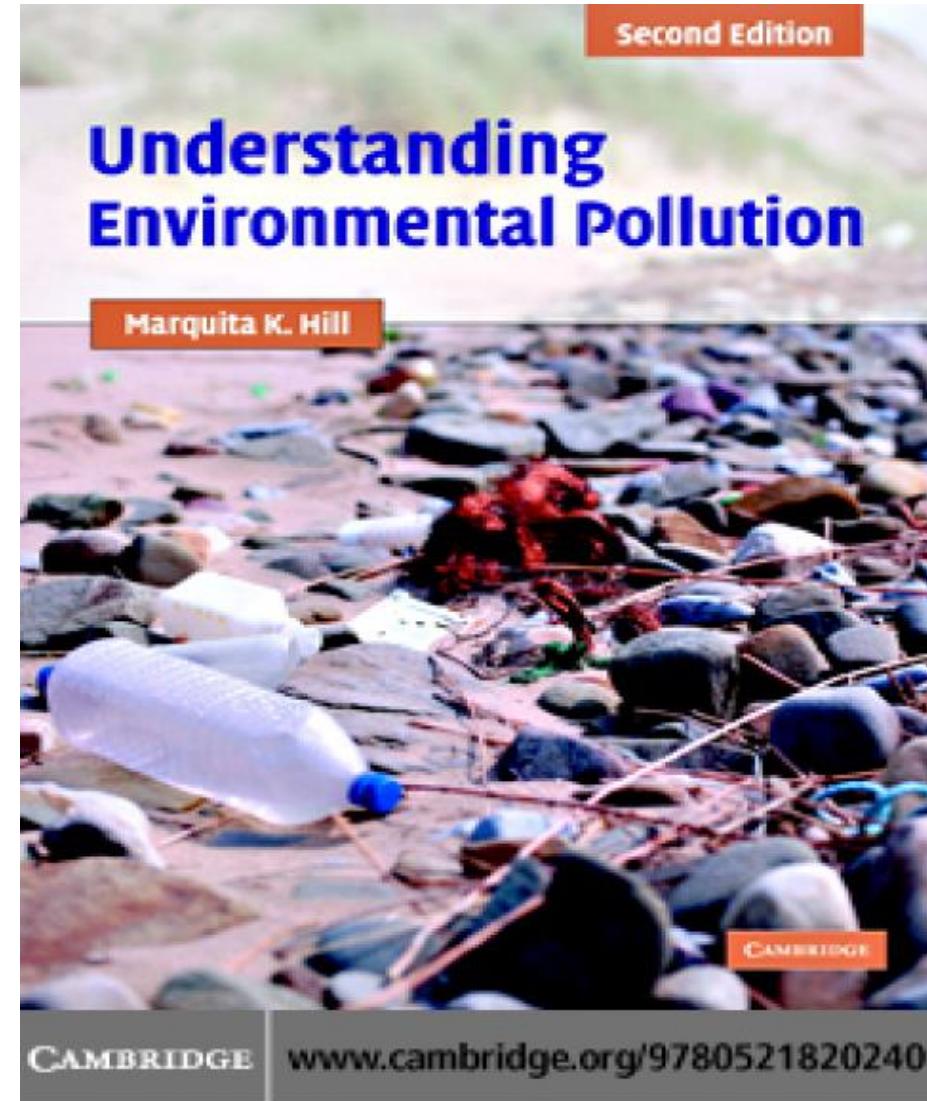


# Environment, Ecology & Ecosystems



# REFERENCES



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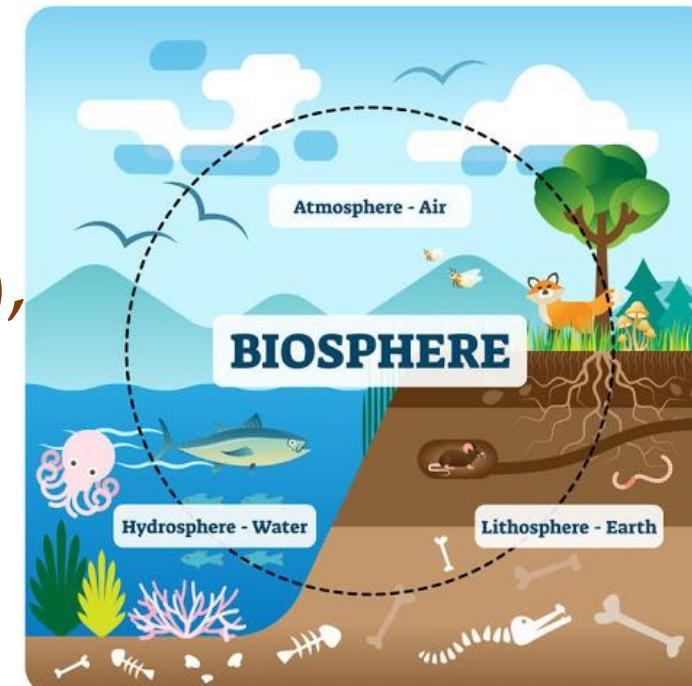
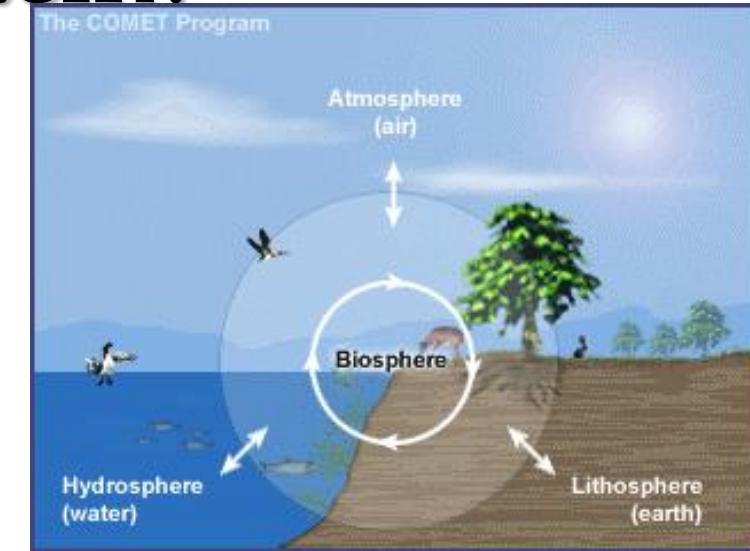
# What is the Environment?

- The environment is everything around us, or as the famous physicist Albert Einstein put it, “The environment is everything that isn’t me.”
- Thus the environment is everything that makes up our surroundings and affects our ability to live on the earth.
- The term the environment comes from the French word "environ" which means everything that surrounds us.

# What is the Earth's Life-Support System?

Scientific studies reveal that the earth's life-support system consists of four main systems that interact with one another:

- The atmosphere (air),
- The hydrosphere (water),
- The geosphere (rock, soil, sediment),
- The biosphere (living things)





The **atmosphere** is a thin spherical envelope of gases surrounding the earth's surface.

Its inner layer, the **troposphere**, extends only about 17 kilometers above sea level at the tropics and about 7 kilometres above the earth's north and south poles.

It contains the majority of the air that we breathe, consisting mostly of nitrogen (78%) and oxygen (21%). The remaining 1% of the air includes water vapor, carbon dioxide, and methane, all of which are called **greenhouse gases**, which absorb and release energy that warms the lower atmosphere.

Without these gases the earth would be too cold for the existence of life as we know it. Almost all of the earth's weather occurs within this layer.



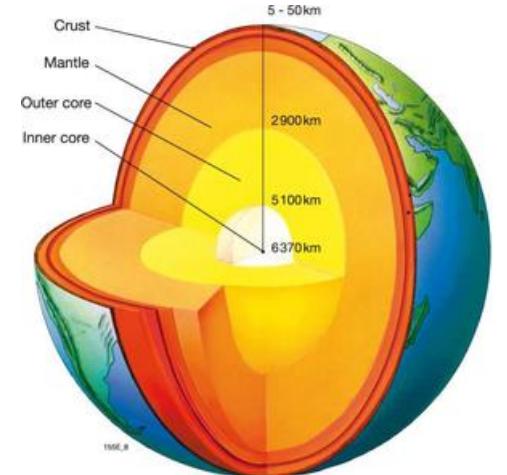
The next layer, stretching 17–50 kilometers above the earth's surface, is called the **stratosphere**.

Its lower portion holds enough ozone ( $O_3$ ) gas to filter out most of the sun's harmful *ultraviolet (UV) radiation*. This global sunscreen allows life to exist on land and in the surface layers of bodies of water.

# The Hydrosphere

The **hydrosphere** consists of all of the water on or near the earth's surface. It is found as liquid water (on the surface and underground), ice (polar ice, icebergs, and ice in frozen soil layers called permafrost), and water vapor in the atmosphere. The oceans, which cover about 71% of the globe, contain about 97% of the earth's water.

The **geosphere** consists of the earth's intensely hot core, a thick mantle composed mostly of rock, and a thin outer crust.



Most of the geosphere is located in the earth's interior.

Its upper portion (crust) contains non-renewable fossil fuels and minerals that we use, as well as renewable soil chemicals (nutrients) that organisms need to live, grow, and reproduce.



# Biosphere

## The Earth



The **Biosphere** is made up of the parts of Earth where life exists. The biosphere extends from the deepest root systems of trees to the dark environment of ocean trenches, to lush rain forests and high mountaintops.

It is the total complex of soil, water, air and living organisms that forms a complete ecosystem. They define the biosphere as

- “The space of our planet that is taken up by living beings”
- or as
- “That part of the Earth's crust, of its hydrosphere and atmosphere, that builds the environment for life”.



The biosphere is that part of the earth inhabited by living organisms, including land, ocean and the atmosphere in which life can exist.

Dynamic interactions occur between the biotic region (biosphere) and the abiotic regions (atmosphere, lithosphere and hydrosphere) of the earth. Energy, water, gases and nutrients are exchanged between the regions on various spatial and time scales.

The study of the relationships of living organisms with one another and with their environment is the science known as ecology.



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# Earth's Interconnected Cycles



- <https://www.youtube.com/watch?v=6j5iHvYBlcg>

# Ecology & Eco-system



Biosphere	Parts of the earth's air, water, and soil where life is found
Ecosystem	A community of different species interacting with one another and with their nonliving environment of matter and energy
Community	Populations of different species living in a particular place, and potentially interacting with each other
Population	A group of individuals of the same species living in a particular place
Organism	An individual living being

**Ecology** : **علم البيئة** is the science that focuses on how organisms interact with one another and with their non living environment of matter and energy.

Ecologists classify matter into levels of organization ranging from the atomic level to the level of the biosphere.

They study interactions within and among five of these levels – organisms, populations, communities, ecosystems, and the biosphere.

# What is an Ecosystem?

An ecosystem is a geographic area where plants, animals, and other organisms, as well as weather and landscape, work together to form a bubble of life. Ecosystems contain biotic or living parts, as well as abiotic factors, or non-living parts.

For example, a forest ecosystem consists of plants (especially trees), animals, and tiny decomposers that recycle its chemicals, all interacting with one another and with solar energy and the chemicals in its air, water, and soil.

The biosphere is a global ecosystem composed of living organisms (biota) and the abiotic (non-living) factors from which they derive energy and nutrients.



## Ecosystems Episode 1: What is an ecosystem?



Pause (k)



— ● 0:41 / 4:40



- <https://www.youtube.com/watch?v=7cRgK0qG00E&t=16s>

## Ecosystems Have Living and Non-living Components

Two types of components make up the biosphere and ecosystems:

One type, called **abiotic**, consists of **non-living components** such as physical conditions (temperature, pH, humidity, salinity, sunlight and solar energy, etc.) and chemical agents (different gases and mineral nutrients present in the air, water, soil, rocks) in an ecosystem.

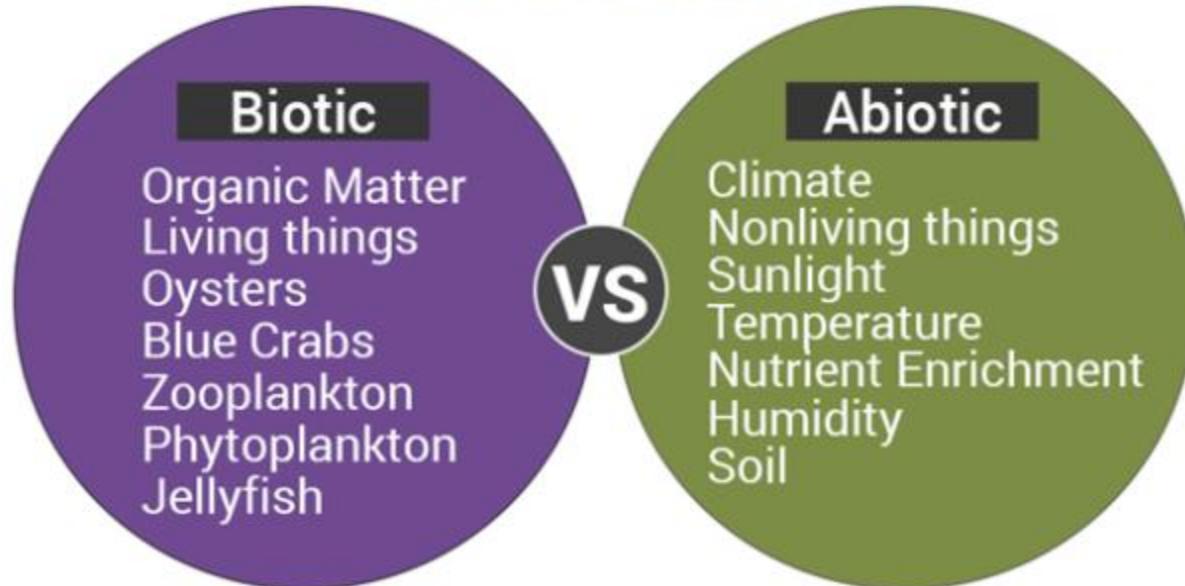
The other type, called **biotic**, consists of living biological components such as plants, animals, and microbes.

Biotic factors also include dead organisms, dead parts of organisms, and the waste products of organisms.

# Ecosystems Have Living and Non-living Components

Biotic and abiotic are the two essential factors responsible for shaping the ecosystem. Therefore, both the abiotic and biotic resources affect survival and reproduction process.

## Biotic Vs. Abiotic



## Abiotic and Biotic Factors



0:40

|| ▶ 🔍 0:00 / 2:39

|| 🔍 ⚙️ 📺



- [https://www.youtube.com/watch?v=E1pp\\_7-yTN4](https://www.youtube.com/watch?v=E1pp_7-yTN4)

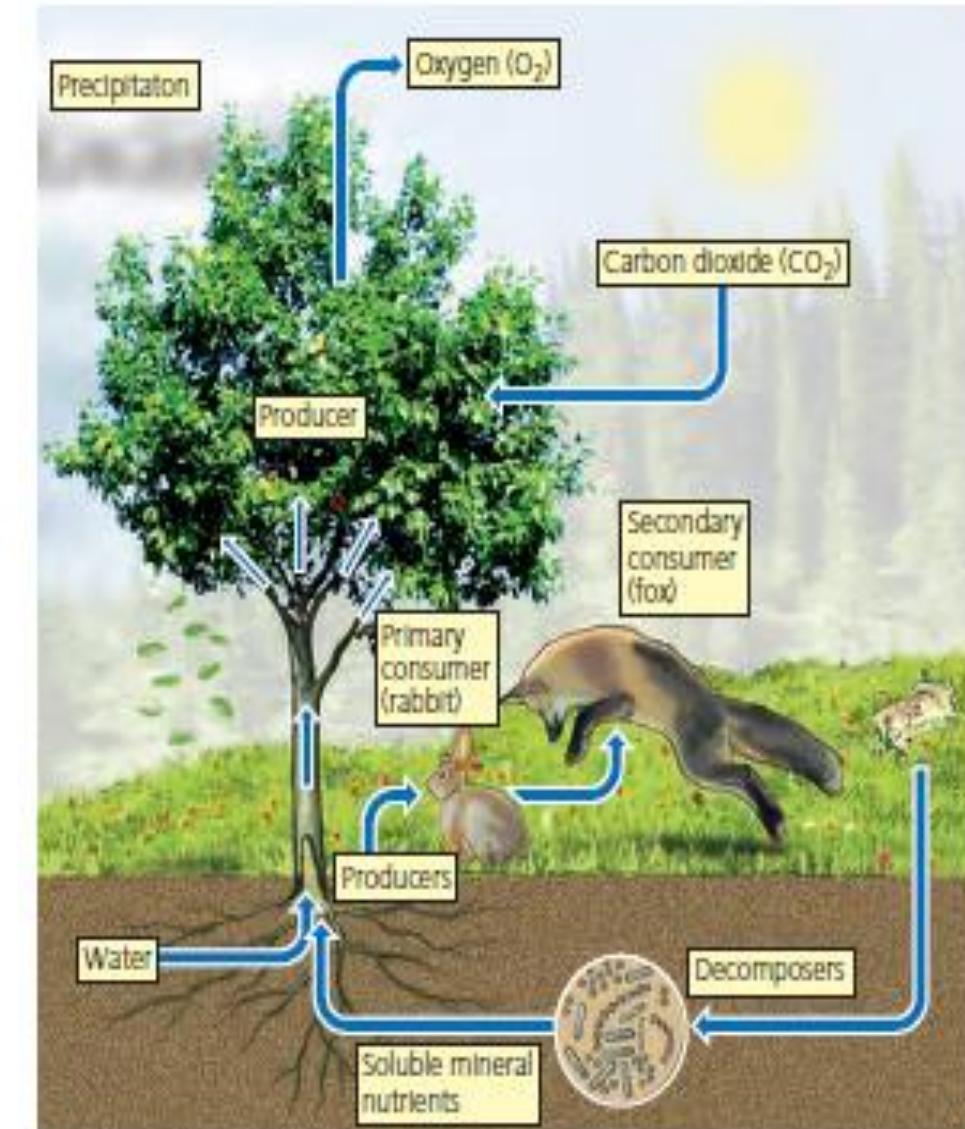
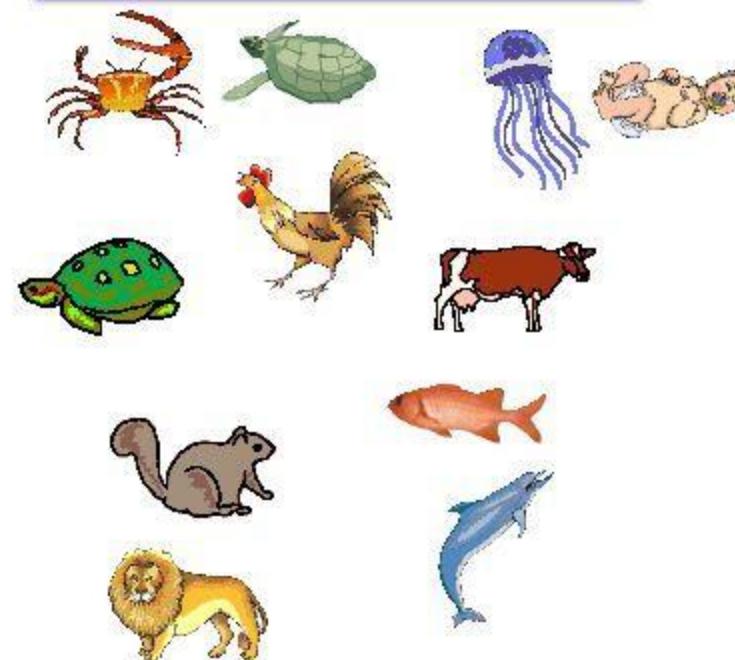
# Biotic Components

The living (biotic) organisms that transfer energy and nutrients from one feeding level to another in an ecosystem can be broadly classified as **producers** and **consumers**.

## Producers



## Consumers



**Producers** (self-feeders) make the nutrients they need from compounds and energy obtained from their environment.

On land, most producers are **green plants**. In a process called photosynthesis, plants capture the solar energy that falls on their leaves and use it to combine carbon dioxide and water to form organic molecules, (such as glucose), which store the chemical energy they need.



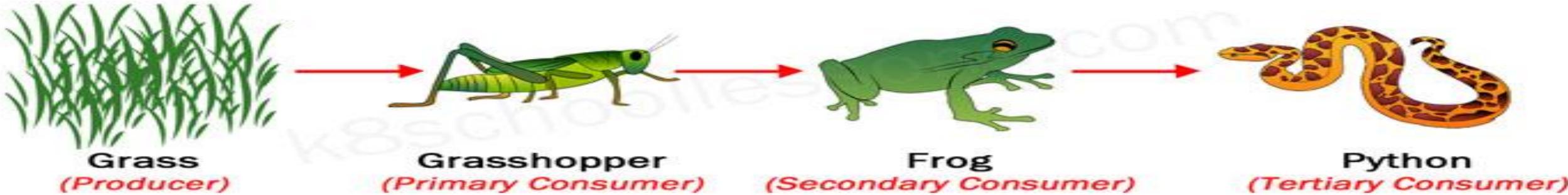
In freshwater and marine ecosystems, **algae and aquatic plants** growing near shorelines are the major producers.

All other organisms in an ecosystem are **Consumers**, which cannot produce the nutrients they need through photosynthesis or other processes.

They feed on other organisms (producers or other consumers) or their remains. In other words, all consumers (including humans) depend on producers for their nutrients.

There are several types of consumers. **Primary consumers**, or **herbivores** (plant eaters), are animals that eat producers, feeding mostly on green plants.

**Carnivores** (meat eaters) are animals that feed on the flesh of other animals. **Secondary consumers** feed on the flesh of herbivores. Other carnivores, **tertiary** (or higher), consumers feed on the flesh of other carnivores.



All dead animals and plants have run out of energy. It can't grow any more. But it is still vital to life, because it contains chemicals that are the basic building blocks of all living things.

These chemicals get recycled into the food web with the help of organisms called **Decomposers**.

**Decomposers**, get nutrients and energy by breaking down dead organisms and animals wastes. They break complex organic materials into more elementary substances: water, carbon dioxide and simple compounds: phosphorus, nitrogen and calcium.

Through this process, they release nutrients back into the environment.

- Decomposers and detritus feeders are microscopic organisms.
- They are the key to nutrient cycling. Without them, the planet would be overwhelmed with plant litter, dead animal bodies, animal wastes, and garbage.



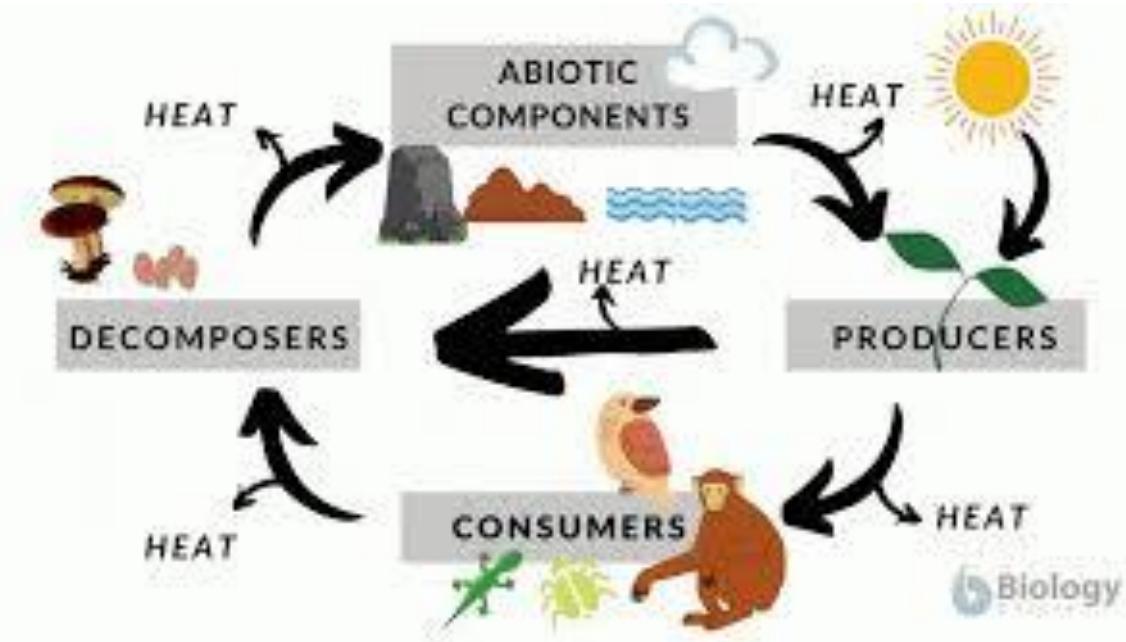
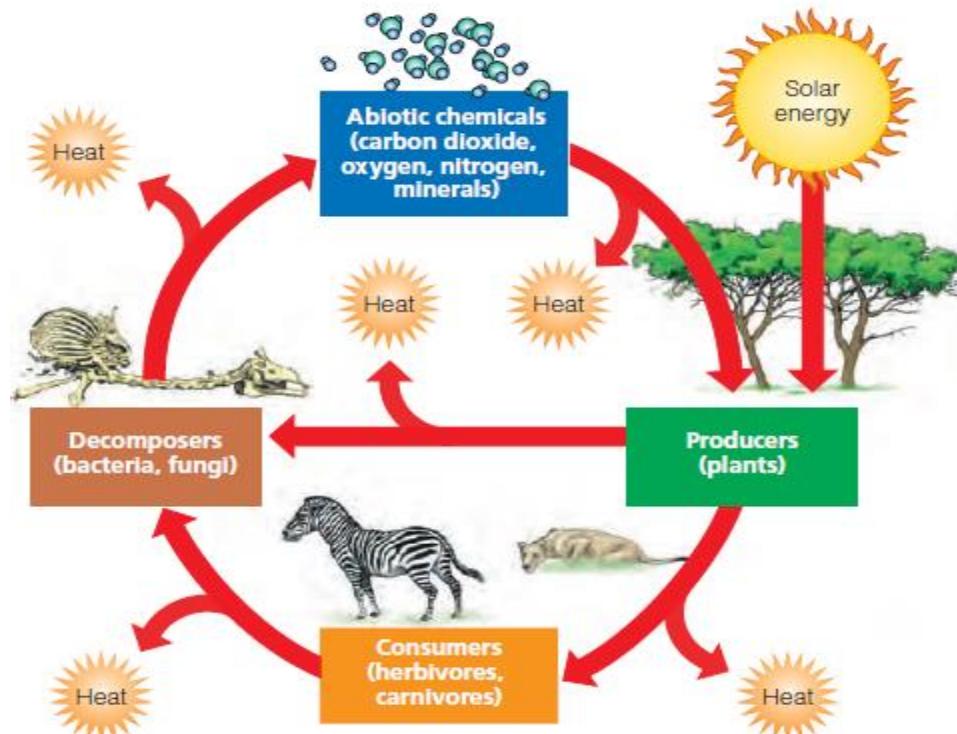


a producer

- [https://www.youtube.com/watch?v=FTIJ\\_e-wmuM](https://www.youtube.com/watch?v=FTIJ_e-wmuM)

# Energy Flow and Nutrient Cycling Sustain Ecosystems and the Biosphere

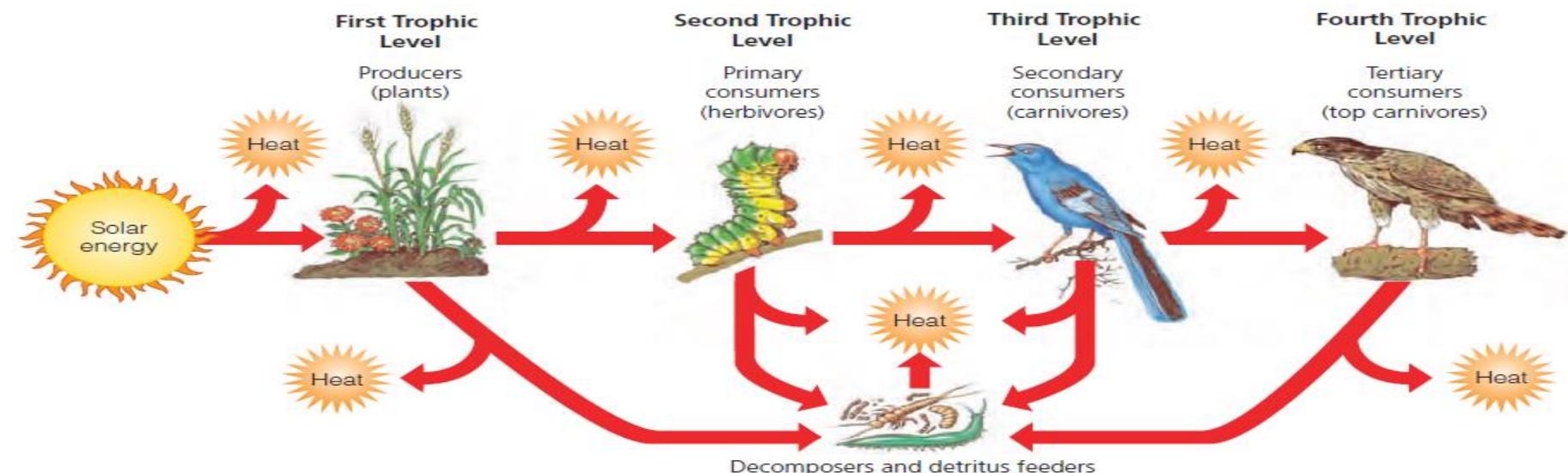
Ecosystems and the biosphere are **sustained** through a combination of one-way energy flow from the sun through these systems and nutrient cycling of key materials within them.



# Energy Flows through Ecosystems in Food Chains and Food Webs

The chemical energy stored as nutrients in the bodies and wastes of organisms flows through ecosystems from one feeding level to another.

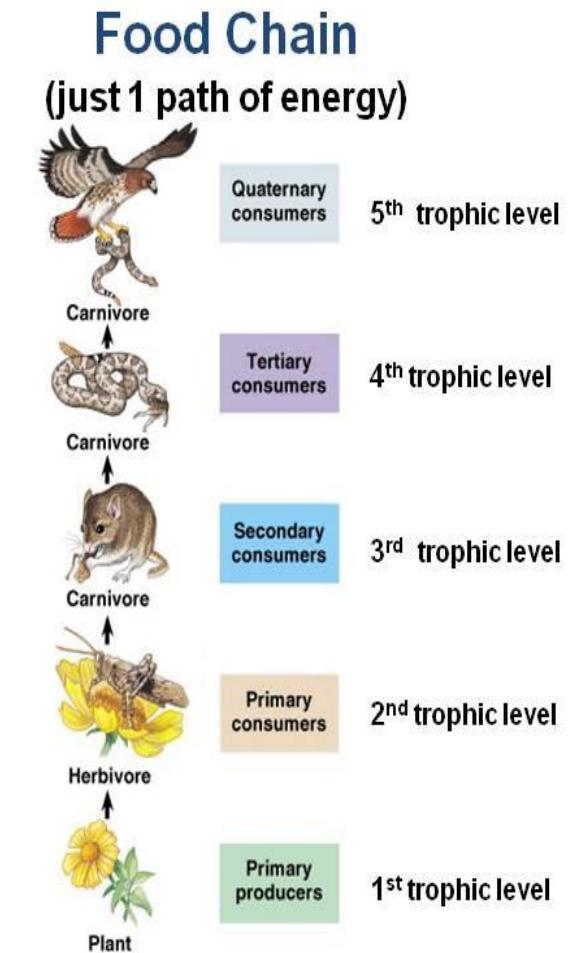
For example, a **plant** uses **solar energy** to store chemical energy in a **leaf**. A caterpillar eats the **leaf**, a **robin** eats the caterpillar, and a **hawk** eats the robin. Decomposers and detritus feeders consume the remains of the leaf, caterpillar, robin, and hawk after they die and return their nutrients to the soil for reuse by producers.



## Food Chains:

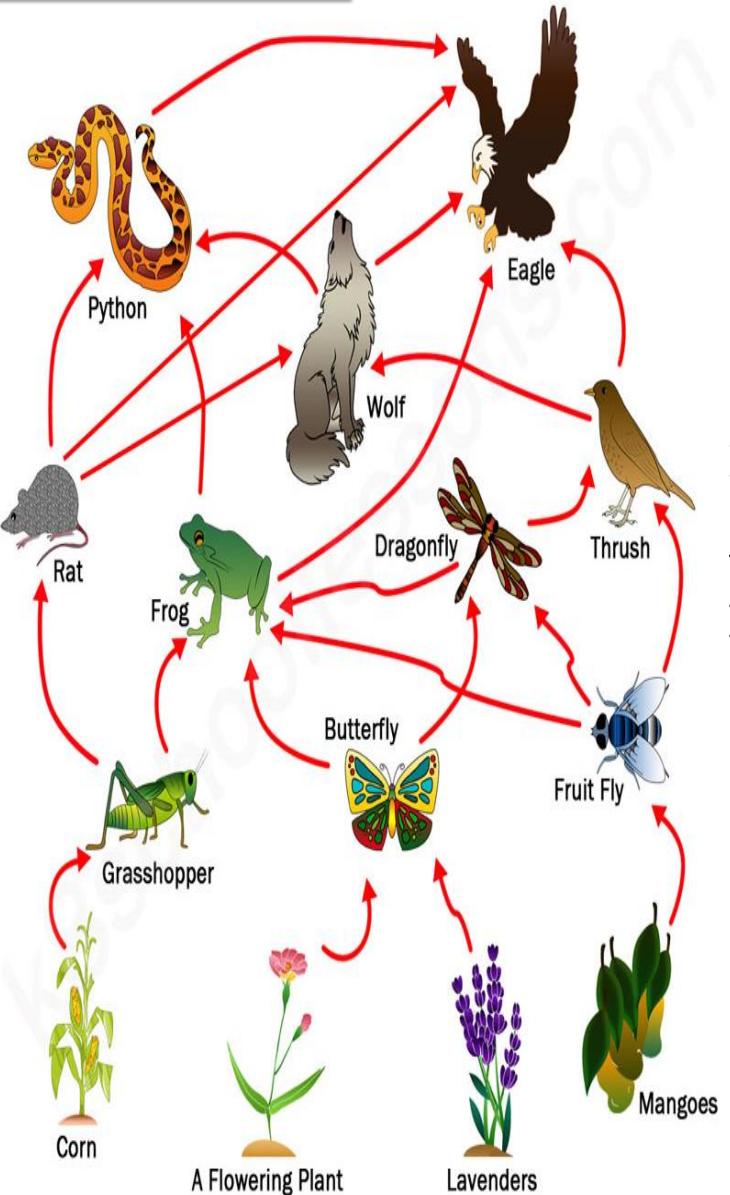
A sequence of organisms, each of which serves as a source of food or energy for the next, is called a food chain.

It determines how chemical energy and nutrients move from one organism to another through the trophic levels in an ecosystem along the same pathways – primarily through photosynthesis, feeding, and decomposition.

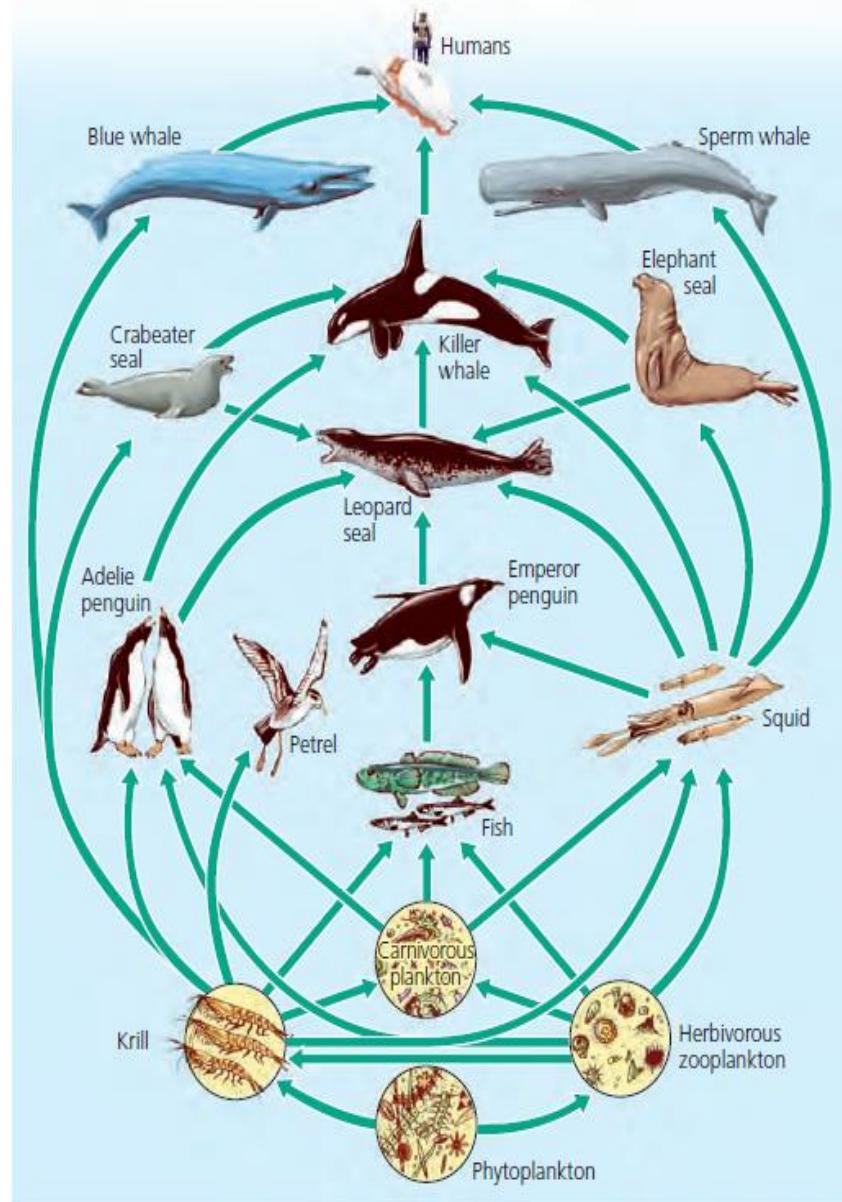


Every use and transfer of energy by organisms involves a loss of some degraded high-quality energy to the environment as **heat**.

## Food Webs:



It is a complex network of many interconnected food chains and feeding relationships.





- <https://www.youtube.com/watch?v=LVJ5BKcAhAg&t=9s>

# Glossary

- **Atmosphere**: Whole mass of air surrounding the earth.
- **Hydrosphere**: Earth's liquid water (oceans, lakes, other bodies of surface water, and underground water), frozen water (polar ice caps, floating ice caps, and ice in soil), and water vapour in the atmosphere.
- **Geosphere**: Earth's intensely hot core, thick mantle composed mostly of rock, and thin outer crust that contains most of the earth's rock, soil, and sediment.
- **Biosphere**: Zone of the earth where life is found. It consists of parts of the atmosphere (the troposphere), hydrosphere (mostly surface water and groundwater), and geosphere (mostly soil and surface rocks and sediments on the bottoms of oceans and other bodies of water) where life is found.

# Glossary

- **Ecosystem:** An ecosystem is a community of living organisms in conjunction with the non-living components of their environment, interacting as a system. These biotic and abiotic components are linked together through nutrient cycles and energy flows
- **Ecology:** Biological science that studies the relationships between living organisms and their environment; study of the structure and functions of nature.
- **Producer:** Organism that uses solar energy to manufacture the organic compounds it needs as nutrients from simple inorganic compounds obtained from its environment.
- **Consumer:** Organism that cannot make their own food, but feed on the producers or other consumers; generally divided into primary consumers (herbivores), secondary consumers (carnivores), tertiary (higher-level) consumers.

# Glossary

- **Decomposer:** Organism that digests parts of dead organisms and release fragments and wastes of living organisms, by breaking down the complex organic molecules in those materials into simpler inorganic compounds. This process returns most of these chemicals to the soil and water for reuse.
- **Food Chain:** Series of organisms in which each eats or decomposes the preceding one.
- **Food Web:** Complex network of many interconnected food chains and feeding relationships.
- **Biomass:** Dry weight of all organic matter in plants and animals in an ecosystem.