

Biosphere to ecosystems *Scope*

Topic	Breakdown of topic
Biosphere to ecosystem 56 Marks	<p><u>Concept of the biosphere.</u> Inter-connectedness with and components of global ecosystems: hydrosphere, lithosphere, atmosphere</p> <p><u>Biomes</u> Terrestrial and aquatic biomes of Southern Africa: how climate, soils and vegetation influence the organisms found in each. Location of different biomes in South Africa</p> <p><u>Environment</u> Concept of environment to show human activities in and interactions with the natural environment.</p> <p><u>Abiotic and biotic factors.</u> Effects on the community</p> <p><u>Ecosystems</u> <u>Concept of ecosystem</u> Structure and ecosystem functioning</p> <p><u>Abiotic factors</u> -physiographic factors (aspect, slope, altitude) -soil (pH, humus content, texture, water retention capacity, air content) -light (day length, seasonal changes) -temperature (effect of day/night, seasons) -water (water cycle, importance of wetlands) -atmospheric gases -wind</p> <p><u>Biotic factors</u> -producers -consumers -decomposers</p> <p><u>Energy flow</u> Energy flow through ecosystems and relationship to trophic structure (food pyramids) -Trophic levels: producers, consumers (herbivores and carnivores and omnivores, decomposers</p> <p><u>Cycles</u> Flow charts of the following: -water -Oxygen -carbon -nitrogen</p>

Biosphere to ecosystems

Notes

The concept: Biosphere

A biosphere is a global ecosystem composed of living organisms (biotic) and the nonliving factors (abiotic) from which they derive energy and nutrients.

Components

- Atmosphere
- Lithosphere
- Hydrosphere

Atmosphere

The layer of gas surrounding the earth is known as atmosphere. It has the ability to absorb ultraviolet rays from the sun allowing life on earth.

Example: Water Vapor in the air

Lithosphere

The rocky part of the earth is known as the lithosphere. Made of the crust and upper mantle.

Example: Solid rock & Soil

Hydrosphere

Water in all its forms makes up the hydrosphere.

Example: Water in lakes, rivers or the ocean.

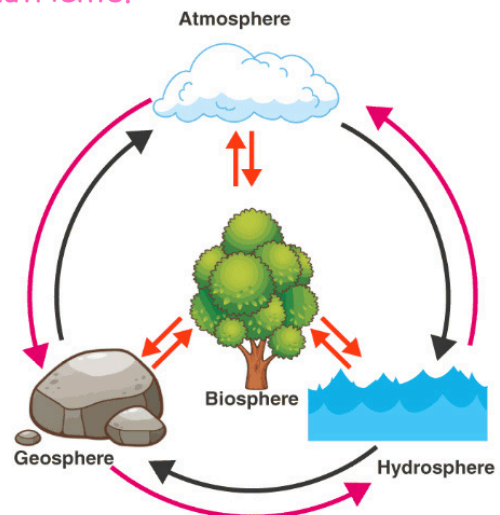
Interactions of the spheres

Lithosphere & Atmosphere: Volcanic eruptions shooting dust into the air

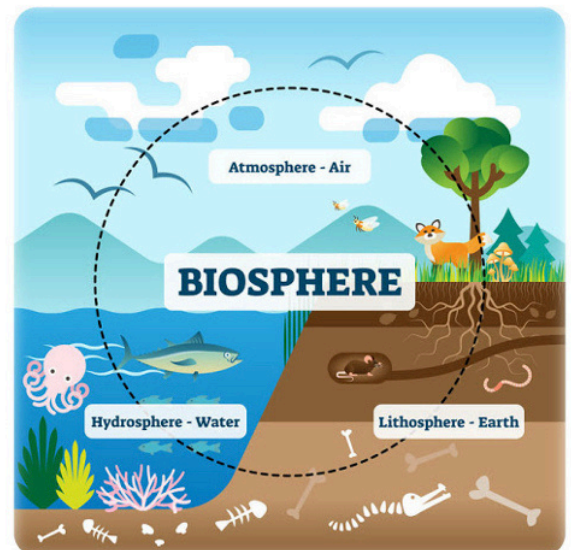
Hydrosphere & Lithosphere: Water run off causing soil erosion

Atmosphere & Hydrosphere: Water evaporation into the air

Biosphere: Plants & Animals in the ecosystem



The three spheres interact to form the biosphere. A disturbance in one sphere can affect life.



Biosphere to ecosystems

Notes

Biomes

A **biome** is a collection of plants and animals that have common characteristics for the environment they exist in.

These biomes have distinct biological communities that have formed in response to a shared physical climate.

Temperature range, soil type, and the amount of light and water are unique to a particular place.

Types of biomes

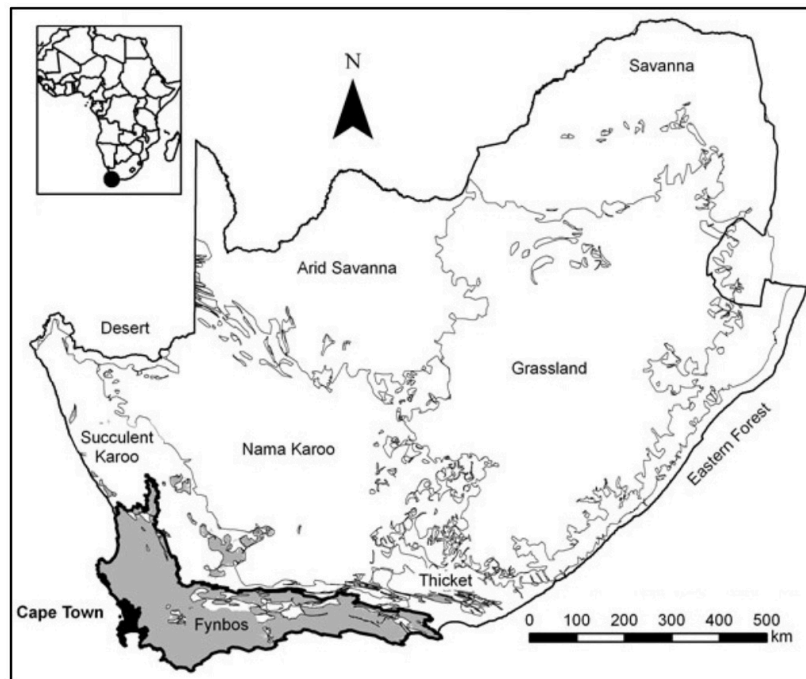
- **Terrestrial** - is an area of land with a similar climate that includes similar communities of plants as trees, shrubs, grasses and animals.
- **Aquatic** - is divided into freshwater (ponds, lakes & rivers) and marine regions (oceans, coral reefs & estuaries)

Terrestrial biomes in SA

South Africa has nine biomes, based on vegetation types that share similar ecological characteristics.

Each biome has a characteristic **climate** envelope, or a range and pattern of temperature and rainfall patterns, within which it occurs.

- 1) Grassland.
- 2) Savannah.
- 3) Arid Savannah
- 4) Succulent Karoo.
- 5) Nama Karoo.
- 6) Forest.
- 7) Fynbos.
- 8) Desert.
- 9) Thicket.



Details on each biome not examined however you should know

— Savannah is the largest biome & has game farms

— Fynbos is rich in flora/flowers & known for having the protea

— Forest is characterised by having large trees and shade - loving shrubs

How climate, soils and vegetation influence organisms

Climates affect soil (dry/drought & Wet/floods) affecting the plants & animals found there.

Vegetation can affect climate and weather patterns due to the release of water vapour during photosynthesis.

Biosphere to ecosystems

Notes

The concept: Environment

The **environment** is the natural world, encompassing the interaction of all living species, climate, weather and natural resources that affect human survival and economic activity.

Human activities have been detrimental to our environment in the forms of atmospheric pollution, global warming and destruction of biodiversity.

The concept: Ecosystem

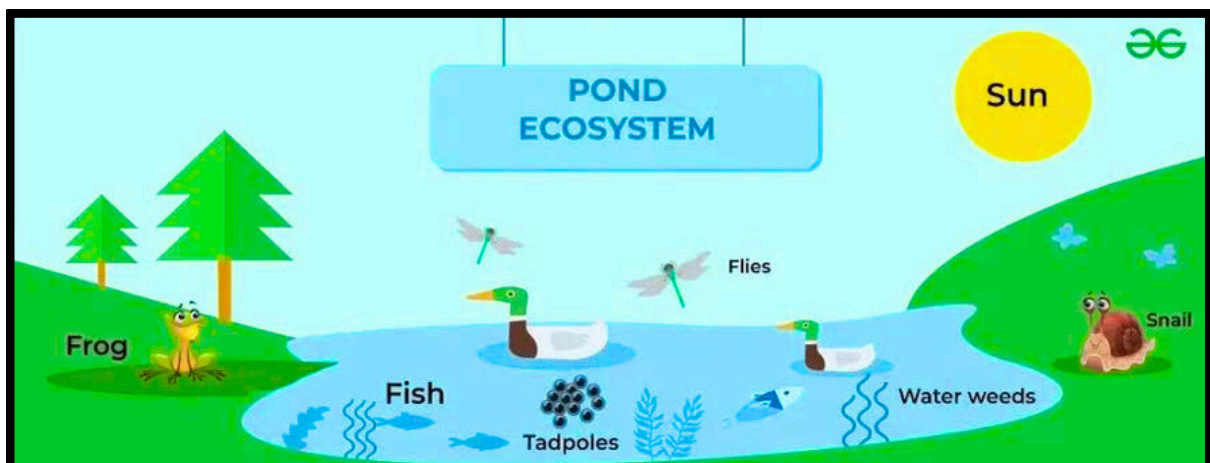
An **ecosystem** is a community of biotic (living) and abiotic (non-living) factors in an area that interact with each other. Some examples of ecosystems are a river, a grassland or even a fallen rock.

Components of the ecosystem

Biotic factors are living organisms such as plants, animals and microorganisms.

Abiotic factors are non-living such as soil, water, temperature and sunlight.

Ecology is the study of biotic & abiotic factors, their interactions with each other together with the environment.



Biotic & Abiotic factors

Notes

Abiotic factors

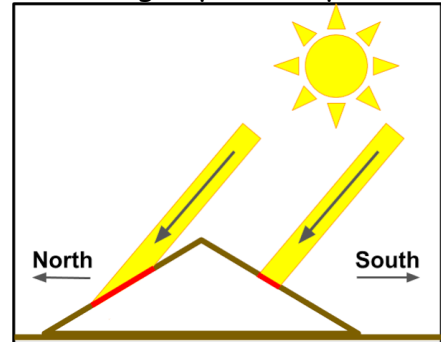
Physiographic factors

Physiographic factors are the physical geography of an area, including aspect, slope and altitude.

Aspect is the direction in which an area faces in relation to the direction of the sun.

The **slope** of the land is how steep or gentle the gradient is.

Altitude is the height above sea level.



Aspect	Slope	Altitude
<ul style="list-style-type: none">Aspect refers to the position of an area in relation to the sunIn South Africa north-facing slopes receive more sunlight than south-facing slopesNorth-facing slopes are warmer and drierSouth-facing slopes are cooler and wetter and shade plants e.g. ferns grow well in such areas	<ul style="list-style-type: none">The slope of a mountain determines the rate of water run-offThe run-off of water on a steep slope is faster and soil erosion will occur more frequentlyThe soil on a steep slope is usually shallow and infertile and few plants and animals will be present	<ul style="list-style-type: none">Areas high above sea level experience extreme weather conditions e.g. strong winds and snowPlants and animals that are found high above sea level will differ from those closer to sea level

Soil/Edaphic factors

Soil is important for plant growth as it provides water and minerals, and holds plants firmly in the ground. The type of soil in an area will determine the kinds of plants that will grow there.

Characteristics of soil:

Soil texture	Soil air	Water-retention capacity	Humus content	pH
<ul style="list-style-type: none">There are 3 types of soil i.e. clay, loam and sandClay consists of small soil particles, loam has slightly bigger particles and sandy soil has large particles	<ul style="list-style-type: none">Spaces between soil particles are filled with air and waterSandy soil has bigger spaces between soil particles and is well aerated.Clay soil is poorly aerated	<ul style="list-style-type: none">Sandy soil has a low water-retention capacity because of the large spaces between soil particlesClay soil has a high water-retention capacityLoam has a medium water-retention capacity and is the most suitable soil for plant growth	<ul style="list-style-type: none">Humus is decayed plant and animal matterHumus increases soil fertility and water-retention capacitySoil with humus is normally dark in colour	<ul style="list-style-type: none">Some plants e.g. proteas grow better in acidic soil (low pH)Succulent plants grow better in alkaline soil (high pH)Most plants grow well in soil with a neutral pH (pH of 7)

Biotic & Abiotic factors

Abiotic factors

Light

- Plants need **light** for photosynthesis
- The effect of day length on the growth of a plant is called photoperiodism.
- Short-day plants only flower when the day length is shorter than 12 hours
- Long -day plants need a day length of more than 12 hours
- Neutral plants are plants that are not affected by day length
- Some animals e.g. moths and bats are nocturnal (active at night).

Temperature

- The **temperature** that plants and animals are exposed to varies between day and night and between summer and winter e.g. ectothermic animals (fish, amphibians, reptiles) become inactive during cold winter temperatures, deciduous trees lose their leaves in autumn to limit photosynthesis and growth.

Water

- **Water** is one of the most important factors in any ecosystem.

Hydrophytes	Mesophytes	Xerophytes
<ul style="list-style-type: none">• Plants that grow in water e.g. water lilies	<ul style="list-style-type: none">• Plants that grow in areas with moderate water supply e.g. fruit trees, wheat etc.	<ul style="list-style-type: none">• Plants that grow in extremely dry conditions e.g. aloe

Wetlands: Is an area of land that is mostly covered with water. Wetlands are essential ecosystems because:

- They act as natural filters trapping nutrients, soil, disease-causing bacteria and pollutants.
- They slow down floodwaters, as they act like a sponge and store water. This reduces erosion and flood damage. It also maintains a steady flow of water during the year.
- Wetlands are rich in plant life and provide food and shelter for many organisms.

Atmospheric gases

Composition of the atmosphere: 78% Nitrogen, 21% Oxygen, 0,04% Carbon dioxide and some water vapour.

Wind

Moving air is called **wind**. Wind is greater at high altitudes and this can effect the growth of trees.

Biotic & Abiotic factors

Biotic factors

Producers	Consumers	Decomposers
<ul style="list-style-type: none">• Green plants are called producers because they contain chlorophyll and can produce their own organic food through photosynthesis.• Producers are autotrophic organisms	<ul style="list-style-type: none">• Animals are consumers because they cannot produce their own organic food but they use the food produced from the plants.• Consumers are referred to as heterotrophic organisms.• Primary consumers e.g. sheep, rabbits, locusts etc. feed directly on the producers (plants). Primary consumers are also called herbivores.• Secondary consumers e.g. lions, owls, dogs, humans etc. feed on the primary consumers and include carnivores and omnivores.• Carnivores e.g. lion, owls etc. feed on animal matter.• Omnivores e.g. humans feed on both animal and plant matter.• Tertiary consumers e.g. snakes feed on secondary consumers and are all carnivores.	<ul style="list-style-type: none">• Decomposers e.g. saprophytic bacteria and fungi feed on dead organic matter.• They break down organic compounds into simple inorganic compounds that are released back into the environment.• Decomposers are also heterotrophic organisms.

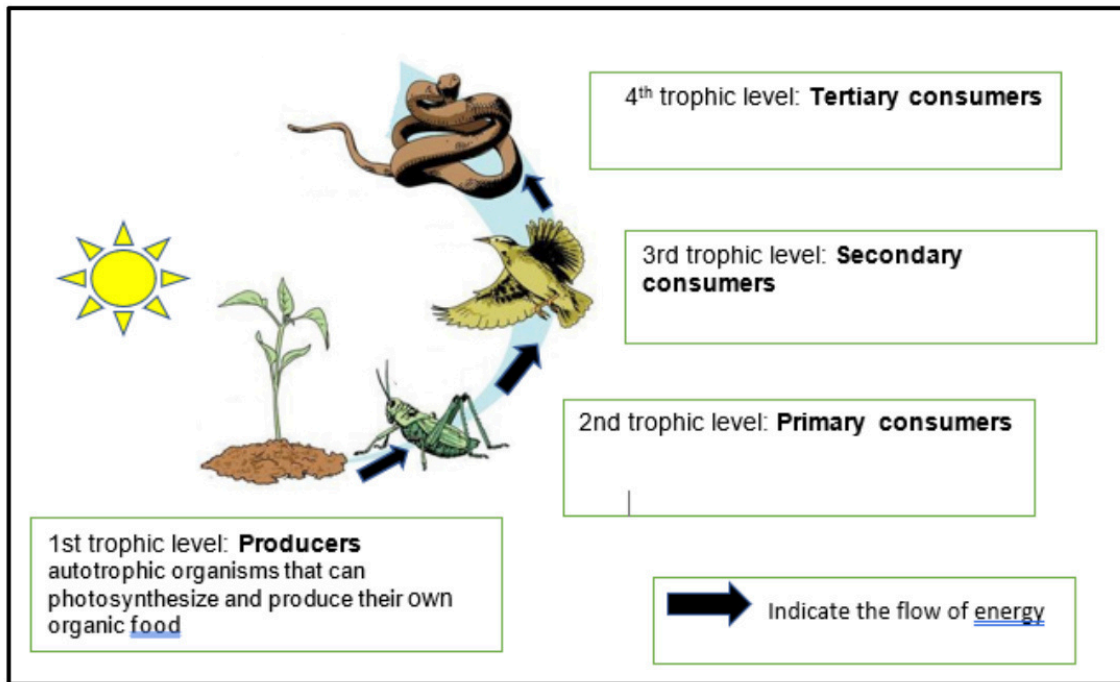
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Energy flow

Notes

The flow of energy in ecosystems is important to the life on Earth.



Nearly all of the energy in Earth's ecosystems originates from the Sun.

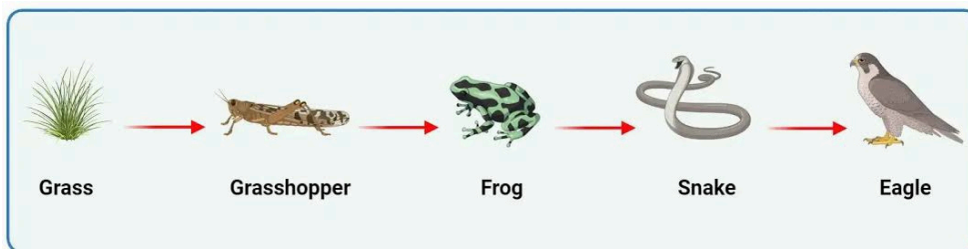
The energy is distributed in the ecosystem through the food chains and food webs.

Living organisms occur at different feeding levels in an ecosystem (food chains or food webs).

These feeding levels are called trophic levels.

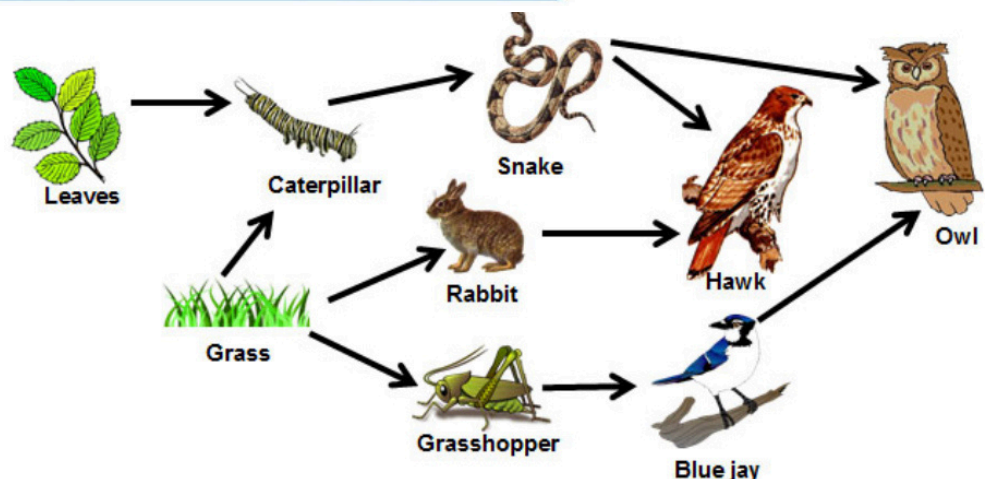
Food chain

The transfer of energy from the sun through the green plants and the various consumers is known as a food chain.



Food web

A series of food chains interlinked is called a food web

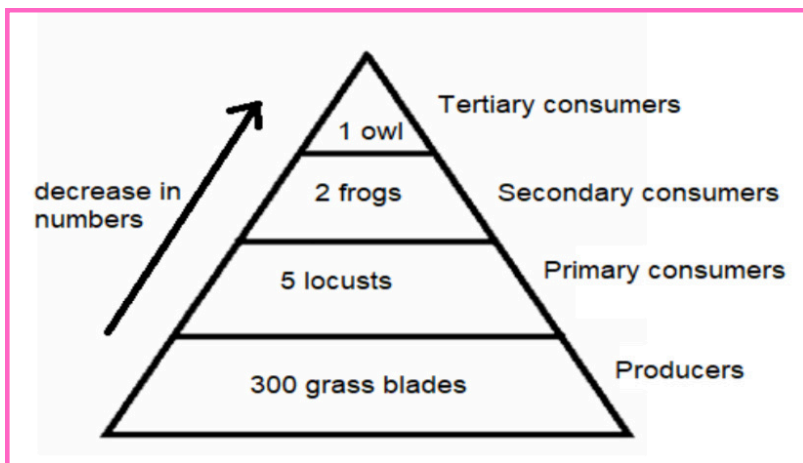


Energy flow

Notes

Ecological pyramids

The different trophic levels are often represented as ecological pyramids. There are three types of ecological pyramids i.e. pyramids of number, pyramids of biomass and pyramids of energy.

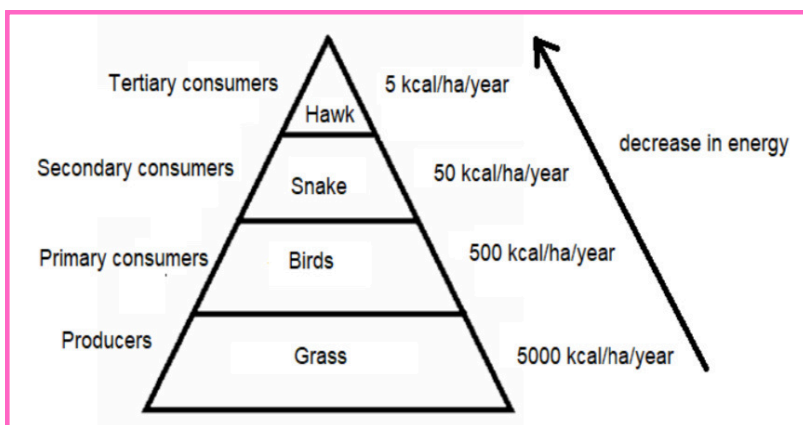
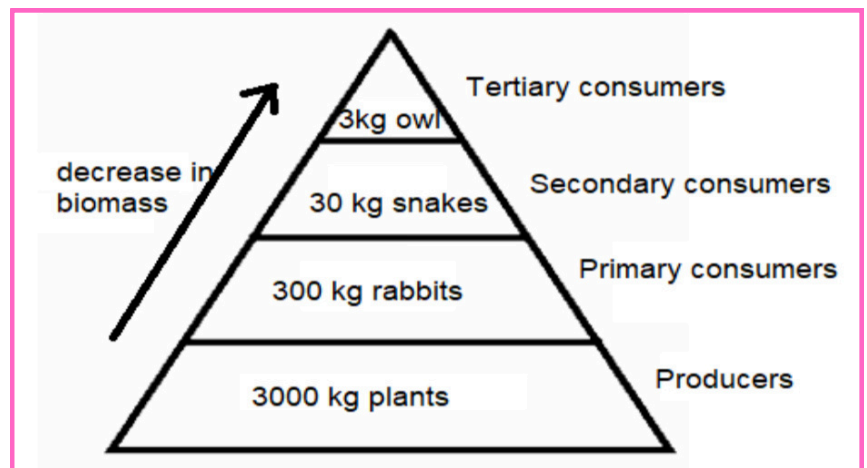


Pyramid of numbers

Pyramids of numbers show the actual number of organisms on each trophic level.

Pyramid of Biomass

Pyramids of biomass show the total mass of the organisms at each trophic level.



Pyramid of Energy

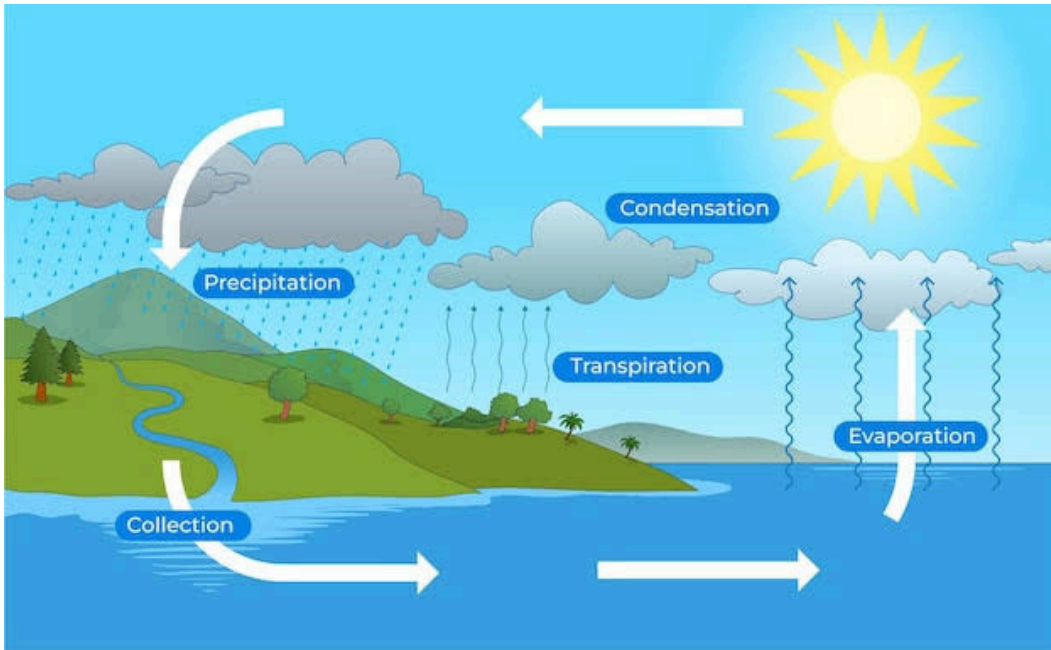
Pyramids of energy show the amount of energy on each trophic level.

Cycles

Notes

Water cycle

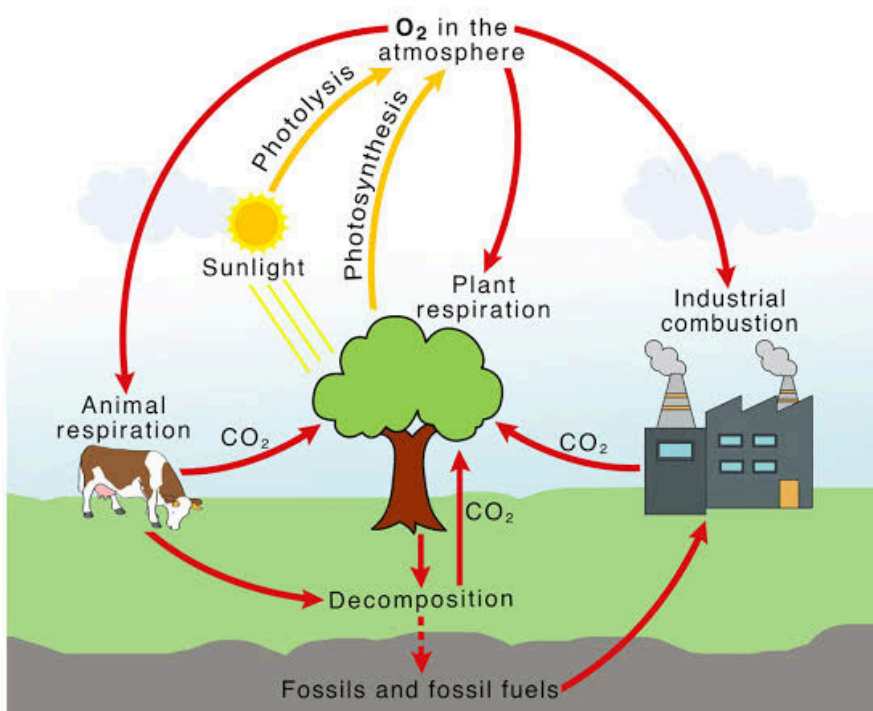
The water cycle shows the continuous movement of water within the Earth and atmosphere. It is a complex system that includes many different processes.



Oxygen cycle

Oxygen is essential for cellular respiration. It is used in the breakdown of glucose to release energy. Energy is required for growth and metabolic activities in living organisms.

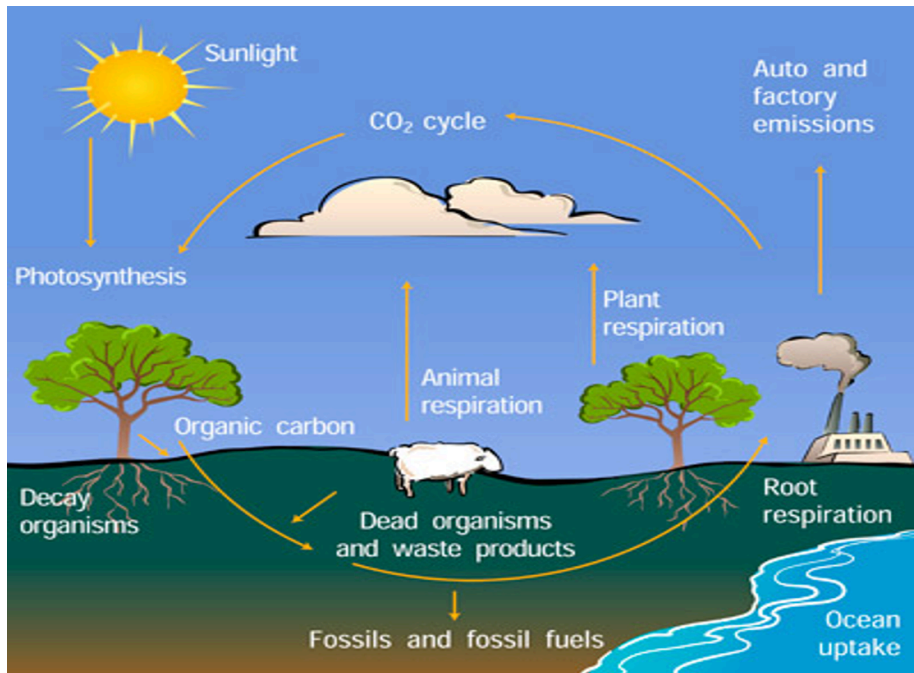
Oxygen Cycle



Cycles

Notes

Carbon cycle



The carbon cycle involves the following processes:

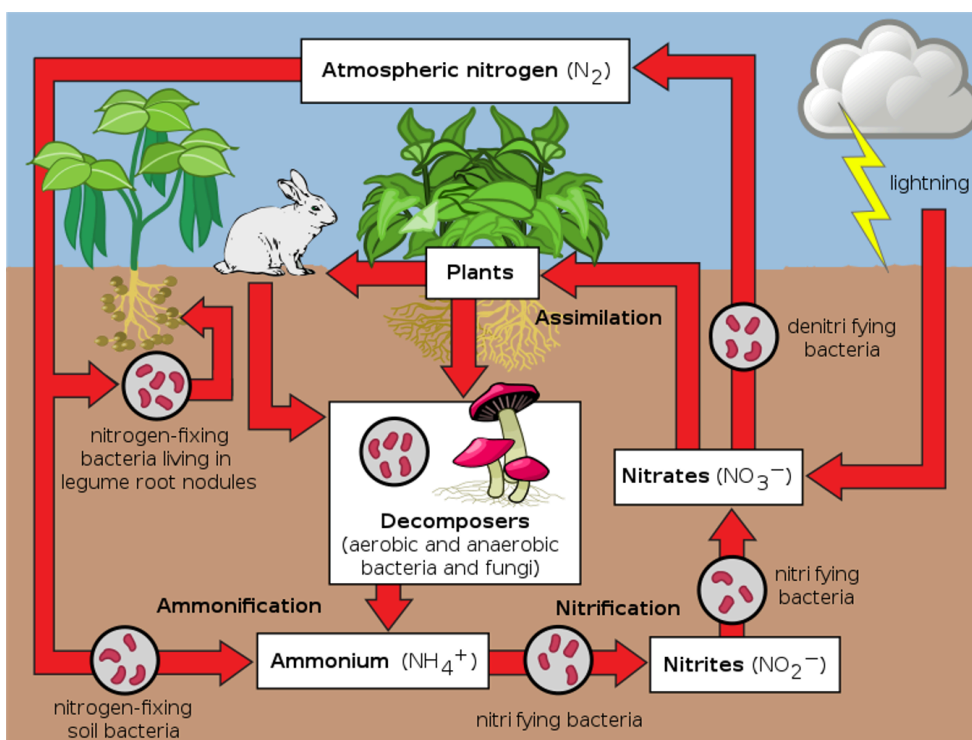
1. Photosynthesis
2. Feeding
3. Death and decay
4. Respiration
5. Compaction

Nitrogen cycle

The nitrogen cycle converts free nitrogen to nitrates (soluble form of nitrogen that living things can absorb)

This is done by nitrogen fixing bacteria & lightning.

Nitrogen is used to make proteins.



Biosphere to ecosystems

Terminology

- Abiotic
- Ammonification
- Altitude
- Atmosphere
- Aspect
- Aquatic Biome
- Biosphere
- Biome
- Biotic
- Climate
- Condensation
- Consumer
- Deamination
- Decomposer
- Ecology
- Ecosystem
- Edaphic
- Energy pyramid
- Environment
- Evaporation
- Food chain
- Food web
- Lithosphere
- Humus
- Hydrosphere
- Hydrophyte
- Mesophyte
- Nitrate
- Nitrogen-fixing bacteria
- Nitrification
- pH
- Precipitation
- Producer
- Slope
- Terrestrial biome
- Transpiration
- Trophic level
- Water holding capacity
- Weather
- Xerophyte