Theme: Interrelationships

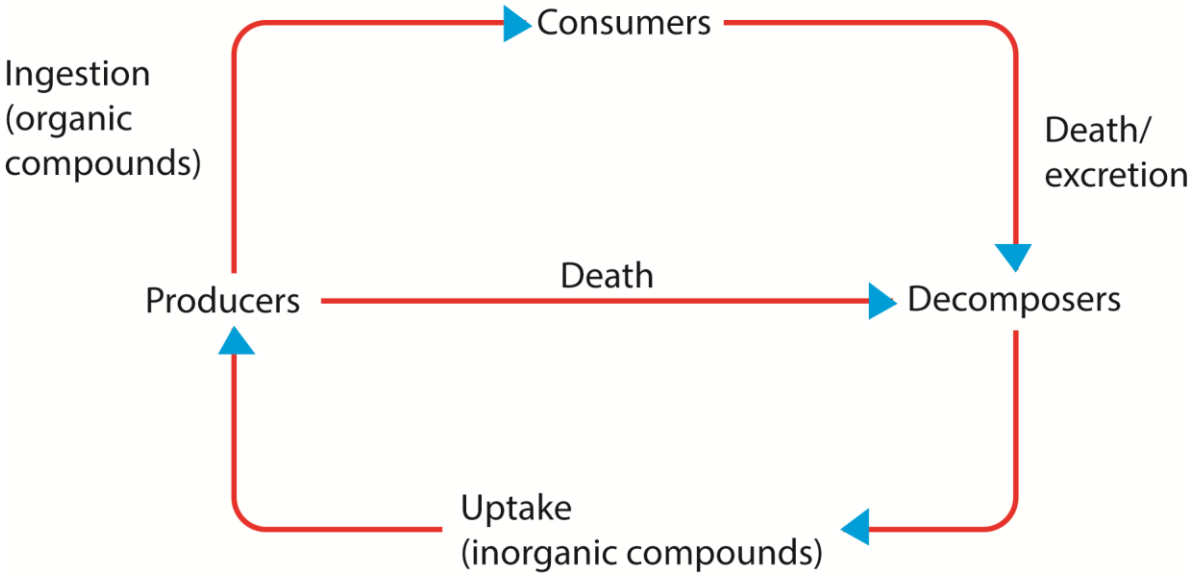
S4 New Curriculum Biology-Chapter 7– Food chains and food webs

Cycling of matter

In almost all ecosystem, the organisms fall into three nutritional groups.

- producers
- Consumers
- Decomposers

These are related as follows;



Organic material synthesized by the **producers** are eaten and assimilated by the **consumers**, All the organic materials incorporated into the bodies of the **Producers and consumers** are eventually broken down into inorganic materials. These are then rebuilt into organic compound by the synthesis activity of the producers.

Energy flow in an ecosystem

Unlike nutrient recycling in ecosystem energy flows in one direction from the sun, to the produces, to consumers and finally lost as heat to the environment.

Food Chain
A food chain is a sequence of organisms with arrows pointing from organisms being eaten to organism that eats it.

Example of food chain

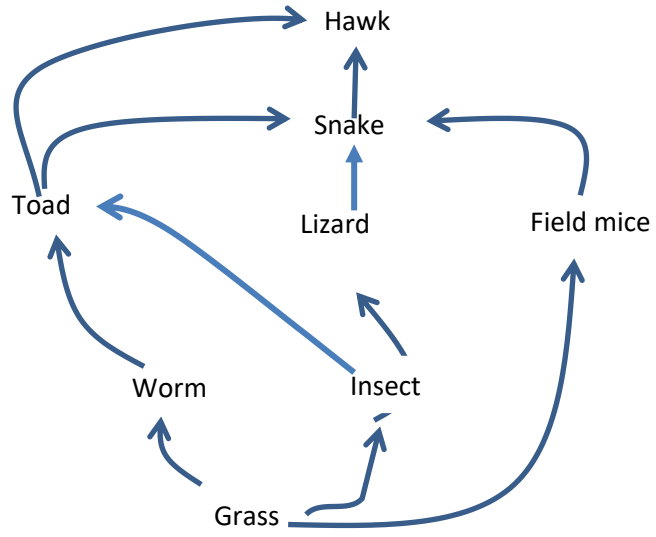
Grass → Grasshopper → Chicken → Man

Each stage of the food chain is known as a **trophic level**, the first trophic level being occupied by **the autotrophic organisms**, the primary producers. The organism of the second trophic level are called **primary consumer**, those of the third level are **secondary consumer** and so on.

Trial 1: Construct three more food chains around your school

Food webs
Is feeding relationship showing organisms feeding on more than one organisms.

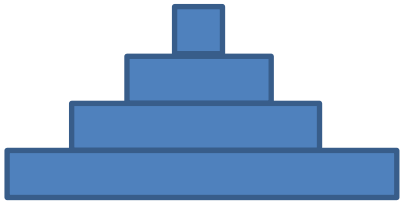
Example of a food web



Trial 2: Construct a food wed in a freshwater ecosystem.

Ecological pyramids
Ecological pyramids are diagrammatic representation of feeding relationships at different trophic levels in a community.

Pyramid of number
These are pyramid drawn base on the number of organism in each tropical level it's based on ideology that preys are usually smaller and more numerous than their predators.



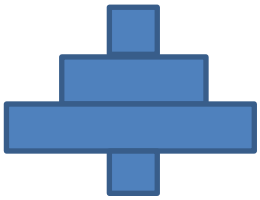
Tertiary consumer

Secondary Consumer

Primary consumer

However, pyramid of numbers, despite their name, need not always be pyramidal in shape. Consider the situation where a single very large producer, such as tree, supports a large number of primary consumers. In this case an inverted pyramid of numbers result. Inverted pyramids of numbers can also result when a community contain parasites. Imagine for instance, a mammal infected with tick or fleas. These parasites are in a trophic level above the mammal, yet their numbers will be greater. Some of inverted pyramids of numbers are shown below.

A



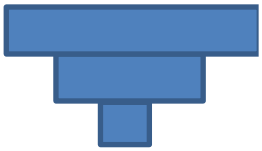
Tertiary consumer

Secondary Consumer

Primary consumer

The producer is a single plant feed on by caterpillars feed on by birds feed on by kites

B



Secondary Consumer

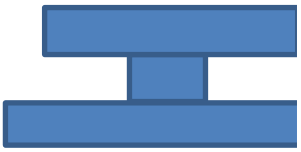
Primary consumer

Producers

The producer is single plant which is infected with Parasites (primary consumer) and the latter are Parasitized by further parasite (hyper parasites)

e.g. fruit tree → monkey → worms

C



Secondary Consumer

Primary consumer

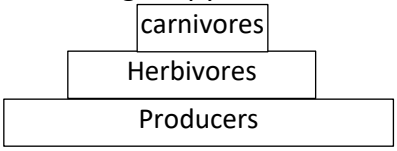
Producers

A large number of producers are eaten by single primary consumer which is infected with parasite (secondary consumers)

(Grass → cow → worms]

Pyramid of biomass

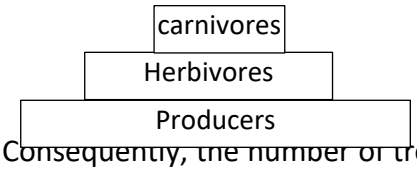
This a type of ecological pyramid base not on numbers but biomass.



Pyramid of energy

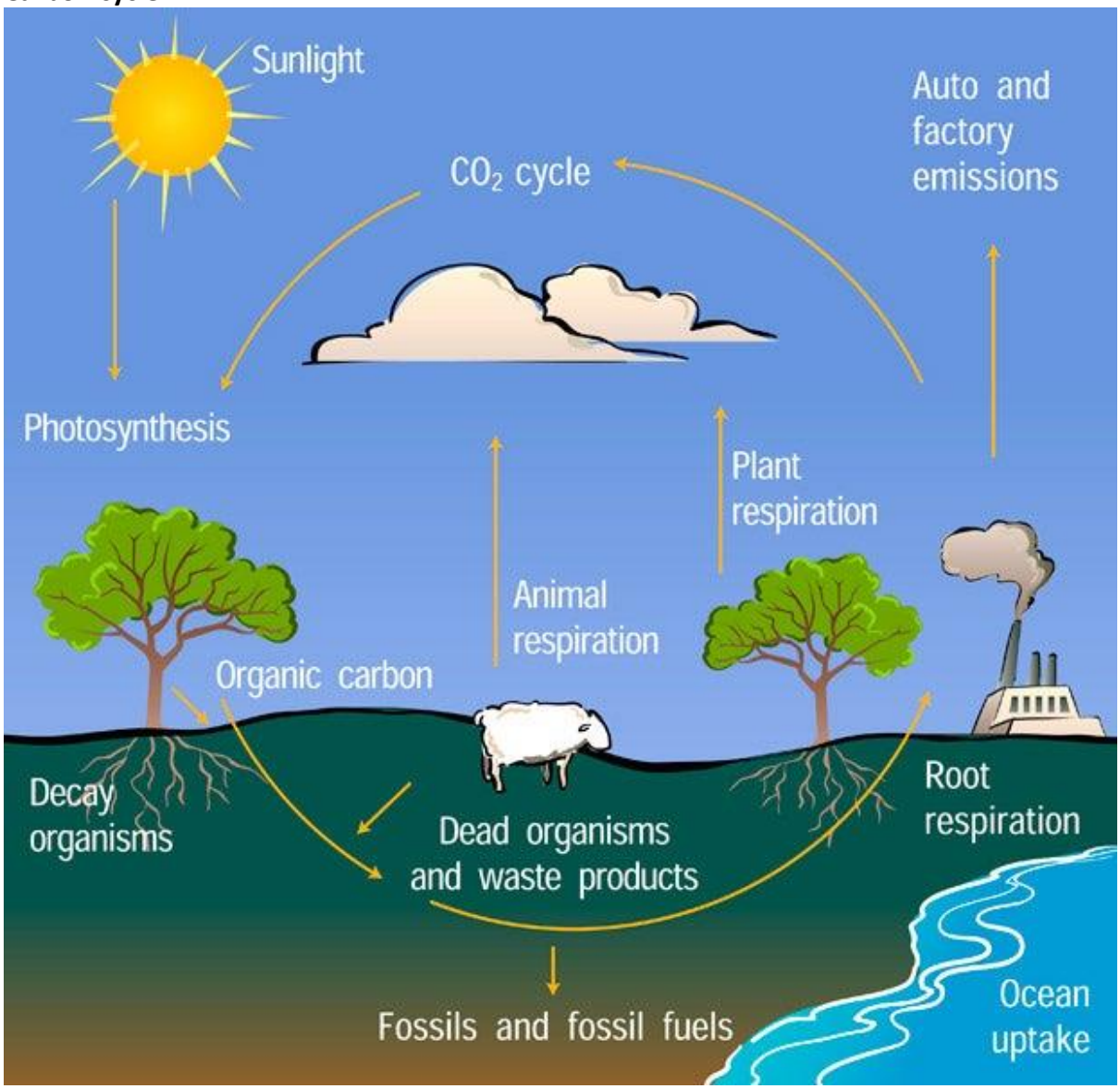
A pyramid of energy shows the transfer or flow of energy through a community. As a result, pyramids energy are expressed in units of energy per area per time e.g., kilojoules $m^{-2}yr^{-1}$. A generalized pyramid of energy is shown below.

Pyramid of energy



Consequently, the number of trophic levels in a food chain or the length of the food chain is limited by the energy wasted as it is transferred from organism, i.e. by the efficiency of energy transfer between trophic levels

Carbon cycle



Processes that remove carbon dioxide from air

Photosynthesis – Plants, algae, and cyanobacteria absorb CO_2 from the air and convert it into oxygen and glucose, storing carbon in their biomass.

Ocean Absorption – Oceans absorb vast amounts of CO_2, dissolving it into seawater and forming carbonic acid, which can later be used by marine organisms.

Formation of Carbonate Rocks – Over time, CO_2 dissolved in water reacts with minerals to form carbonate rocks like limestone, effectively locking away carbon.

Soil Carbon Sequestration – Healthy soils, particularly those rich in organic matter, store CO_2 through plant roots and microbial activity.

Weathering of Rocks – Certain minerals react with atmospheric CO_2 in a process called chemical weathering, reducing CO_2 levels over long geological timescales.

Reforestation & Afforestation – Planting trees and restoring forests increases the rate of CO_2 absorption, contributing to climate stability.

Processes that release carbon dioxide in air

Respiration – Living organisms, including plants, animals, and humans, release CO_2 as they break down food for energy.

Decomposition – When organic matter (such as dead plants and animals) decays, microbes break it down and release CO_2.

Volcanic Activity – Eruptions and geothermal processes release CO_2 stored within the Earth's crust.

Combustion of Fossil Fuels – Burning coal, oil, and natural gas for energy production, transportation, and industry releases massive amounts of CO_2.

Deforestation – Cutting down trees reduces CO_2 absorption by plants, and burning or decomposing wood releases stored carbon.

Ocean Release – Oceans naturally exchange CO_2 with the atmosphere. When water temperatures rise, oceans can release stored CO_2.

Agricultural Practices – Livestock, soil management, and fertilizer use contribute to CO_2 emissions, alongside methane production.

Effects of high carbon dioxide concentration in air

High concentrations of carbon dioxide (CO_2) in the atmosphere have significant environmental and health impacts. Here are some key effects:

- **Climate Change & Global Warming** – CO_2 is a major greenhouse gas that traps heat, leading to rising global temperatures, melting ice caps, and extreme weather events.
- **Ocean Acidification** – Excess CO_2 dissolves in seawater, forming carbonic acid, which lowers ocean pH. This threatens marine life, especially coral reefs and shellfish.
- **Disruption of Ecosystems** – Changes in temperature and precipitation patterns affect plant and animal species, leading to habitat loss and biodiversity decline.
- **Human Health Risks** – Increased CO_2 can contribute to air pollution and respiratory issues. In confined spaces, high CO_2 levels can lead to fatigue, dizziness, and difficulty breathing.
- **Agricultural Impacts** – Changes in climate patterns affect crop yields, water availability, and soil fertility, making food production more challenging.
- **Extreme Weather Events** – Higher CO_2 levels contribute to more frequent and intense hurricanes, floods, droughts, and wildfires.

Thanks

Dr. Bbosa Science