrogen cycle is of particular interest because it can affect the rate of key ecosystem processes (primary production and decomposition).

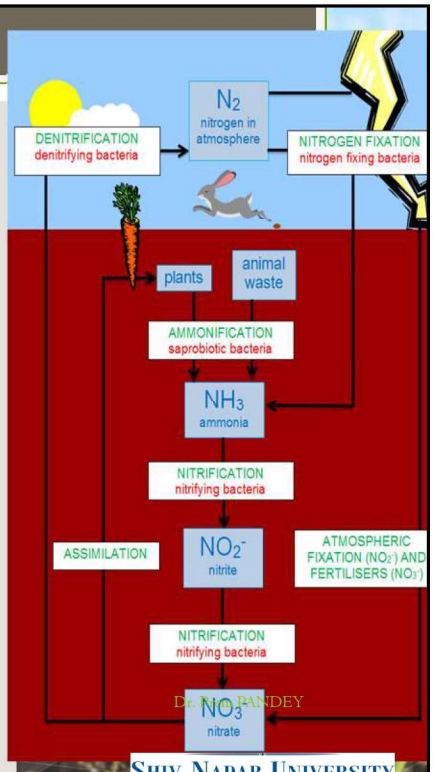
Nitrogen Cycle

The processes of the nitrogen cycle

Nitrogen is present in the environment in a wide variety of chemical forms including

1. Ammonium (NH_4^+),
2. Nitrite (NO_2^-),
3. Nitrate (NO_3^-),
4. Nitrous oxide (N_2O),
5. Nitric oxide (NO) or
6. Inorganic nitrogen gas (N_2).

Organic nitrogen may be in the form of a living organism, humus or in the intermediate products of organic matter decomposition.



Nitrogen Cycle

1. Fixation

- Either Biotic or Abiotic fixation.
- **Biotic Fixation--** Nitrogen gas (N2) is converted to solid ammonium (NH4) by soil bacteria.
- **Abiotic Fixation-** Nitrogen gas (N2) is converted to solid nitrates (NO3) by lightning or synthetic fertilizer production.

Ammonification

- When a plant or animal dies or an animal expels waste (in the form of gas), the initial form of nitrogen is organic. Bacteria or fungi convert the organic nitrogen into ammonia or ammonium (NH_4^+) compounds, a process called ammonification or mineralization.

Nitrogen Cycle-Nitrification and Denitrification

2. Nitrification

- The conversion of ammonia to nitrate is performed primarily by soil-living bacteria and other nitrifying bacteria.

NH4…. Nitrosomas …. NO2 - …. *Nitrobacter.* …..NO3-

1. NH4 to Nitrite -nitrifying bacteria called Nitrosomas
2. Nitrite is converted into Nitrate, by *Nitrobacter.*

3. Denitrification

- Denitrification is the reduction of nitrates back into nitrogen gas (N_2), completing the nitrogen cycle.
- This process is performed by bacterial species such as *Pseudomonas* and *Clostridium* in anaerobic conditions.
- NO3-… ……..N2

(*Pseudomonas* and *Clostridium* in anaerobic conditions)

Nitrogen Cycle

Assimilation

- Plants take nitrogen from the soil by absorption through their roots as amino acids, nitrate ions, nitrite ions, or ammonium ions.
  - Most nitrogen obtained by terrestrial animals can be traced *back to the eating of plants at some stage of the food chain*.

Nitrogen Cycle

- The nitrates in the soil are taken up by the plants and converted into amino acids.

NO_3….. → ..Amino acids ---- 20 amino acids (9 essential)

- During the decay of dead plants, N_2 is released and returned to the soil and in atmosphere in the form of NH_3.

Dead plants/animals……NH_3 atmosphere

N_2 Soil

- The denitrifying bacteria (*Pseudomonas*) in the soil convert the nitrates into N_2 and escapes in the atmosphere.

NO_3…… → ……..N_2

Nitrogen Cycle

In natural process (fixation), the gases N2 is converted into NO (during periodic thunderstorm and lightening), which is oxidized into NO2.

N2 ….  …….….NO…….…….…NO2

oxidation

Both oxides are washed down by rain and form nitric acid in the soil.
Nitric acid combines with salt (Na, Ca, etc) and form nitrates.

NO, NO2…R……..……../

in Soil…. HNO3 salt of Na, Ca……..Ca/NaNO3

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Nitrogen Cycle

- Also, during lightening, N2 may also combine with H2 to form NH3, which is washed down to form ammonium salts in the soil.
- N2 + H2…..  …NH3
- In alternative, certain microorganisms including nitrifying bacteria (aerobic *Azototobactor*)

Convert atmospheric N2 into ammonium ions.

- N2……..NH4 ions

(aerobic *Azototobactor* and anaerobic *Clostridium*)

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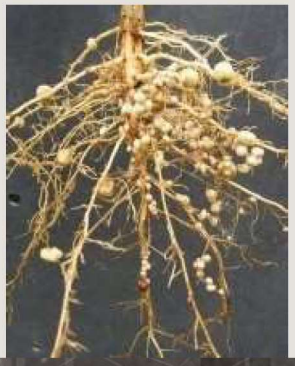
Nitrogen Fixation

- Atmospheric nitrogen must be processed, or "fixed", in a usable form to be taken up by plants.
- Between $5x10^{12}$ and $10x10^{12}$ g per year are fixed by lightning strikes, but most fixation is done by free-living or symbiotic bacteria known as diazotrophs.

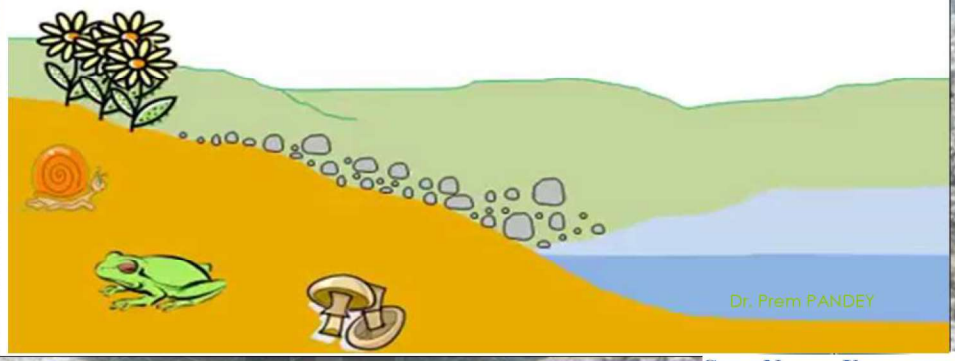
Nitrogen Fixation

- An example of the free-living bacteria is *Azotobacter*.
- Symbiotic nitrogen-fixing bacteria such as *Rhizobium* usually live in the root nodules of legumes (such as peas,beans, shisham tree).



5. Phosphorus Cycle

Phosphorus (P) Cycle



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5. Phosphorus Cycle

Weathering
Water breaks down rock, releasing phosphates (PO_4) into soil, rivers, lakes, and the ocean.

Mining
Phosphates (PO_4) are removed from underground minerals to make fertilizer.

*Phosphates also assimilate into plants, are consumed by animals, undergo leaching, and are released via decomposition.

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Phosphorus Cycle

- The phosphorus cycle is the biogeochemical cycle that describes the movement of phosphorus through the lithosphere, hydrosphere, and biosphere.
  - Unlike many other biogeochemical cycles, the atmosphere does not play a significant role in the movement of phosphorus.
    - because phosphorus and phosphorus-based compounds are usually solids at the typical ranges of temperature and pressure found on Earth.
    - The production of phosphine gas occurs in only specialized, local conditions.

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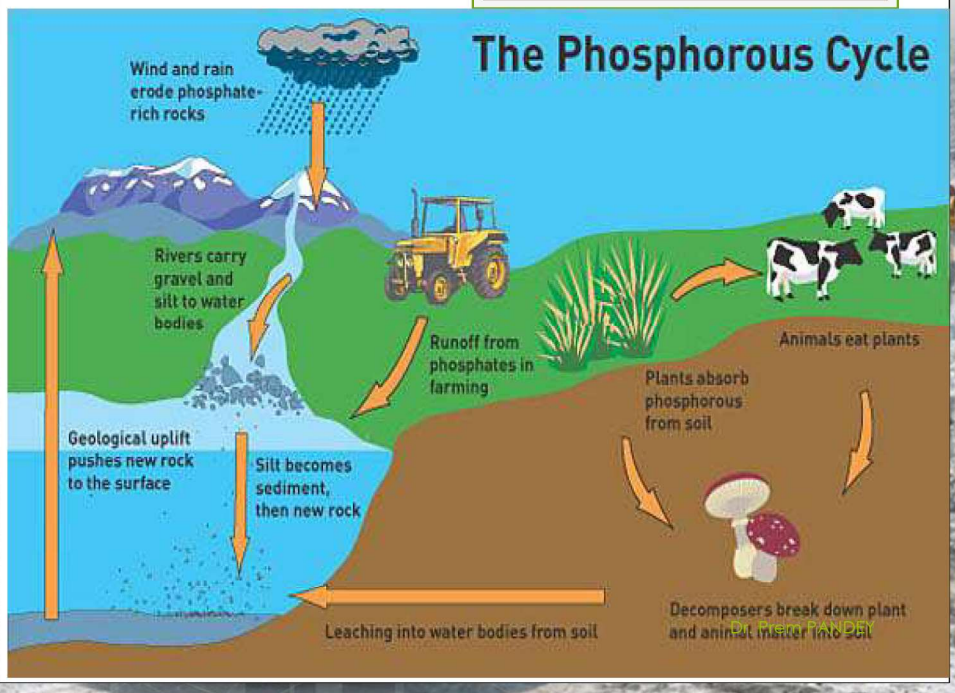

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Phosphorus Cycle

Plays two important roles in the biosphere

- As sugar-phosphate units forms the helical framework of DNA
  - ADP ATP – one Adenosine , one ribose sugar and phosphates depending upon ADP or ATP.
- Facilitates all of life's energy transactions
- Occurs in its oxidized state as phosphate, forming minerals found in soils and water.
- ADP – ATP
- Eroded from rocks, used by life on land, washed to the ocean, temporarily available to plankton, then deposited on the seafloor

Phosphorus Cycle

- Phosphorus is an essential nutrient for plants and animals.
- Phosphorus: for aquatic organisms its acts as a limiting nutrient
- Phosphorus forms parts of important life-sustaining molecules that are very common in the biosphere.
- Phosphorus does not enter the atmosphere, remaining mostly on land and in rock and soil minerals.
- Eighty percent of the mined phosphorus is used to make fertilizers

Phosphorus Cycle-Biological functions

- The primary biological importance of phosphates is as a component of nucleotides, which serve as energy storage within cells (ATP) or when linked together, form the nucleic acids DNA and RNA.
- The double helix of our DNA is only possible because of the phosphate ester bridge that binds the helix.
- Besides making bio-molecules, phosphorus is also found in bone and the enamel of mammalian teeth, whose strength is derived from calcium phosphate in the form of Hydroxylapatite.

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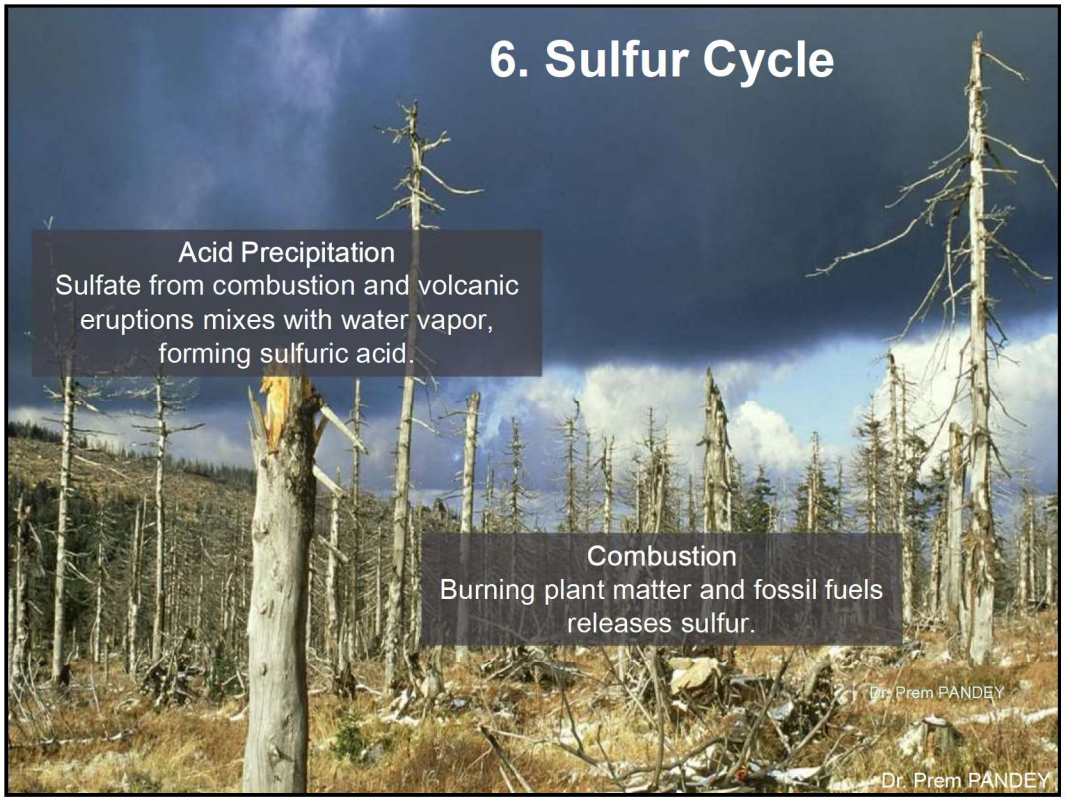


Thank You !!!
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