
Environment:
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ENVIRONMENT AND ITS SEGMENTS

- Word **"Environment"** derived from French word **"Environner"** meaning "**To encircle or Surround**".

- Simply be defined as the **surrounding of an organism** in which the **organism lives**.

- **Surrounding** includes things-

✓ **Non-living (Abiotic)- Air, Water, Soil** etc.

✓ **Living (Biotic)- all other living beings which organism comes into regular contact in its environment.**

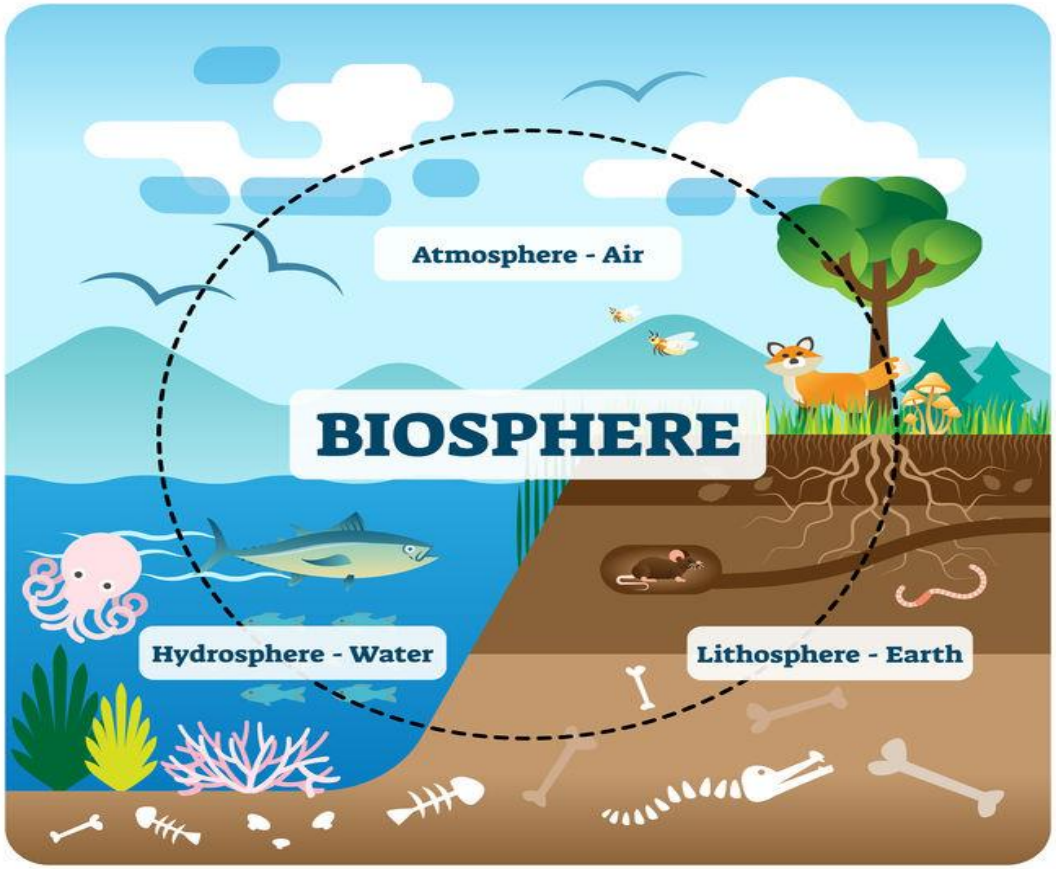
- Absence of these organism meaningless to speak of **environment and vice versa**.

- In other words exists a **mutual interaction** between **every organism and its environment**.

Global Environment

Consist four segments-

1. Atmosphere
2. Hydrosphere
3. Lithosphere
4. Biosphere



1. ATMOSPHERE

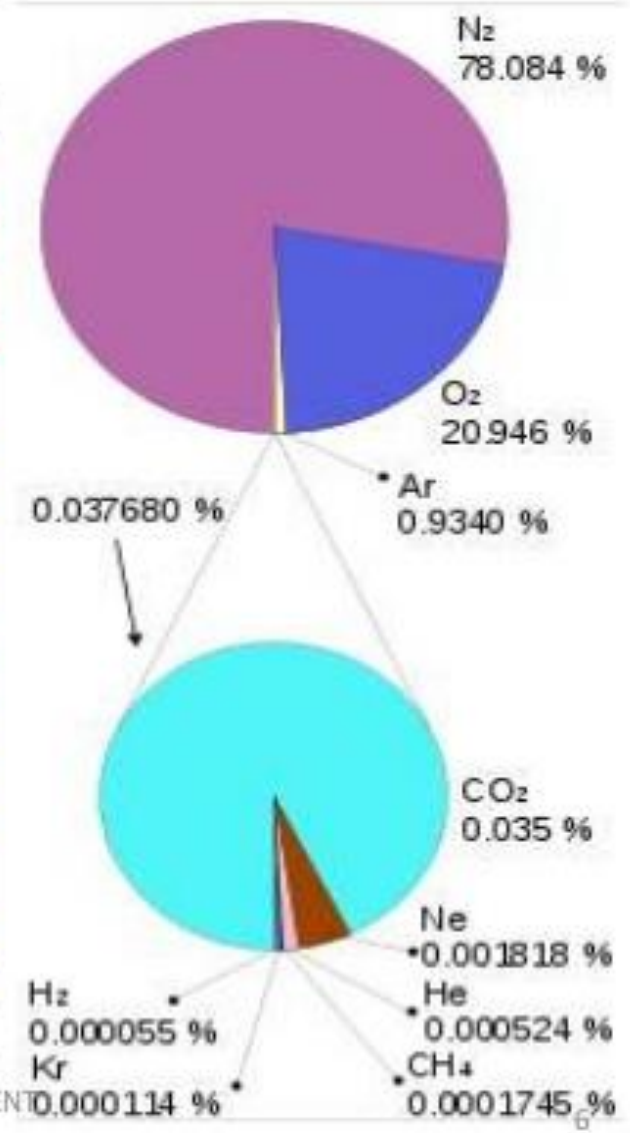
- **Definitions:** "*The **thin envelope of gases surrounding** the earth **Highly compressible**"*
- **Absorb** most **cosmic rays from outer space and a major portion of electromagnetic radiation (EMR)** from Sun and transmits only **near UV, visible & IR radiation (300-2500nm)** and **radio wave** while filtering out **harmful UV radiation below 300nm**.
- **Atmosphere is bound to earth by gravity.**
- **Total mass of Atmosphere: $5x10^5$ tones** which is **1 millionth of Earth's total mass**.
- Density decreases **rapidly with height**

Cont....

- **Air:** *A mechanical mixture of* ***Gases and Aerosols***
- **Pure air- colorless, odorless, tasteless** and **can't felt except in motion**.
- By weight of **1 liter air= 1.3gm**
- Pressure at sea level= **1033.6g/sq.cm (called 1 Atmosphere)**
- **Source Of O_2 – essential for life**
- **Source Of CO_2 – essential for plants in photosynthesis**
- **Without that would be – no clouds, no winds or storm and hence no weather.**

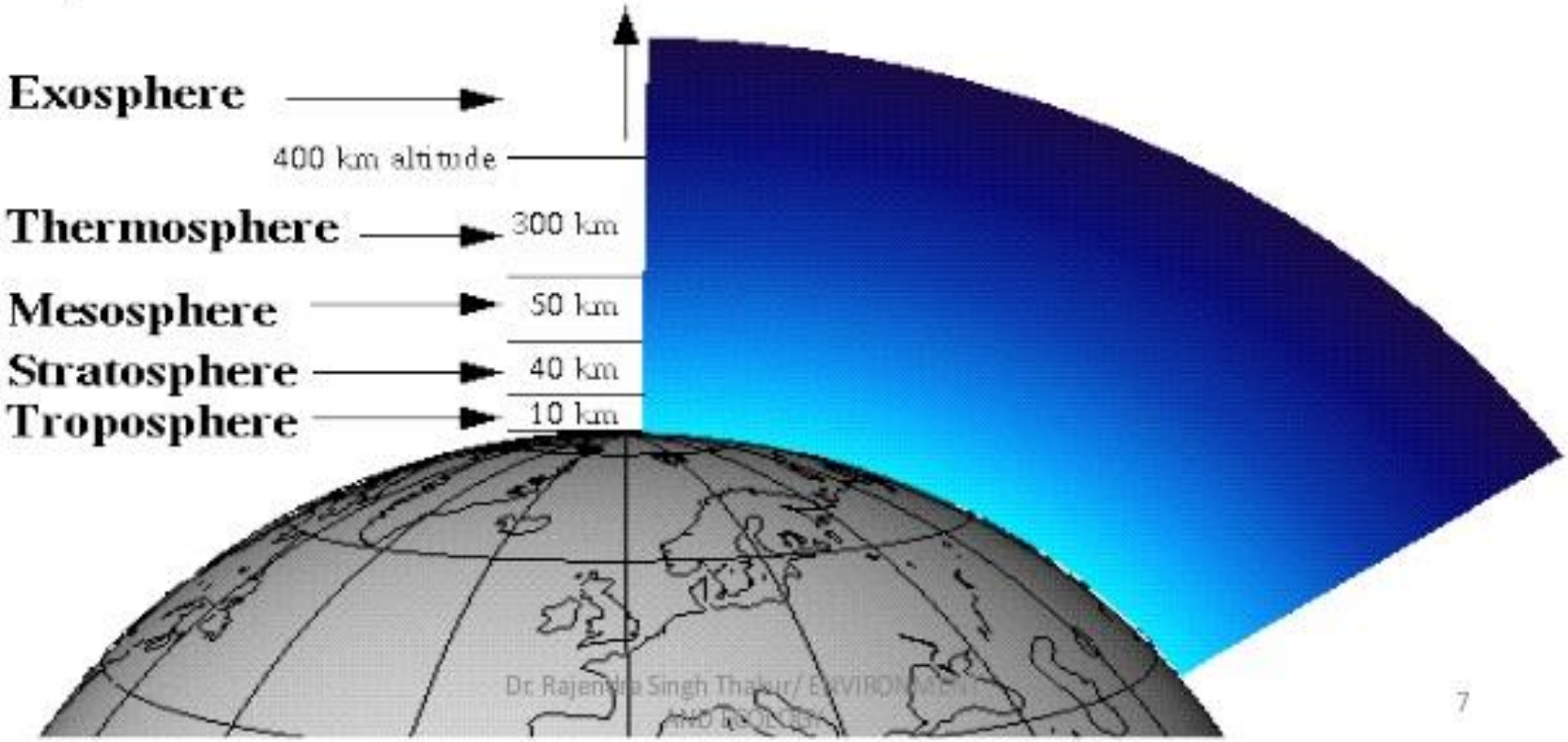
Composition of Atmosphere

ppmv: parts per million by volume (note: volume fraction is equal to mole fraction for ideal gas only, see volume (thermodynamics))		
Gas	Volume	%
Nitrogen (N_2)	780,840 ppmv	(78.084%)
Oxygen (O_2)	209,460 ppmv	(20.946%)
Argon (Ar)	9,340 ppmv	(0.9340%)
Carbon dioxide (CO_2)	397 ppmv	(0.0397%)
Neon (Ne)	18.18 ppmv	(0.001818%)
Helium (He)	5.24 ppmv	(0.000524%)
Methane (CH_4)	1.79 ppmv	(0.000179%)
Krypton (Kr)	1.14 ppmv	(0.000114%)
Hydrogen (H_2)	0.55 ppmv	(0.000055%)
Nitrous oxide (N_2O)	0.325 ppmv	(0.0000325%)
Carbon monoxide (CO)	0.1 ppmv	(0.00001%)
Xenon (Xe)	0.09 ppmv	(9×10^{-6}%) (0.000009%)
Ozone (O_3)	0.0 to 0.07 ppmv	(0 to 7×10^{-6}%)
Nitrogen dioxide (NO_2)	0.02 ppmv	(2×10^{-6}%) (0.000002%)
Iodine (I_2)	0.01 ppmv	(1×10^{-6}%) (0.000001%)
Ammonia (NH_3)	trace	
Not included in above dry atmosphere:		
Water vapor (H_2O)	~0.25% by mass over full atmosphere, locally 0.001%–5%	



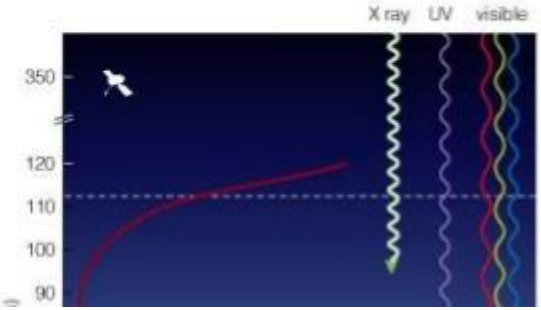
Structure of Atmosphere

- **No sharp boundary** with extraterrestrial space
- **Phenomena – magnetic and gravitational field** extend outward for thousand km to vague zone of **nebulas gases and radiation particle**.
- Basis of **Temperature and other related phenomenon** divided in to four major layer-



Troposphere

- Altitude extending about up to about **8km at the pole and 16 km at the equator**
- The **lowest region** of the atmosphere, where **life & weather exist**.
- **Temperature decreases** with altitude **(about 6°C/km) to minimum of -50° or -60°C.**

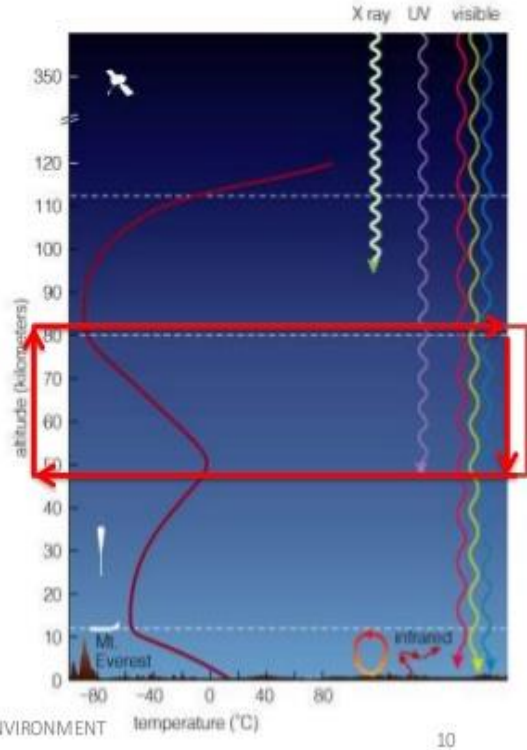


Stratosph

- **16 to 50 km** altitude
- **Temperature increases** with altitude and **increases from -60°C up to a maximum of 0°C** near outer limits, **stratapause**.
- **Heating occurs because ozone (O_3) absorbs ultraviolet radiation** from the Sun.
- Top of the stratosphere is known as the **stratopause.**

Mesosphere

- **50 to 80 km** altitude
- **Temperature decreases** slowly with altitude **0°C to minimum about -75°C** near the mesopause.
- The **lowest temperatures in the entire atmosphere** are found at the mesopause during summer at high latitudes.
- Top of the mesosphere is known as the **mesopause at 80km.**



2. HYDROSPHERE

- The hydrosphere includes **all water on Earth.**
- The abundance of water on Earth is a unique feature that **clearly distinguishes our "Blue Planet"** from others in the **solar system**.
- **Not a drop of liquid water** can be found anywhere else in the **solar system**.
- It is because the **Earth** has just **the right mass, the right chemical composition, the right atmosphere, and is the right distance from the Sun** that permits water to exist

The Structure of Hydrosphere

- **Oceans—97%** of water is **salt water** and it found in **the oceans**.
- **Fresh water**—the remaining **3%** is **freshwater**.
- Fresh water distribution:
  - **Ice: 1.762%**
  - **Groundwater: 1.7%**
  - **Surface Fresh Water: 0.014%**
  - **Atmosphere and soil: 0.002%**

4.BIOSPHERE

- The **interaction of life with environment** takes place of many levels.
- **A single bacterium in the soil interact** with the **water, air and particle of soil** within a fraction of **a cubic centimeter**.
- While **forest extending hundred square km interact with large volume of water, air and soil**.
- Part of Earth in which life exists including **land, water, and air or atmosphere**.
- We live in **the natural world and use its resources (water, space, food, etc).**
- The natural world effects our lives (**weather, fire, economy**).
- To protect **biodiversity.**
- Thus all **lower atmosphere and near surface part of lithosphere and hydrosphere** affected by life is whole exist **few meters of exists surface**.
- **This region of the earth where life exist** is known as **"Biosphere"**.
- **All living things** required **energy and materials**.
- In biosphere **energy received from the sun** and interior of the **earth received energy is then used** and **given off a material are recycled.**

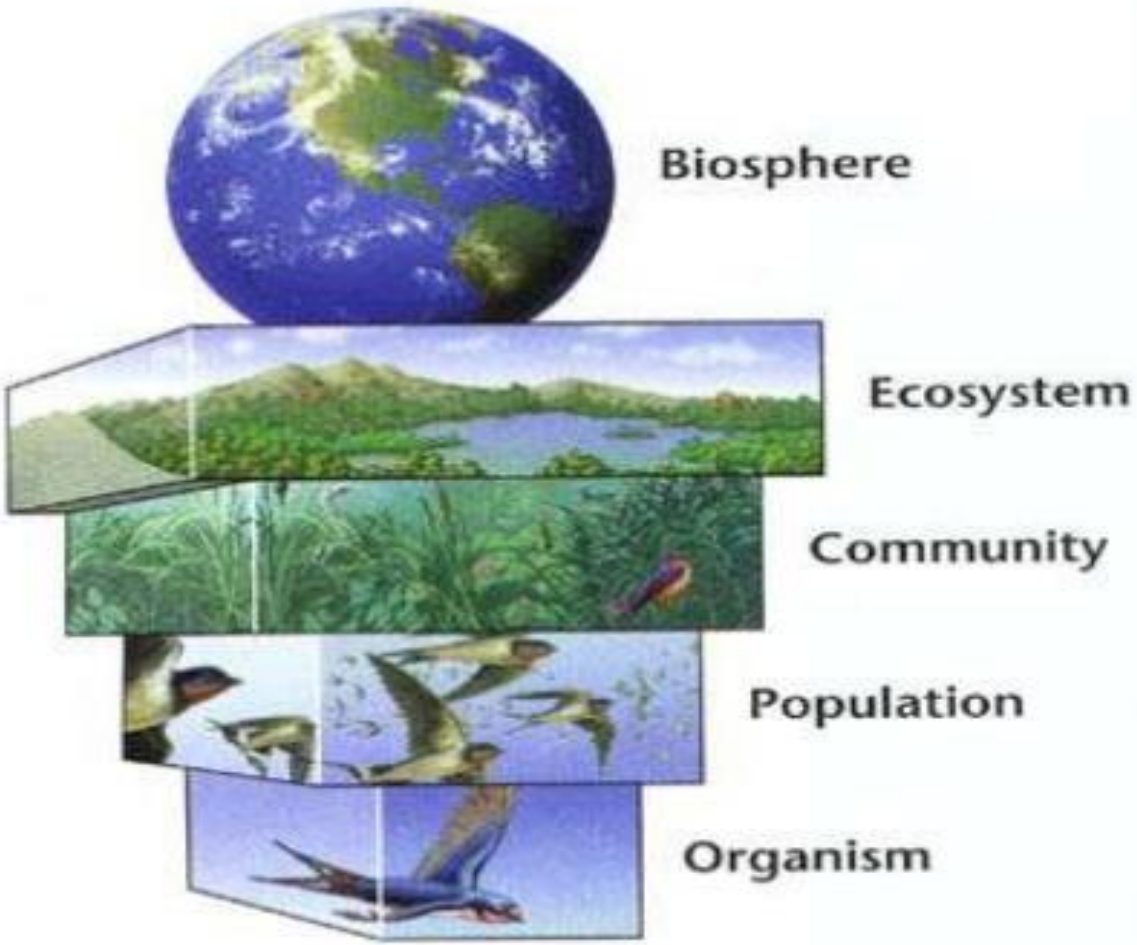
Biosphere

- The biosphere infect is **a thin shell that encapsulates the earth** which includes **all life as well as the lower atmosphere and the oceans, rivers, lakes, soils and solid sediments** that activity **interchange materials with life**.
- According to an estimate biosphere contains-

✓ More than **3.5 lacs species of plant** (including-**algae, fungi, mosses & higher from of plants**).

✓ More than **11 million species of animal** (ranging from **unicellular protozoa to man**).

- **Supplies all the essential requisite of life-**namely, **light, heat, air, water, food & living space (habitats) for all these species**.
- Since biosphere is **very large and complex** then it better understanding by **divided in to smaller units** called **"Ecosystems" or "Ecological systems."**


Biosphere
Ecosystem
Community
Population
Organism

Ecosystem :

•The term ‘ecosystem’ was proposed by a British ecologist A.G. Tansley in the year 1935.

•Odum has defined the ecosystem as the basic fundamental unit of ecology which includes both the organisms and the nonliving environment, each influencing the properties of the other and each is necessary for the maintenance of life (Odum, 1971).

•Mathavan (1974) has given another definition of ecosystem according to which ecosystem is the sum total of living organisms, the environment and the processes of interaction between the various components of the system (Odum, and Barrett, 2005).

•ecosystem has been divided into four components:
(i) Abiotic substances
(ii) Producers
(iii) Composers
(iv) Decomposers

Types of Ecosystems:

There are many types of ecosystems on earth. There are three major classes of ecosystems:

1. Fresh water Ecosystems
2. Terrestrial Ecosystems
3. Ocean Ecosystems

Examples of Ecosystems

Pond Ecosystem
Forest Ecosystem:
Sea Ecosystem:

Uses of ecosystem:

Water Cycle,
The Carbon Cycle,
The Oxygen Cycle,
The Nitrogen Cycle and
The Energy Cycle

Ecology:

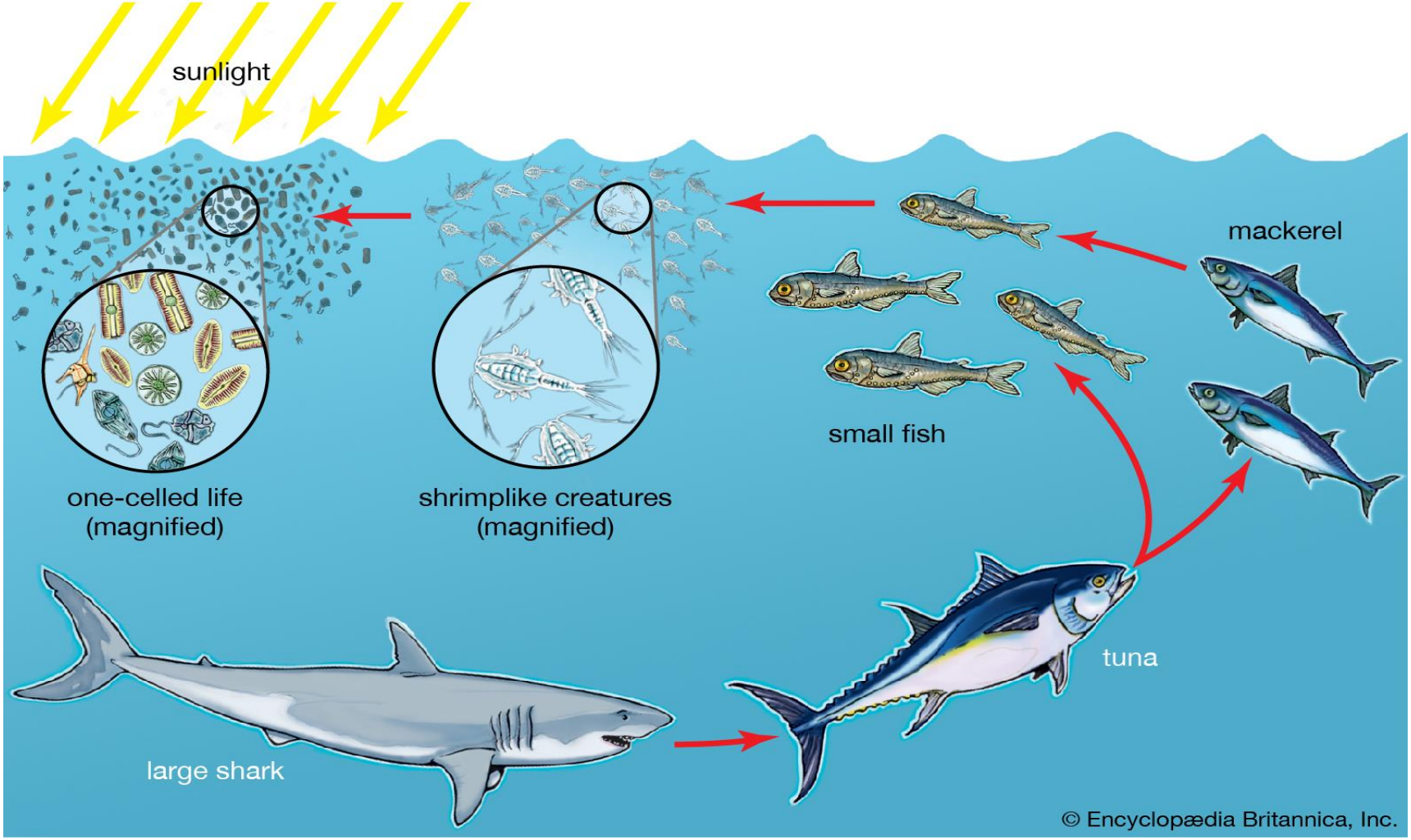
•Ecology is concerned with the study of interrelationships between organisms and their environments.
•Two distinct components of environment can be identified: Abiotic (nonliving or nonorganic, sometime called the physical environment) and Biotic (living or organic)

Food chain

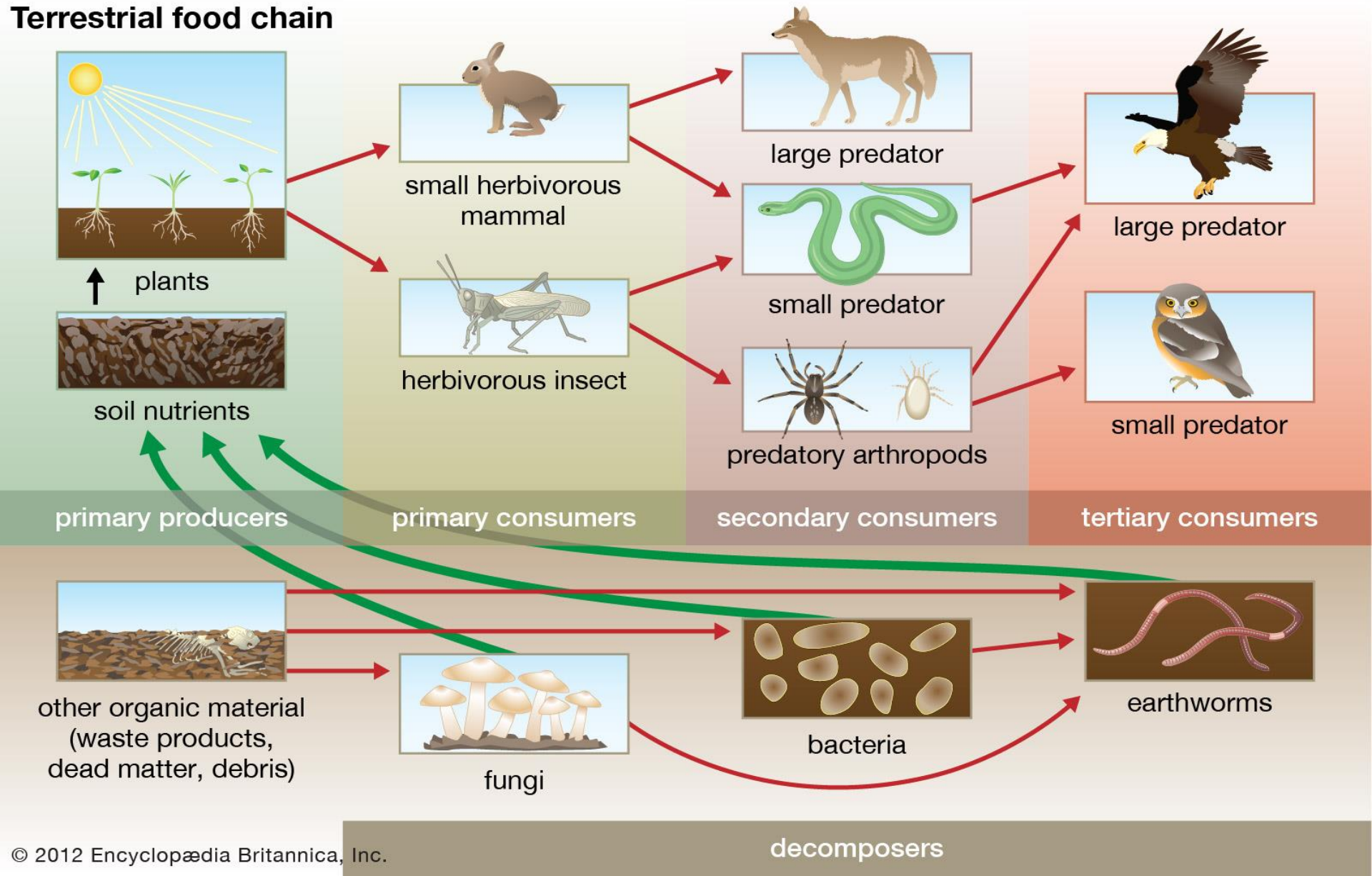
In ecology, the sequence of transfers of matter and energy in the form of food from organism to organism. Food chains intertwine locally into a food web because most organisms consume more than one type of animal or plant.

Plants, which convert solar energy to food by photosynthesis, are the primary food source. In a predator chain, a plant-eating animal is eaten by a flesh-eating animal. In a parasite chain, a smaller organism consumes part of a larger host and may itself be parasitized by even smaller organisms. In a saprophytic chain, microorganisms live on dead organic matter.

Diatoms and other phytoplankton form the foundations of ocean food chains. Shrimplike krill consume the phytoplankton, and small fishes eat the krill. At the top of the food chain, dining on these smaller fishes, are larger, predatory fishes.



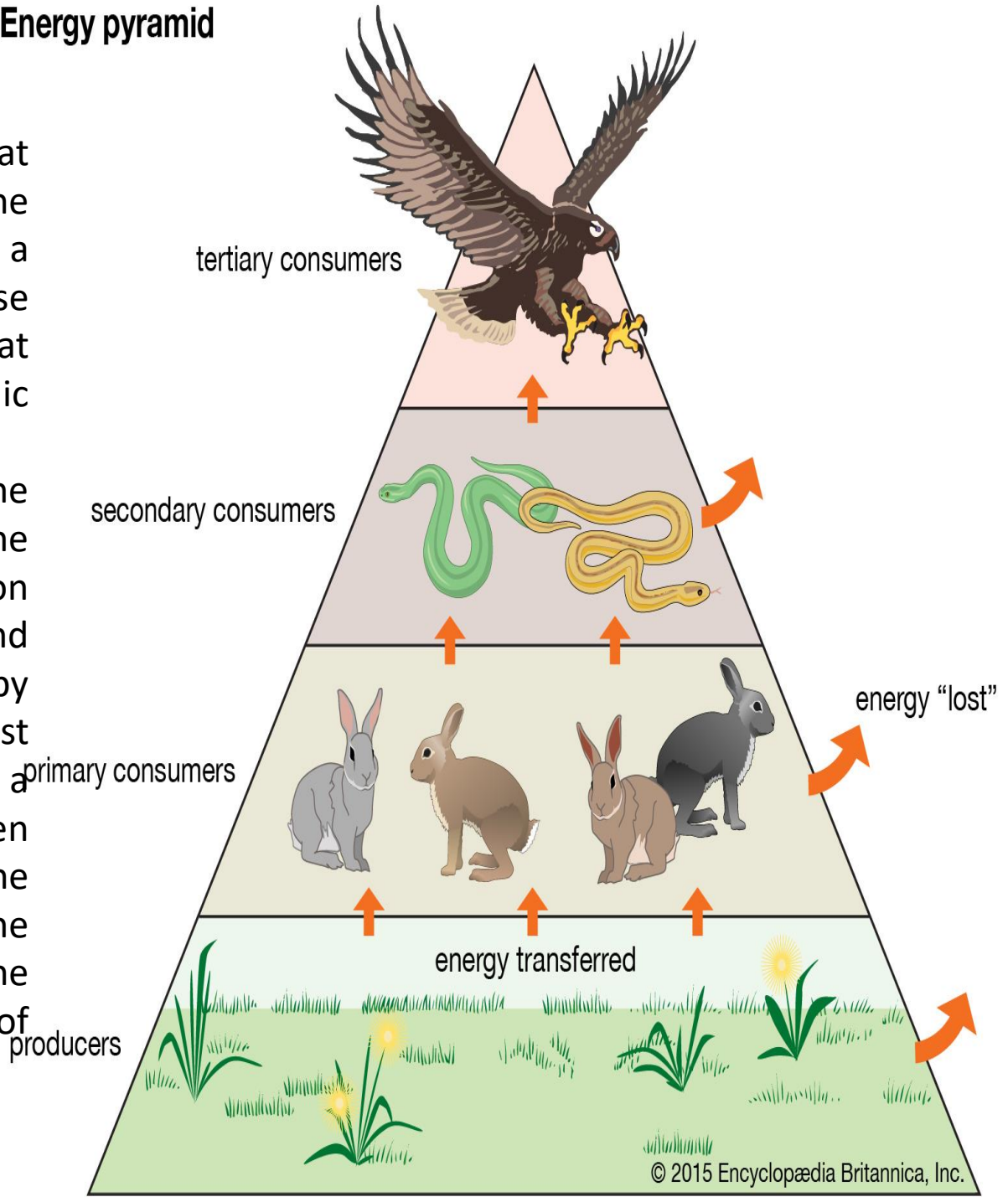
The terrestrial food chain featuring producers, consumers, and decomposers.



energy pyramid

An energy pyramid is a model that shows the flow of energy from one trophic level to the next along a food chain. The pyramid base contains producers—organisms that make their own food from inorganic substances.

All other organisms in the pyramid are consumers. The consumers at each level feed on organisms from the level below and are themselves consumed by organisms at the level above. Most of the food energy that enters a trophic level is “lost” as heat when it is used by organisms to power the normal activities of life. Thus, the higher the trophic level on the pyramid, the lower the amount of available energy.

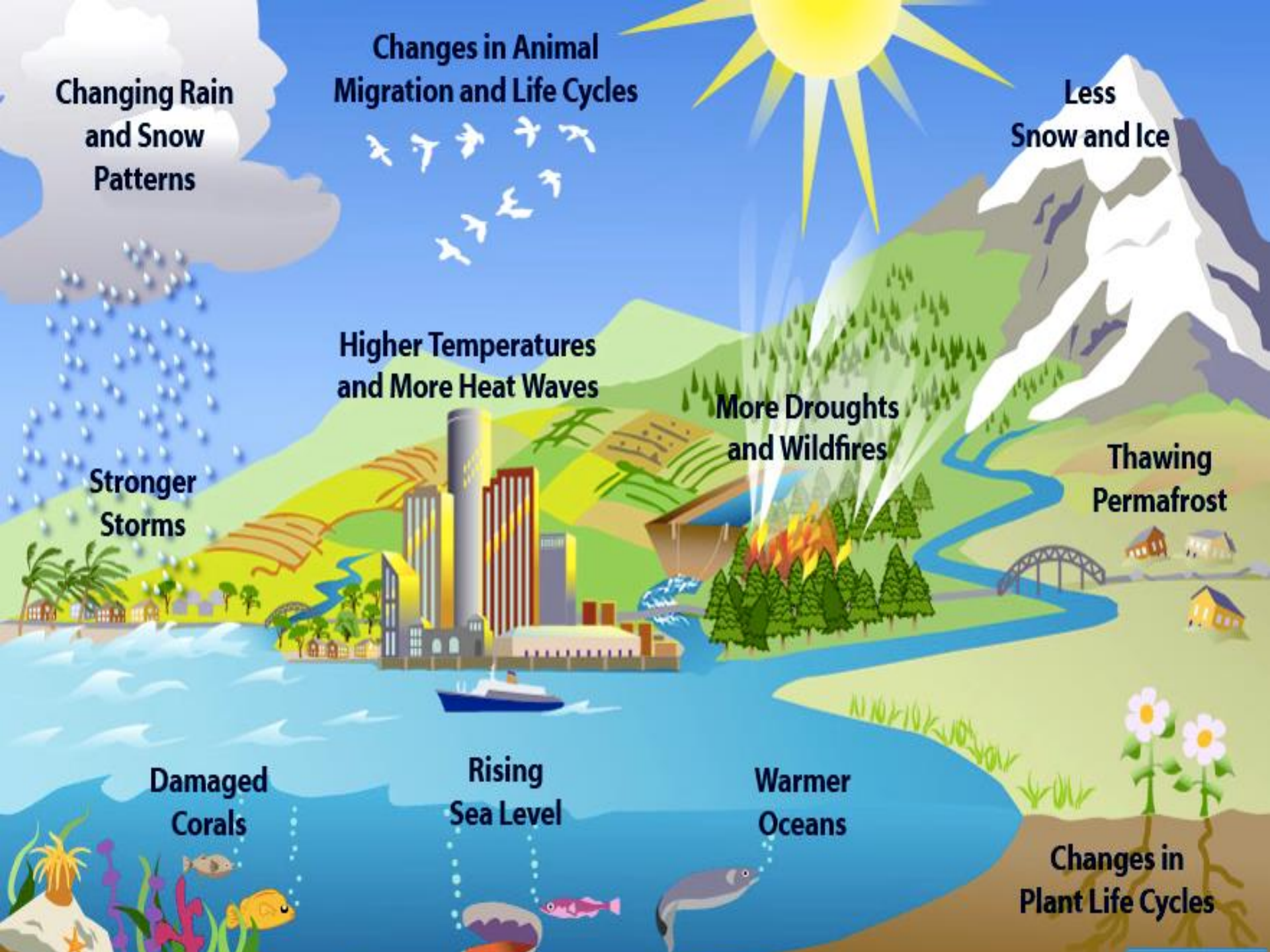


Global warming

Global warming is a term used for the observed century-scale rise in the average temperature of the Earth's climate system and its related effects. Scientists are more than 95% certain that nearly all of global warming is caused by increasing concentrations of greenhouse gases (GHGs) and other human-caused emissions.

How long carbon dioxide remains in our atmosphere

Carbon dioxide is currently the most important greenhouse gas related to global warming. For the longest time, our scientists believed that once in the atmosphere, carbon dioxide remains there for about 100 years. New research shows that is not true. 75% of that carbon will not disappear for thousands of years. The other 25% stays forever. We are creating a serious global warming crisis that will last far longer than we ever thought possible.


Changing Rain and Snow Patterns
Changes in Animal Migration and Life Cycles
Less Snow and Ice
Higher Temperatures and More Heat Waves
More Droughts and Wildfires
Thawing Permafrost
Stronger Storms
Damaged Corals
Rising Sea Level
Warmer Oceans
Changes in Plant Life Cycles

Global warming is a phenomenon of climate change characterized by a general increase in average temperatures of the Earth, which modifies the weather balances and ecosystems for a long time. It is directly linked to the increase of greenhouse gases in our atmosphere, worsening the greenhouse effect.

FOSSIL FUELS

DEFORESTATION

INTENSIVE FARMING

WASTE DISPOSAL

MINING

OVERCONSUMPTION

Global warming prevention

1. Renewable energies

2. Energy & water efficiency

3. Sustainable transportation

4. Sustainable infrastructure

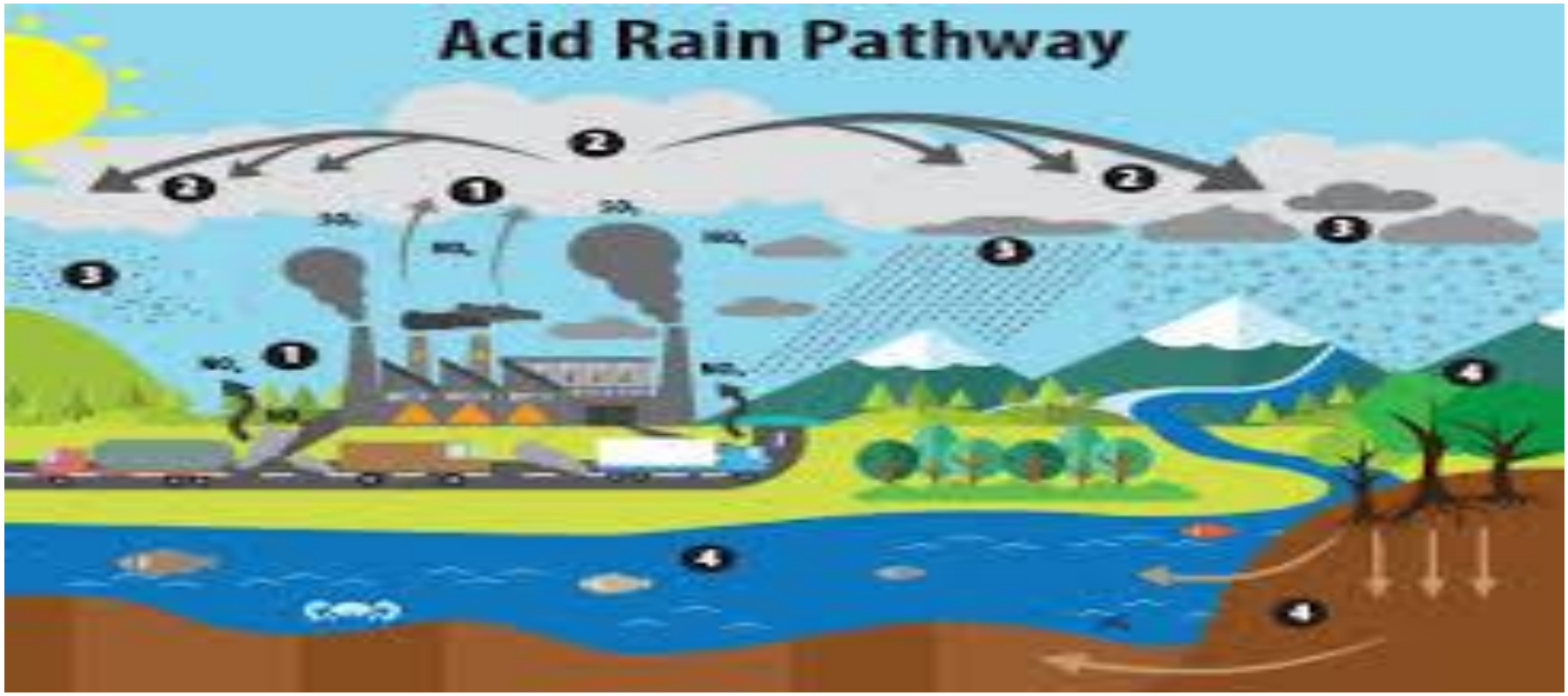
5. Sustainable agriculture & forest management

6. Responsible consumption & recycling

Acid rain:

When fossil fuels such as coal, oil and natural gas are burned, chemicals like sulfur dioxide and

nitrogen oxides are produced. These chemicals react with water and other chemicals in the air to form sulfuric acid, nitric acid and other harmful pollutants like sulfates and nitrates. These acid pollutants spread upwards into the atmosphere, and are carried by air currents, to finally return to the ground in the form of acid rain, fog or snow.



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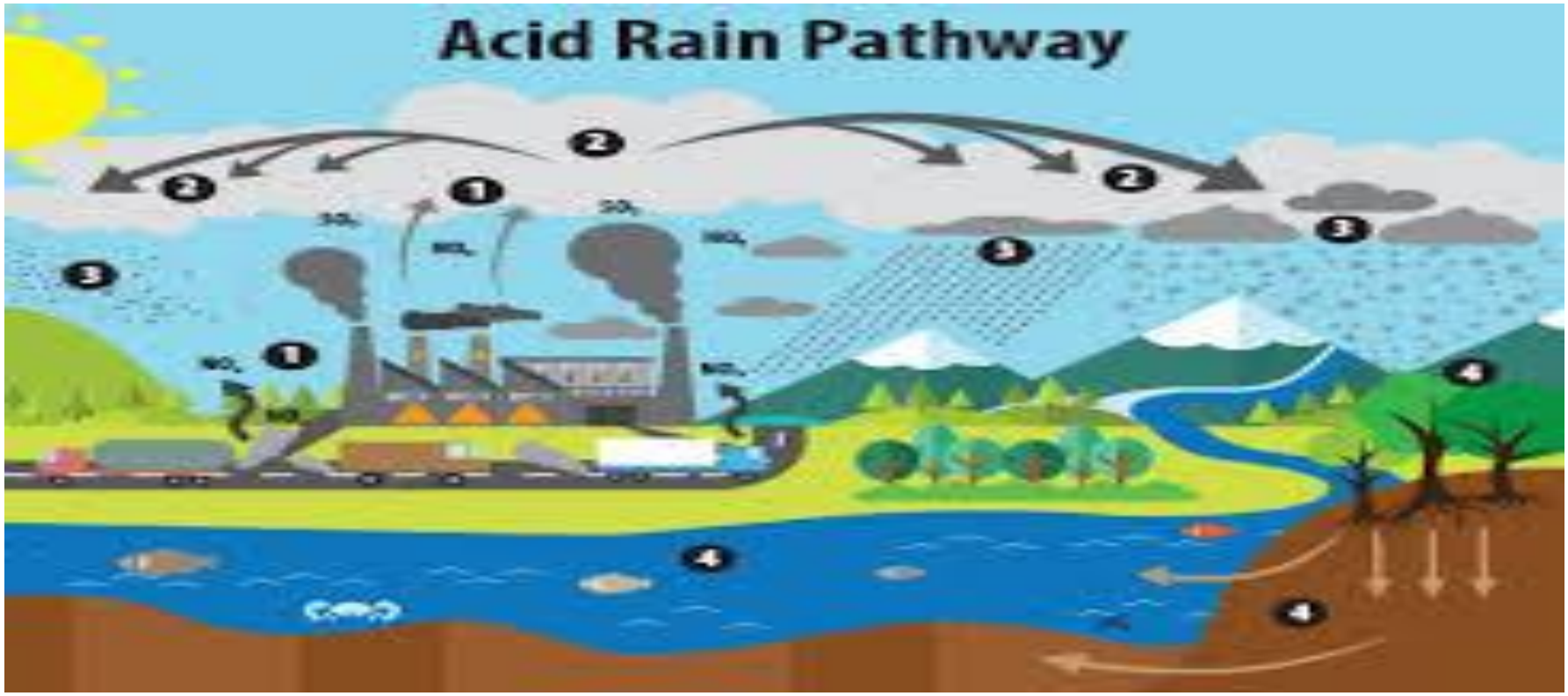


Forms of Acid Deposition

Wet Deposition

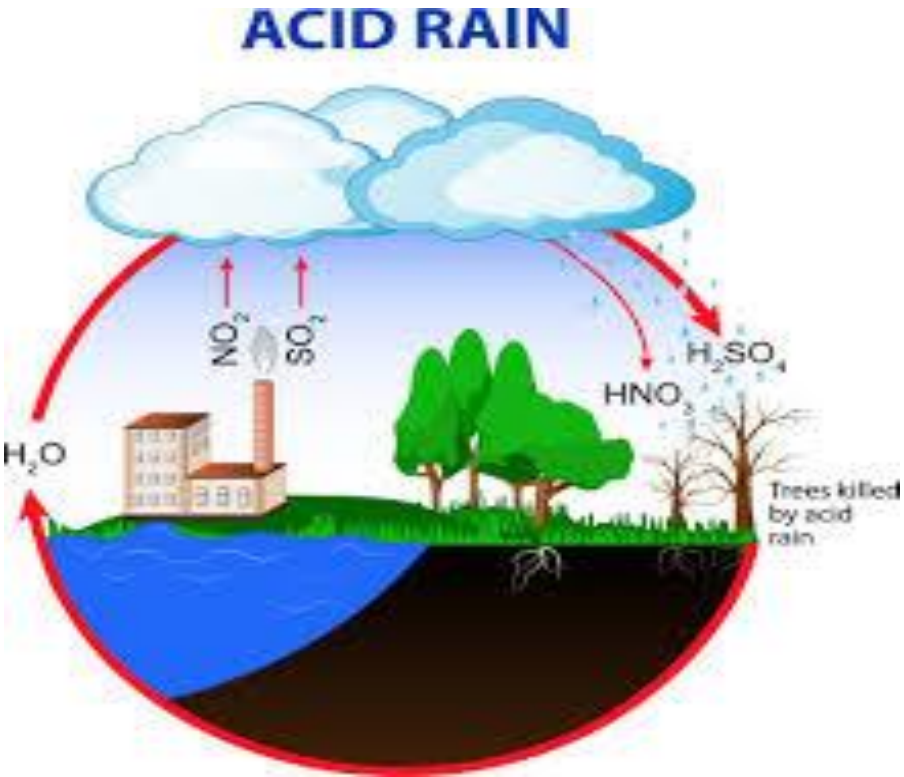
Dry Deposition

The amount of acidity in the atmosphere that deposits to earth through dry deposition depends on the amount of rainfall an area receives. For example, in desert areas the ratio of dry to wet deposition is higher than an area that receives several inches of rain each year.

How to Prevent Acid Rain Pollution

The planet that we inherited from our parents is not the same planet that we'll be giving to our children. Through the excessive burning of our nonrenewable fossil fuels in power plants, factories and cars, we have created acid rain pollution, i.e. today's precipitation has high levels of nitric and sulfuric acids. This has devastating effects on our oceans, lakes and rivers and all the animals that inhabit them.

Energy conservation
Transportation
Alternative fuels



exploitation of natural resources

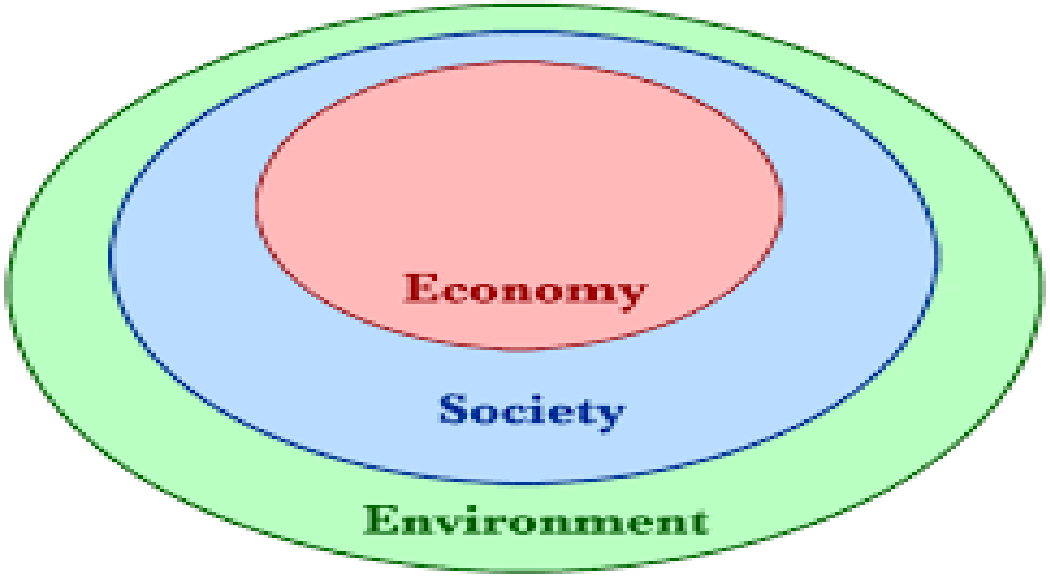
The **exploitation of natural resources** is the use of natural resources for economic growth

What are sustainable resources?

A **resource** is anything that is useful to people. Natural resources can be divided into **renewable** and **non-renewable** resources.

A **renewable resource** can be used again and again, so is more sustainable, eg water, wind, wood, sun and wave energy.

A **non-renewable resource** will eventually run out, so it is not sustainable in the long run, eg fossil fuels such as gas, oil and coal. There is only a **finite** supply of non-renewable resources.



Natural resources are not limitless, and the following consequences can arise from the careless and excessive consumption of these resources:

Deforestation
Desertification
Extinction of species
Forced migration
Soil erosion
Oil depletion
Ozone depletion
Greenhouse gas increase
Extreme energy
Water gasefication
Natural hazard/Natural disaster
Metals and minerals depletion

As we transition from fossil fuel reliance to a new energy future, innovative microbial biotechnologies may offer new routes to maximize recovery from conventional and unconventional energy assets; as well as contributing to reduced emission pathways and new technologies for carbon capture and utilization.