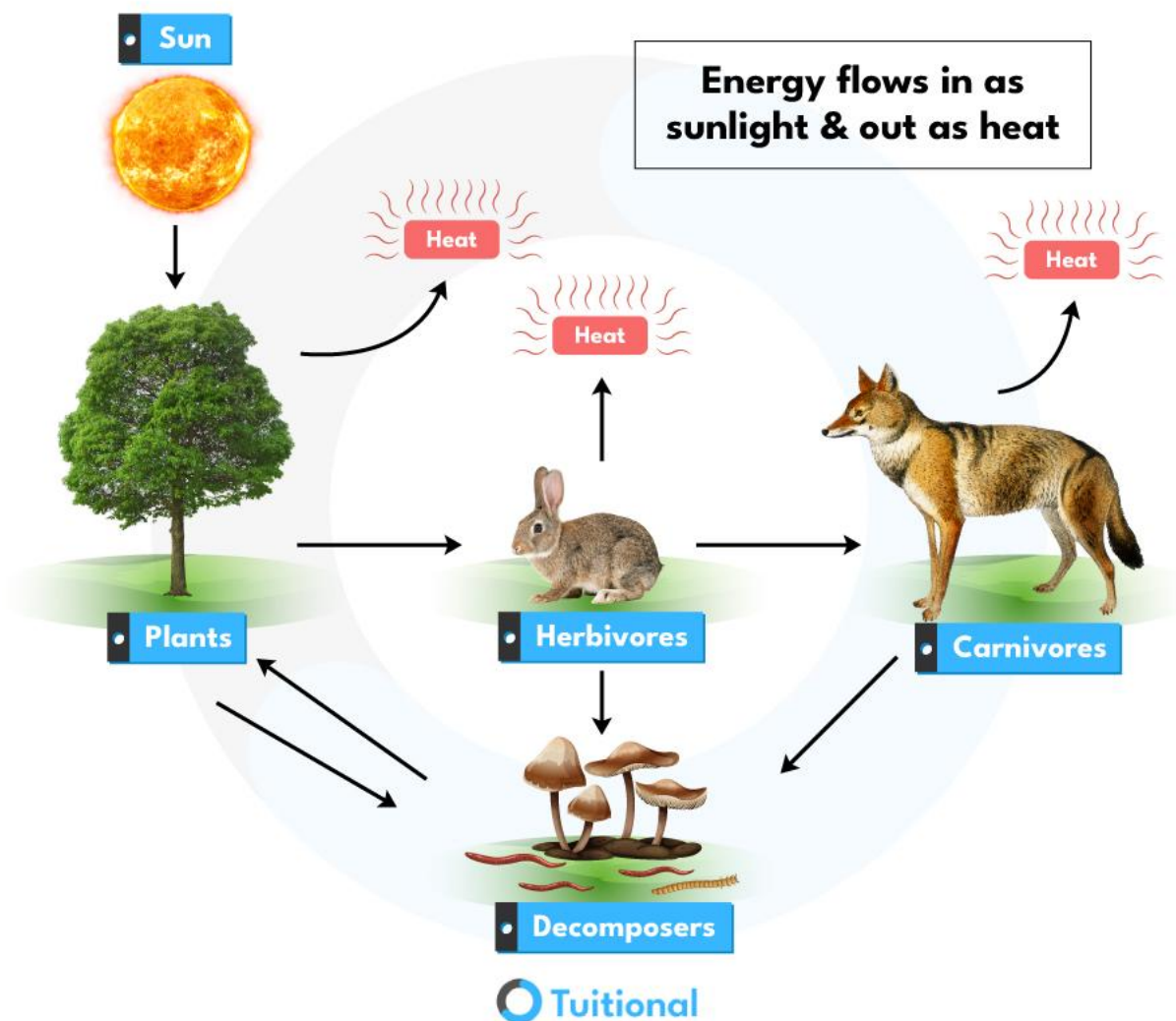
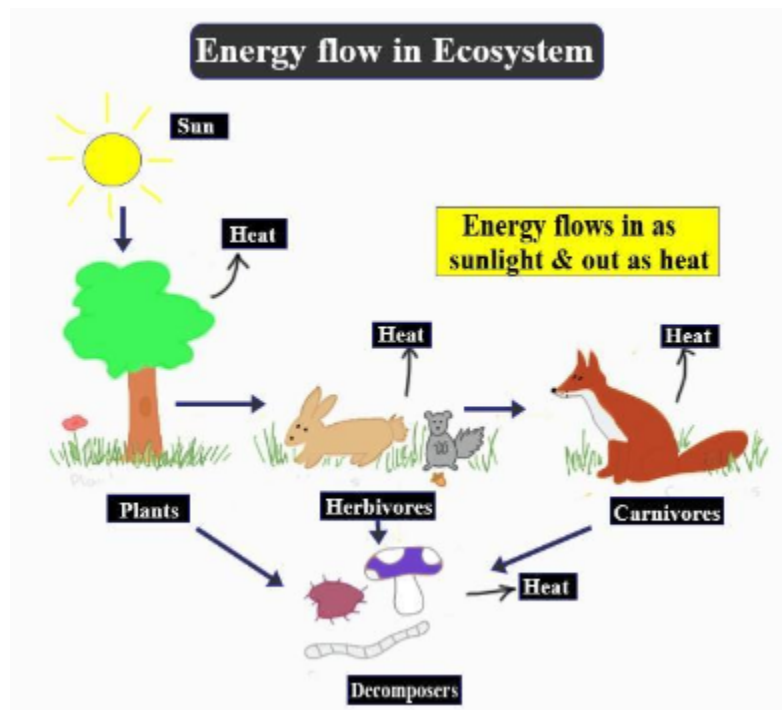


Energy flow

The Sun is the primary source of energy for life on Earth. Photosynthetic organisms, like plants and algae, convert sunlight into chemical energy stored in compounds such as glucose.

This energy flows through ecosystems as organisms eat and are eaten, forming food chains. During metabolism, some energy is released as heat, eventually returning to the environment and completing the energy cycle. This continuous flow maintains balance in ecosystems, influencing species abundance and interactions, emphasizing the vital role of the Sun in sustaining life processes and interconnected ecosystems.





Food Chain and Food Webs

A food chain is like a natural lineup, showing who eats whom.

It starts with **producers**, usually plants, **making their own food**.

Then come **consumers** - **animals that eat either plants (herbivores), other animals (carnivores), or both (omnivores)**.

At the end of the chain are **decomposers** like bacteria and fungi, **breaking down leftovers and returning nutrients to the soil**.

This cycle keeps repeating, forming a connection where energy and nutrients flow through different levels, maintaining the balance of the ecosystem.

Producers

These are **organisms that can produce their own food** through photosynthesis or chemosynthesis. Typically, plants are the primary producers in terrestrial ecosystems, and certain bacteria are primary producers in some aquatic environments.

Consumers

Consumers are **organisms that obtain their energy by consuming other organisms**. They can be classified into different trophic levels:

- **Primary consumers (herbivores):**
These organisms feed directly on producers.
- **Secondary consumers (carnivores or omnivores):**
These organisms feed on primary consumers.
- **Tertiary consumers:**
They are carnivores that feed on secondary consumers.

Decomposers

These organisms **break down the remains of dead plants and animals**, as well as waste materials, into simpler substances. Decomposers, such as bacteria and fungi, play a crucial role in recycling nutrients back into the ecosystem.

A simple example of a food chain could be as follows:

Grass (Producer) -> Rabbit (Primary Consumer) -> Fox (Secondary Consumer) -> Decomposers

Trophic Level	Organism	Example	Description
Producers	Grass	Photosynthetic plants	Organisms that produce their own food through photosynthesis. They are the foundation of the food chain.
Primary Consumers	Rabbit	Herbivores	Animals that feed directly on plants or plant based material. They are the first consumers in the food chain.
Secondary Consumers	Fox	Carnivores/Omnivore	Carnivores primarily consume other animals, while omnivores consume both plant and animal material. They are secondary consumers.
Tertiary Consumers		Carnivores	Carnivores that feed on other carnivores. They are tertiary consumers in the food chain.
Decomposers	Bacteria, Fungi	Break down dead organisms and waste	Organisms that decompose dead plant and animal matter, playing a crucial role in recycling nutrients in the ecosystem.

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Decomposers	Bacteria, Fungi	Break down dead organisms and waste	Organisms that decompose dead plant and animal matter, playing a crucial role in recycling nutrients in the ecosystem.

Herbivores

Herbivores are animals that primarily **consume plants or plant-based material**.

They have specialized digestive systems adapted for breaking down plant cellulose.

Herbivores play a key role in controlling plant populations and are often prey for carnivores.

Examples include

- Rabbits
- Deer
- Cows
- Elephants.

Carnivores

Carnivores are animals that primarily **consume other animals**.

They have specialized adaptations such as sharp teeth and claws for hunting and tearing meat.

Carnivores are often categorized as either obligate carnivores (strictly meat-eaters) or facultative carnivores (can consume both plant and animal material).

Examples include

- Lions
- Wolves
- Hawks.

Food Chains



Food Web

A food web is like a vast, intricate web of connections between different living things in an ecosystem. It's more complex than a simple food chain, which just shows one path of energy from one organism to the next. Instead, **a food web illustrates the many ways different species interact and depend on each other for food**.

Picture it as a community of organisms where each one is part of multiple food chains. Animals in this web eat and are eaten by others, forming a network of relationships. Unlike a linear chain, it's like a dynamic map showing the diverse feeding connections between various organisms.

This complexity is crucial because in nature, animals usually don't rely on just one type of food. They interact with and consume multiple species. The food web, therefore, reflects the reality of ecosystems where different animals have diverse diets, contributing to a rich tapestry of interactions.

The web also plays a role in maintaining balance. **It helps regulate the populations of different groups of organisms by allowing them to feed on various types of prey.** This, in turn, influences the flow of energy and nutrients through different levels of the ecosystem.

Analogy:

Imagine a food web as a big dinner party for plants and animals. It's like a friendship circle where everyone is connected because they eat each other. Unlike a simple food chain, where it's just one friend passing a snack, a food web shows that everyone has more than one favorite food. If something happens to one friend, like fewer earthworms, it affects everyone else in the circle. Humans, sometimes unintentionally, can mix things up at the party by taking too much food or bringing in new snacks. We need to be careful, so our animal and plant friends can keep enjoying their dinner parties!

Food chain vs Food Web

A food chain and a food web both depict the flow of energy in an ecosystem, but they differ in their complexity and representation of feeding relationships.

Food Chain

A food chain is a linear representation of the flow of energy, showing a single pathway from one organism to the next.

It focuses on a direct sequence of who eats whom, typically consisting of producers, primary consumers, secondary consumers, and so on.

Food chains are simpler and easier to understand, making them useful for illustrating basic energy transfer.

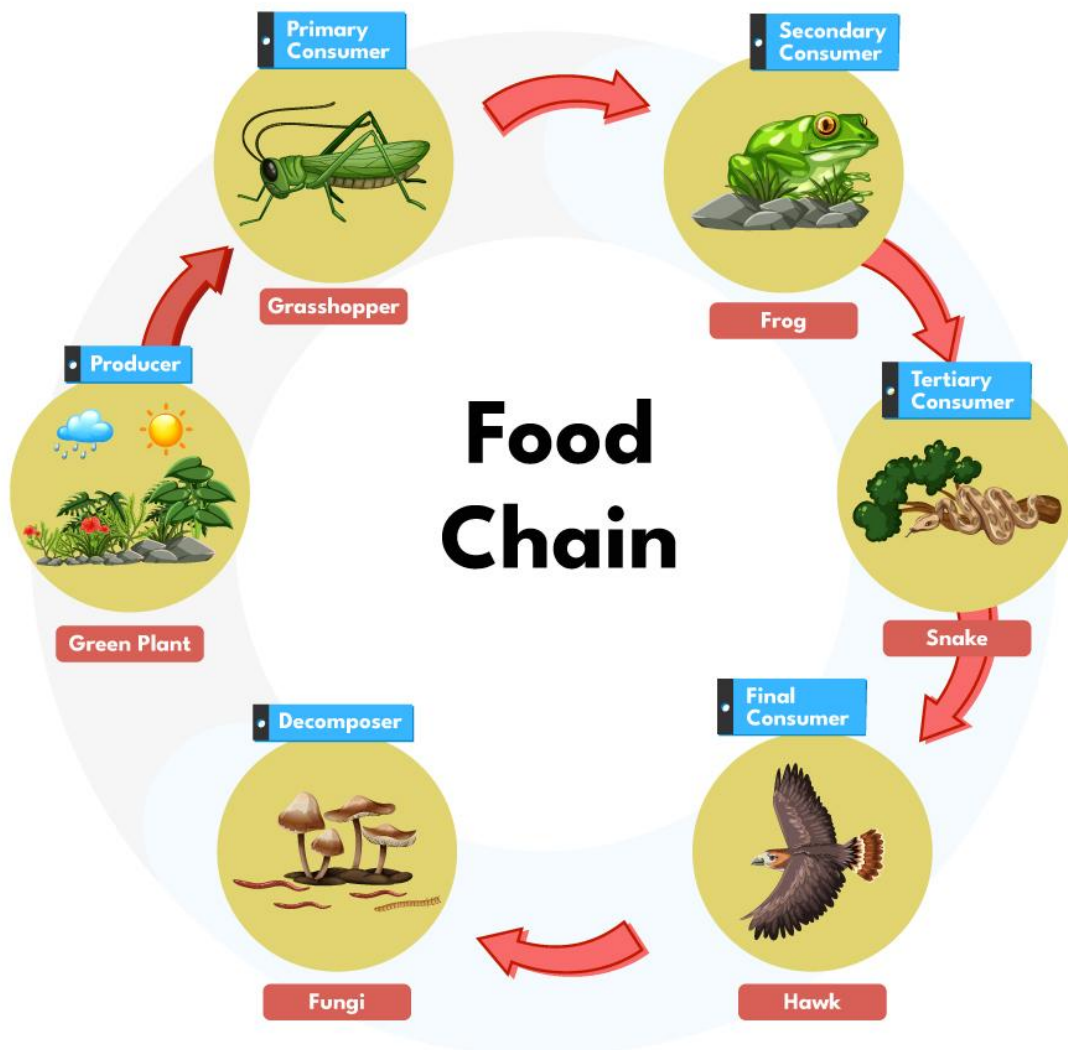
Food Web

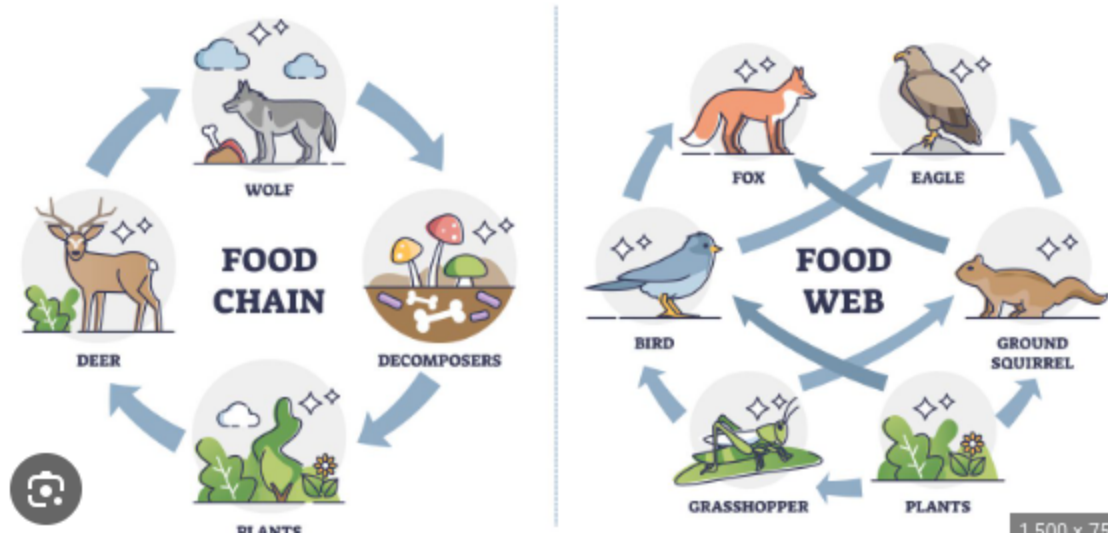
A food web is a more complex and interconnected representation of feeding relationships within an ecosystem.

It consists of **multiple food chains**, illustrating the various ways different species interact and depend on each other for food.

Food webs provide a more realistic view of ecosystems by acknowledging that animals often interact with and consume multiple types of prey.

Animals in a food web have diverse diets, contributing to a rich tapestry of interactions that go beyond a single, linear path.





Food Pyramid

Pyramids of number and biomass are graphical representations used in ecology to depict the relative abundance or productivity of different trophic levels within an ecosystem. They provide insights into the structure and energy flow within a food chain or food web.

Pyramid of Number

A pyramid of numbers **illustrates the number of individual organisms at each trophic level** in a given ecosystem.

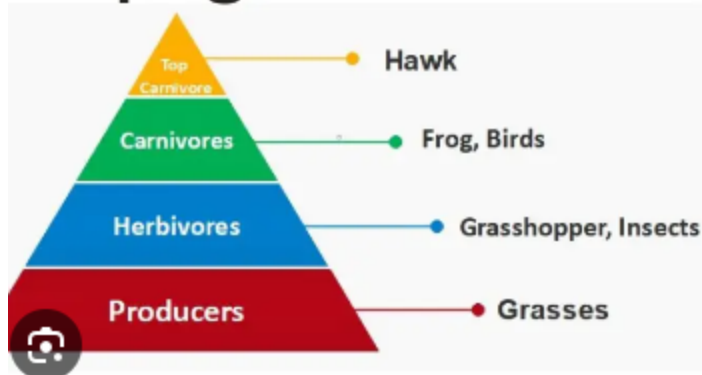
It typically takes the shape of a pyramid, with the base representing the primary producers (usually plants), and each higher level depicting the number of organisms at successive trophic levels.

Example: In a simple grassland ecosystem, the pyramid may have a broad base representing a large number of grass (producers), followed by a smaller layer of herbivores (primary consumers), and an even smaller layer of carnivores (secondary consumers).

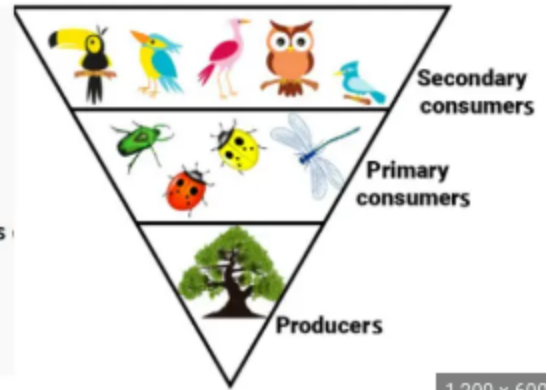
The shape of the pyramid may vary depending on the ecosystem. **Inverted or irregular pyramids can occur when the number of individuals at a lower trophic level is less than the number at a higher trophic level.** This can happen, for example, in the case of a parasitic relationship where a single parasite may have many hosts.

Pyramid of numbers

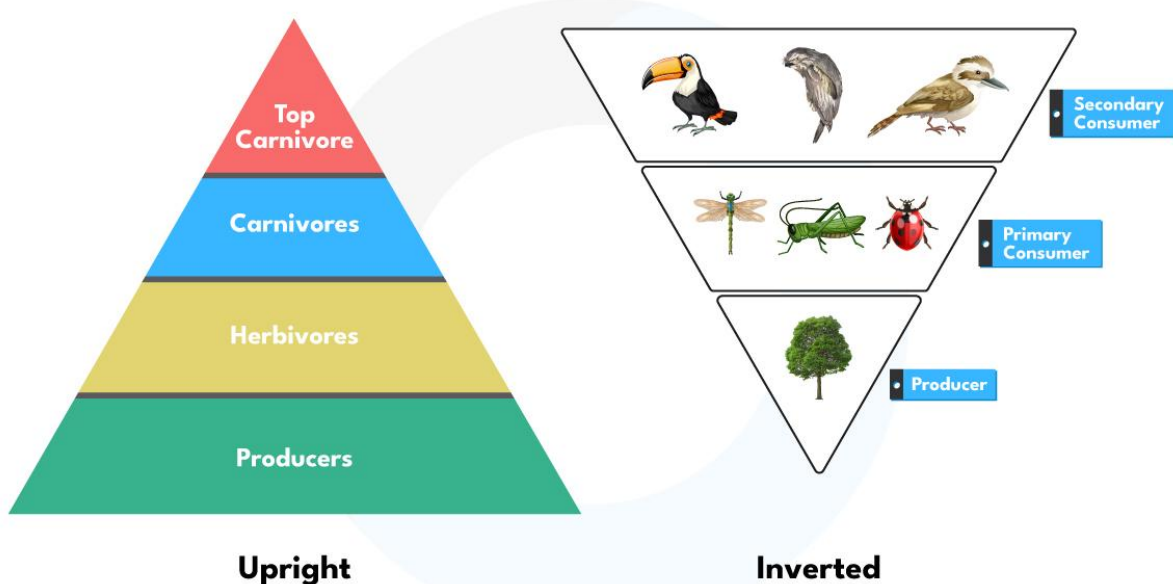
Upright



Inverted



Pyramid of Numbers



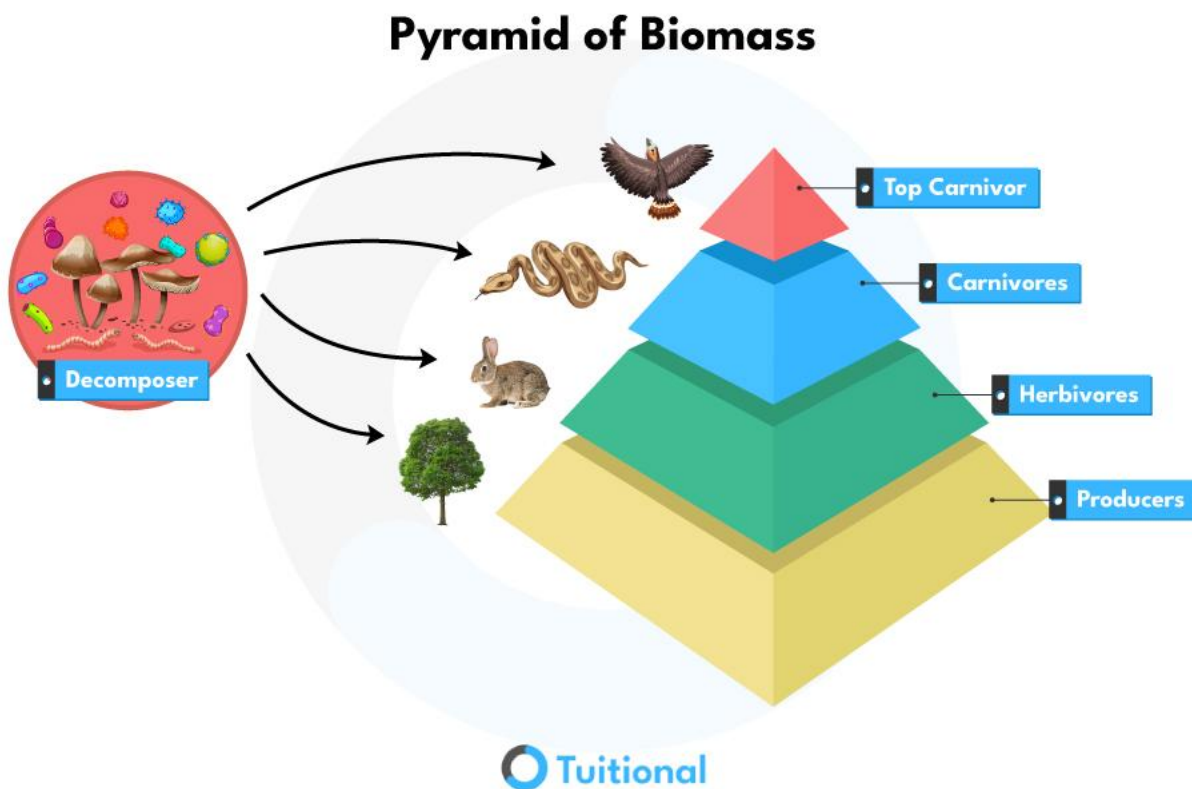
Pyramid of Biomass

A pyramid of biomass represents the **total mass of living organic matter at each trophic level in an ecosystem**.

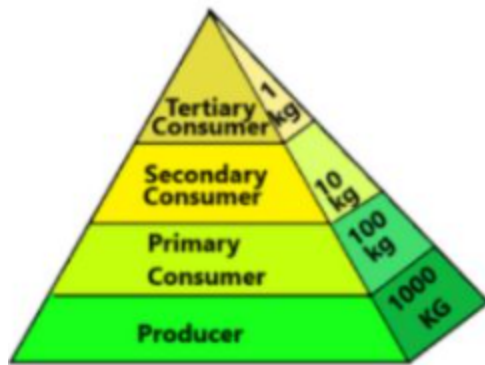
Similar to the pyramid of number, it often has a pyramid shape. The base represents the biomass of producers, and each successive level shows the biomass of consumers.

Example: In a forest ecosystem, the pyramid might have a broad base representing the mass of trees (producers), followed by a smaller layer of herbivores (primary consumers), and an even smaller layer of carnivores (secondary consumers).

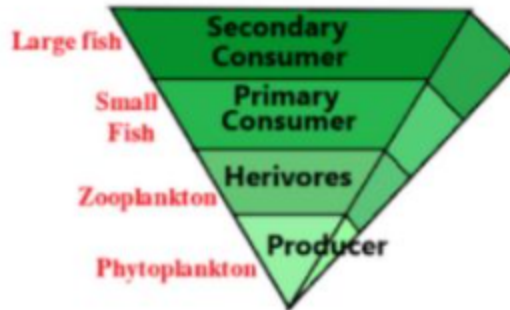
Biomass pyramids provide a more accurate representation of the energy available at each trophic level. It takes into account the fact that not all organisms are of the same size, and some may have more mass than others. In certain ecosystems, the biomass pyramid may be inverted, especially if the primary producers have a short lifespan and rapid turnover.



Pyramid of biomass



A. Upright pyramid



B. Inverted pyramid

Pyramid of Biomass	Pyramid of Numbers
Shows the total mass of living organisms	Gives the numbers of living organisms present
Biomass accounts for organism weight, giving size variation. More weight comes first in the energy level.	Numbers represent the contribution of larger organisms, irrespective of weight.
Biomass is measured in consistent units (e.g., grams or kilograms), making it easier to compare and standardize across different ecosystems.	Numbers may have varying units, such as individuals or groups, making direct comparisons more challenging.
Biomass indicates ecosystem productivity through the combined weight of living organisms.	Numbers may not accurately represent total biomass and productivity, as small organisms can play a significant role in energy flow.



Pyramid of Biomass	Pyramid of Numbers
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Biomass accounts for organism weight, giving size variation. More weight comes first in the energy level.	Numbers represent the contribution of larger organisms, irrespective of weight.
Enhances trophic efficiency representation by	Numbers alone don't depict energy transfer,

considering actual energy transfer between trophic levels.	complicating trophic efficiency assessment.
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Pyramid of energy

A Pyramid of Energy is like a chart that shows **how energy moves through different levels in nature**. Think of it as a tower where each floor represents a group of living things (like plants or animals), and the size of each floor shows how much energy they have.

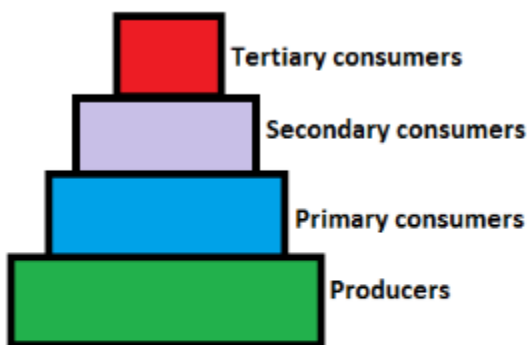
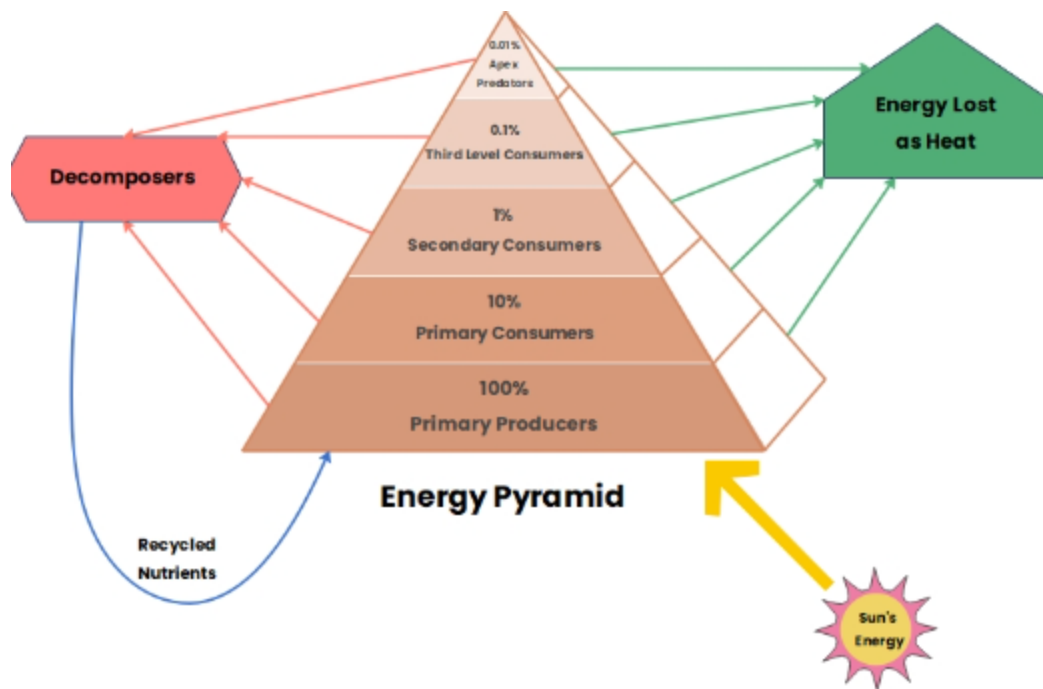
Base of the Pyramid: At the bottom are the plants (like grass or trees), which capture energy from the sun through a process called photosynthesis. This level is big because plants have a lot of energy.

Middle of the Pyramid: In the middle are the plant-eating animals (herbivores), like rabbits or cows. This level is smaller because some energy is used by the plants, and not all of it is passed to the animals.

Top of the Pyramid: At the top are the meat-eating animals (carnivores), like lions or hawks. This level is even smaller because more energy is used up as it moves up the chain from plants to plant-eaters to meat-eaters.

Arrows show how energy moves from one level to the next. The pyramid shape shows that there's less and less energy available as you go higher up.

Inverted Pyramids: Sometimes, especially in water ecosystems, the pyramid might look upside down, where the top level is bigger than the bottom. This happens when small things in the water multiply quickly, even though they don't have a lot of energy individually.



Pyramid of energy

Pyramid of Energy

Advantages	Pyramid of Energy	Pyramid of Biomass/Numbers
Reflects Energy Transfer	Directly represents energy flow	May not explicitly show energy flow
Accounts for Losses	Includes energy losses at each level	Losses are not explicitly considered.
Standardizes Units	Energy is measured in consistent units	Numbers or biomass may have varying units
Highlights Trophic Efficiency	Emphasizes the efficiency of energy transfer	May not provide insights into efficiency
Size Variability	Focuses solely on energy content.	May be influenced by varying organism sizes



Advantages	Pyramid of Energy	Pyramid of Biomass/Numbers
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Size Variability	Focuses solely on energy content.	May be influenced by varying organism sizes.

Nutrient Cycle

A nutrient cycle is the continuous journey of essential elements as they move through living organisms, cells, communities, and ecosystems, undergoing processes of recycling and reuse.

This cyclical pathway ensures the efficient utilization of nutrients within the biological and environmental components of an ecosystem.

Examples of a nutrient cycle:

- Carbon cycle
- Nitrogen cycle

The Carbon Cycle

The carbon cycle is a vital biogeochemical process that **describes the movement of carbon** through various reservoirs on Earth, including the atmosphere, oceans, land, and living organisms. It involves several key processes, each playing a crucial role in maintaining a balance of carbon.

Photosynthesis

Plants, algae, and some bacteria perform photosynthesis, **a process where they use sunlight, carbon dioxide, and water to produce glucose (a sugar) and oxygen**. This process takes place primarily in the chloroplasts of plant cells.

Relevance to Carbon Cycle: Photosynthesis removes carbon dioxide from the atmosphere and converts it into organic carbon compounds, such as carbohydrates.

Respiration

All living organisms, including plants, animals, and microorganisms, engage in respiration. During respiration, **organic carbon compounds are broken down to release energy, and carbon dioxide is produced as a byproduct**.

Respiration releases carbon dioxide back into the atmosphere, completing the cycle by returning carbon to the air.

Feeding

Animals acquire carbon by consuming plants or other animals, absorbing organic carbon compounds from their food. Through digestion and metabolic processes, these animals integrate the acquired carbon into their own biomass. This process is essential for the transfer of carbon through various trophic levels in ecosystems. Essentially, feeding forms a critical link in the intricate web of relationships between different species, enabling the flow of carbon from primary producers to consumers and up the food chain. This dynamic interaction not only

sustains individual organisms but also influences the overall carbon balance within ecosystems, highlighting the interconnectedness of life in these natural systems.

Decomposition

Decomposition is a natural process in which bacteria, fungi, and other decomposers break down organic matter, including deceased plants and animals. As these organisms decompose, carbon is released back into the soil and atmosphere, often in the form of carbon dioxide or methane. This recycling of carbon through decomposition plays a vital role in ecosystems by making the carbon from dead organic matter available for reuse by living organisms. Essentially, decomposition ensures that the carbon, initially captured by plants during their growth, returns to the environment, becoming accessible for new life and contributing to the overall balance of carbon in the biosphere.

Formation of Fossil Fuels

Over millions of years, the remains of plants and animals undergo geological processes deep within the Earth, resulting in the formation of fossil fuels like coal, oil, and natural gas. These fuels store carbon that was once part of living organisms, effectively sequestering it from the natural carbon cycle for extended periods. The transformation occurs through pressure, heat, and chemical changes, converting organic matter into energy-rich fossil fuels. When these fuels are used for energy, the stored carbon is released back into the atmosphere as carbon dioxide, impacting the Earth's carbon balance and contributing to environmental concerns such as climate change.

Combustion

Combustion, or burning, is a process where fossil fuels are used for energy, releasing carbon dioxide into the atmosphere. It also occurs during natural events like wildfires.

Combustion reintroduces stored carbon from fossil fuels into the atmosphere, contributing to the overall carbon cycle and influencing the Earth's carbon balance.

The carbon cycle involves the continuous exchange of carbon between living organisms, the atmosphere, and the Earth's crust through processes like photosynthesis, respiration, feeding, decomposition, formation of fossil fuels, and combustion. These processes collectively maintain a dynamic equilibrium of carbon in the biosphere.

Sources of Carbon

Living Organisms:

- Release carbon dioxide through cellular respiration.
- Photosynthesis removes carbon dioxide from the atmosphere, converting it into organic compounds.

Decomposition and Burning:

- Decomposition of dead organisms and burning organic materials release carbon dioxide into the atmosphere.

Geological Processes:

- Carbon cycles slowly through geological processes like sedimentation.
- Carbon can be stored in sedimentary rock for millions of years.

Volcanic Activity:

- Volcanic eruptions release carbon dioxide stored in the Earth's mantle.

Human Activities:

- Burning fossil fuels significantly increases atmospheric carbon dioxide levels.
- Land clearance, including deforestation, reduces the number of plants that absorb carbon dioxide through photosynthesis.
- Land clearing often involves burning, releasing stored carbon dioxide.

Industrial Processes:

- The production of cement releases carbon dioxide when limestone is heated.

Ocean Dynamics:

- Ocean water releases dissolved carbon dioxide into the atmosphere as water temperature rises.
- Carbon dioxide is removed when ocean water cools and absorbs more from the air.

Climate Change Impact:

- Human-induced activities have led to higher carbon dioxide levels in the atmosphere.
- Increased carbon dioxide contributes to global warming and climate change.

Analogy:

Chef Plants (Photosynthesis):

Plants are like chefs in the kitchen. They use sunlight to cook up delicious meals (food) and produce fresh air (oxygen).

Kitchen Workers (Respiration):

All living things, including plants, are like kitchen workers. They munch on the meals, releasing some smells (carbon dioxide) while getting energy.

Food Delivery (Feeding):

Animals are like delivery folks. They bring the food to different tables, passing the tasty carbon around.

Composting Crew (Decomposition):

When meals are done, a composting crew breaks down the leftovers, releasing aromas (carbon) back into the kitchen.

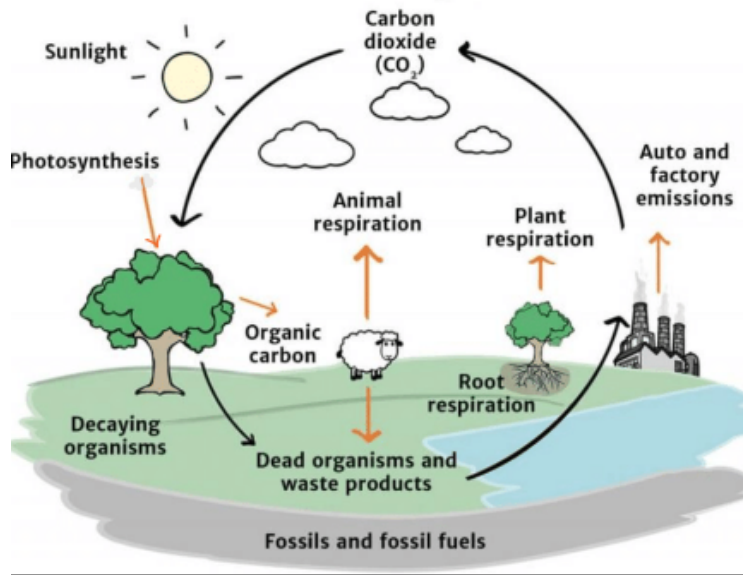
Time Capsule (Fossil Fuels):

Some meals get packed away in a time capsule (fossil fuels), saving them for a later date.

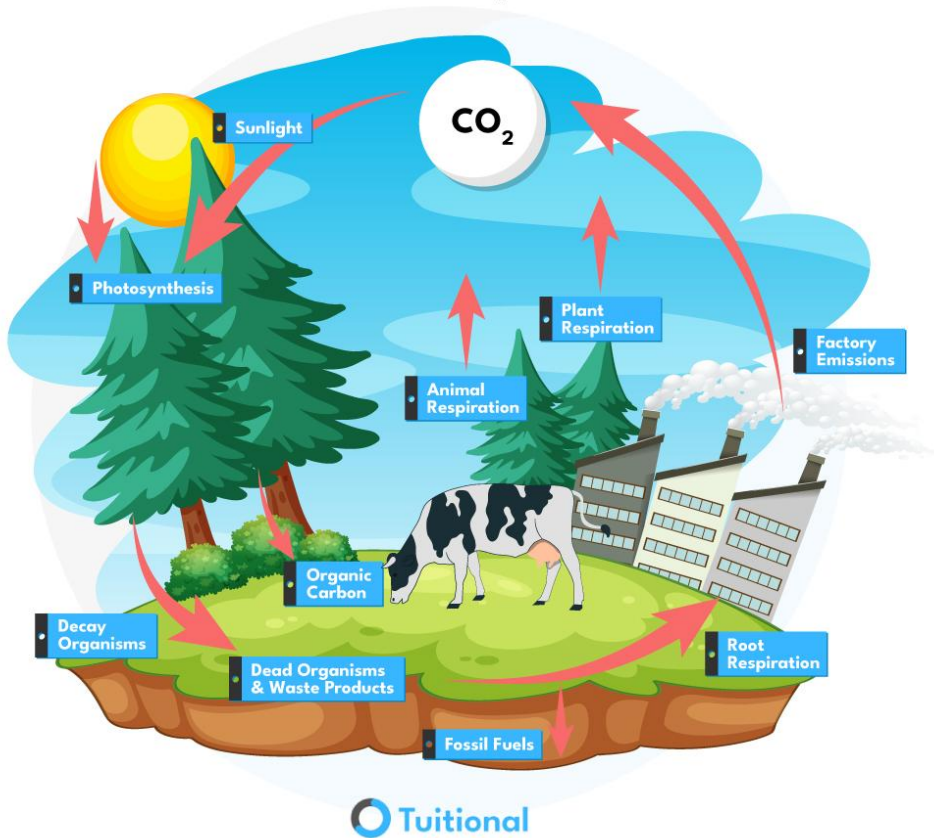
Bonfire (Combustion):

Sometimes, we have a big bonfire (burning fossil fuels or wildfires). It releases the saved smells (carbon) back into the air.

Carbon Cycle



Carbon Cycle



The Nitrogen Cycle

The nitrogen cycle is a natural process where nitrogen transforms between the air, soil, and living organisms. Nitrogen fixation converts atmospheric nitrogen into a usable form for plants, which are then consumed by animals. Decomposition and denitrification return nitrogen to the atmosphere, completing the cycle.

Nitrogen Fixation

The atmospheric nitrogen gas (N_2) is relatively inert and cannot be directly utilized by most organisms. Nitrogen fixation is the process by which atmospheric nitrogen is converted into ammonia (NH_3) or related compounds.

There are two primary mechanisms of nitrogen fixation:

- **Biological Nitrogen Fixation:**

Certain bacteria, such as *Rhizobium* and *Azotobacter*, can convert atmospheric nitrogen into ammonia in the soil. Some of these bacteria form symbiotic relationships with plants (e.g., legumes), providing them with a source of usable nitrogen in exchange for carbohydrates.

- **Industrial Nitrogen Fixation:**

Human activities, such as the Haber-Bosch process, have been developed to fix nitrogen on an industrial scale to produce synthetic fertilisers.

- **Ammonification:**

Ammonification is the process by which organic nitrogen compounds (e.g., proteins and nucleic acids) from dead organisms, animal waste, or decaying plant material are broken down by decomposer bacteria and fungi into ammonia.

Nitrification

Nitrification involves the conversion of ammonia (NH_3) into nitrite (NO_2^-) and then into nitrate (NO_3^-) by specific groups of bacteria.

The two-step process of nitrification is carried out by different bacteria: ammonia-oxidizing bacteria and nitrite-oxidizing bacteria

Assimilation

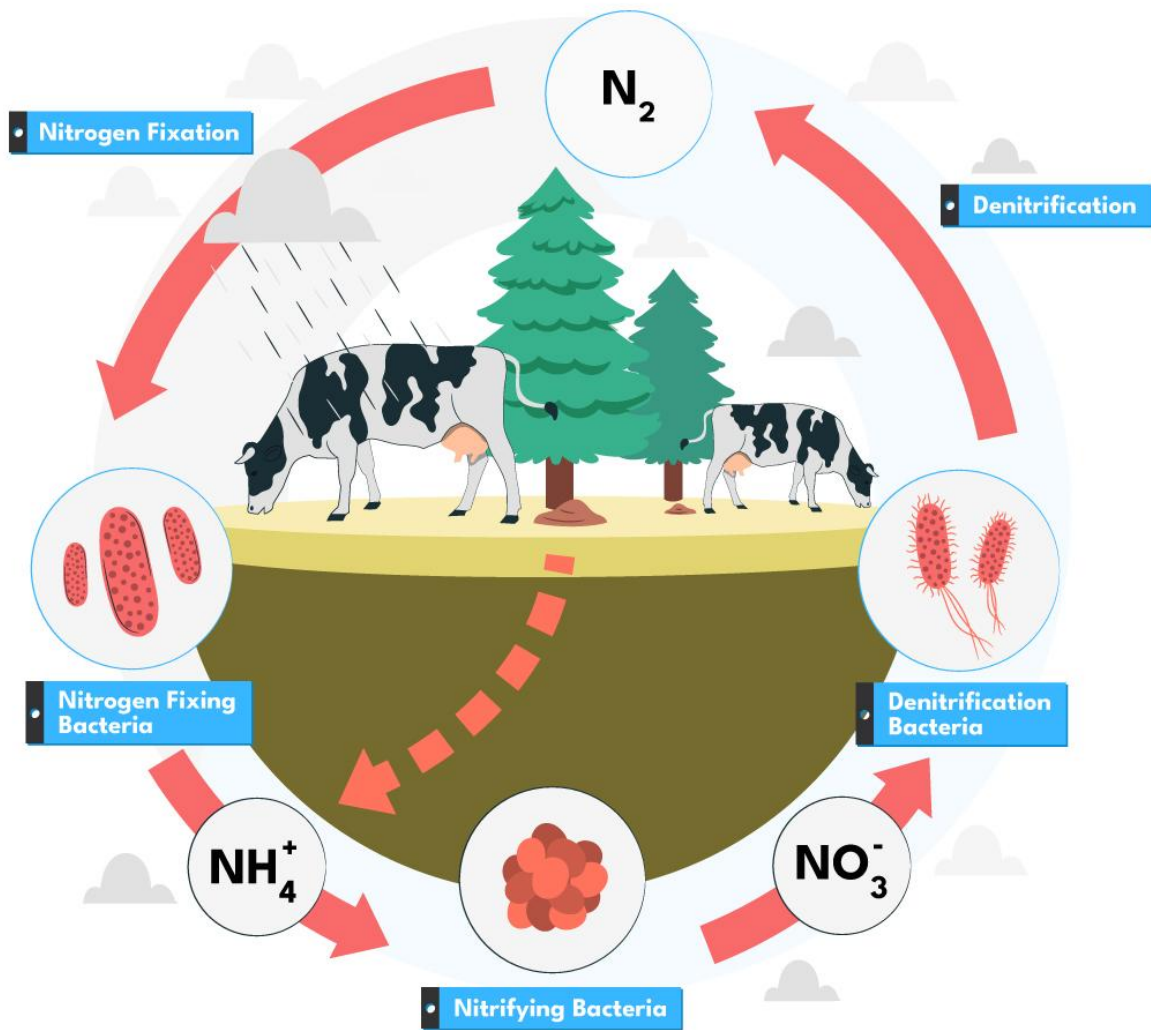
Assimilation is the incorporation of nitrate or ammonium ions into organic molecules, such as amino acids and proteins, by plants and other organisms. These organic compounds become part of the food web.

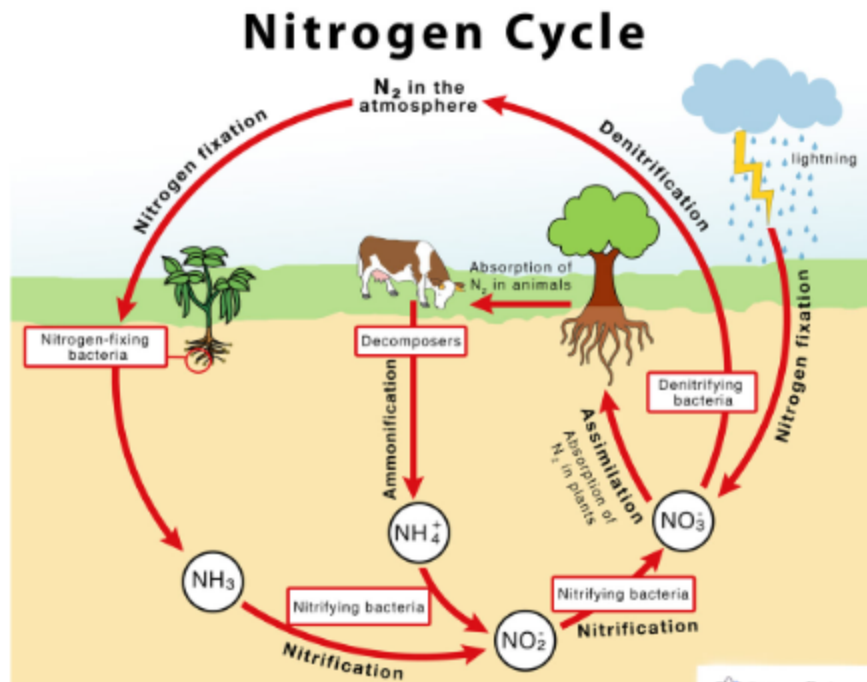
Denitrification

Denitrification is the final step of the nitrogen cycle, where certain bacteria convert nitrate (NO_3^-) back into nitrogen gas (N_2), completing the cycle and returning nitrogen to the atmosphere.

Denitrification occurs under anaerobic (low-oxygen) conditions and helps regulate the availability of nitrogen in ecosystems.

Nitrogen Cycle





Imagine the Nitrogen Cycle as an exhilarating cosmic quest in the sky. Nitrogen atoms, initially inert like floating adventurers, are captured by nitrogen-fixing bacteria, transforming into reusable jetpacks. These nitrogen jetpacks embark on a high-altitude journey, encountering Nitrosomonas and Nitrobacter, who upgrade them into supersonic jets. As these airborne particles explore, they interact with living organisms, leaving behind stardust. Decomposer microbes on the ground convert this stardust into magical energy capsules, fueling the next leg of the adventure. In a hidden realm, denitrifying creatures transform nitrogen compounds into invisible mist, acting as mysterious guardians. This captivating cycle continues, with each stage contributing to the grand narrative of an ever-evolving and enchanting nitrogen expedition in the cosmic atmosphere.

Population Size

Population size is influenced by various demographic factors, and understanding these dynamics is crucial for comprehending population growth or decline.

Birth Rate

The birth rate refers to the number of live births per 1,000 people in a population over a specified period. In this case, the population is experiencing a significant contribution to its growth due to a relatively high birth rate of 100 babies per year. The more births there are, the larger the annual increase in population.

Death Rate

The death rate is the number of deaths per 1,000 people in a population over a specified period. A lower death rate contributes positively to population growth. In this scenario, the death rate is 50 people per year, indicating that a smaller proportion of the population is dying, contributing to a net increase in population.

Net Population Growth

Net population growth is the result of subtracting the death rate from the birth rate. In this scenario, the net growth is 50 individuals per year (100 births - 50 deaths), meaning that 50 new individuals are added to the population annually.

Doubling Time

The doubling time is an estimate of how long it will take for a population to double in size. In this case, with a net growth of 50 individuals per year, the population is projected to double in 20 years.

Infant Mortality

The decline in infant mortality, the death rate for children less than 1 year old, is highlighted as a key factor in population growth. Reduced infant mortality means more babies survive to reach reproductive age, contributing to a sustained or increased birth rate.

Life Expectancy

Increasing life expectancy, the average number of years a person can expect to live, is another influential factor. If people are living longer, it means more individuals are contributing to the population for an extended period, further influencing population size.

Community

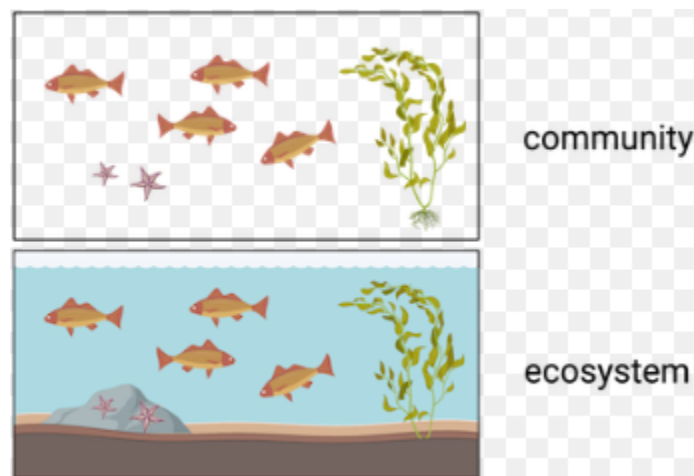
A community refers to a group of interacting organisms of different species, living in a particular habitat or environment. These organisms depend on each other for various reasons, such as food, shelter, protection, or other ecological interactions. In a broader sense, a community encompasses all living organisms within a specific area and the physical environment they inhabit. It involves both biotic (living) and abiotic (non-living) components and represents the intricate web of relationships and interactions among different species.

Think of a community like a big group of different living things (plants, animals, and other organisms) that all live together in the same neighborhood, like a forest or a pond. These neighbors rely on each other for things like food, protection, and a place to live. It's like a big team where everyone has a role, and they work together to keep their home running smoothly.

Ecosystem

An ecosystem includes both the living organisms (biotic factors) and the physical environment (abiotic factors) in a specific geographic area. It comprises the interactions and relationships among organisms and their environment, encompassing the flow of energy and the cycling of nutrients. Ecosystems can range from small-scale, such as a pond or a forest, to large-scale, like a desert or a coral reef. They play a crucial role in maintaining ecological balance and sustaining life on Earth.

Now, picture the entire neighborhood, including all the living things (plants, animals, and others) and the non-living things (like air, water, and soil) as a giant, interconnected system. This whole system is called an ecosystem. It's like a big, bustling community with not only the living beings but also the places they live in. In an ecosystem, everything is connected – animals eat plants, plants need certain conditions to grow, and everything depends on each other to keep the balance.



Sigmoid population growth curve

The S-shaped growth curve, also known as the sigmoid growth curve, represents a particular pattern of population growth observed in ecological and biological systems. This curve is

characterized by an initial slow increase in population density, followed by a rapid acceleration in growth, and eventually, a decrease leading to stabilization. The curve is typically shaped like the letter "S," hence the name.

Lag phase

In this phase, the population is small, and there is slow growth. This is often a period of adjustment and acclimatization, where the population is establishing itself in a new environment. The doubling of numbers is not leading to a substantial increase in population size.

Exponential phase (log phase)

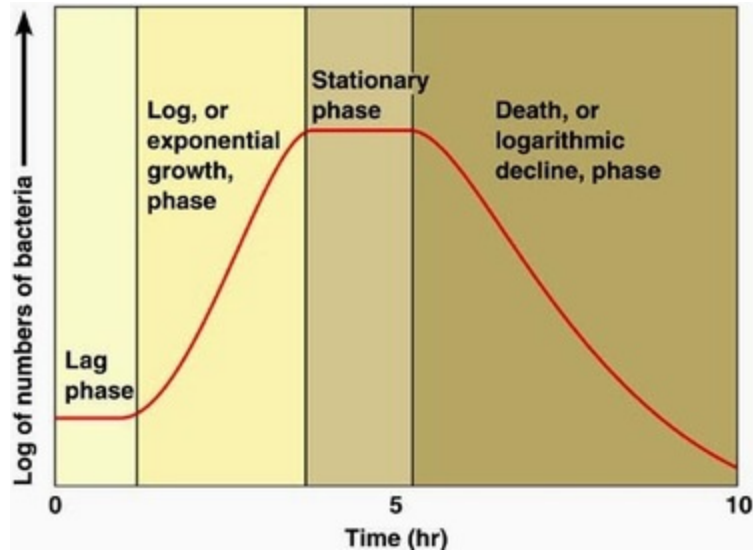
This is a phase of rapid, exponential growth. The population doubles at each generation, leading to a logarithmic growth rate. Initially, this phase allows for significant population increase without straining the resources of the habitat. However, as the population grows, competition for resources intensifies, and the growth rate begins to slow down.

Stationary phase

At this point, the population growth starts to level off. The resources in the environment are no longer sufficient to support an increasing population. Limiting factors, such as food supply, diseases, and overcrowding, come into play. The reproduction rate equals the mortality rate, resulting in a stable population size.

Death phase

In this phase, the mortality rate surpasses the reproduction rate. Population numbers start to decline due to factors like insufficient food supply, habitat degradation from waste products, or the spread of diseases. Offspring face greater challenges in surviving to reproductive age, leading to a decline in overall population numbers.



Past Paper Questions:

The diagram shows a simple food chain.

green plant → herbivore → carnivore

If a disease causes the number of herbivores to decrease, what will be the effect on the numbers of green plants and carnivores?

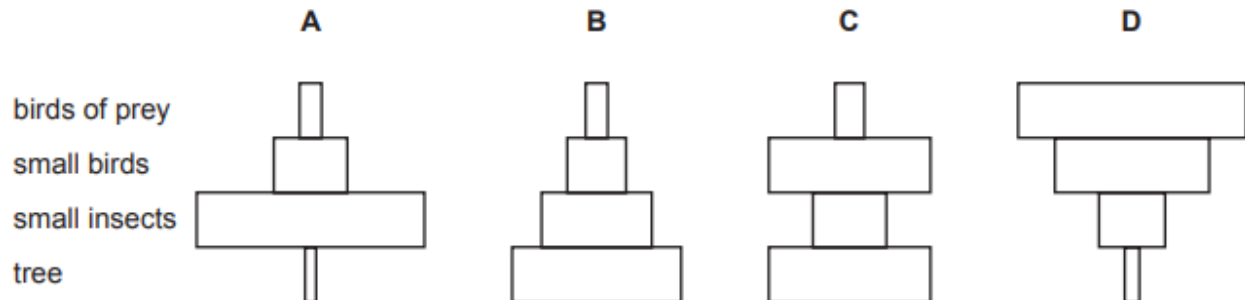
	green plants	carnivores
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

Ans: C

The diagram shows a food chain.

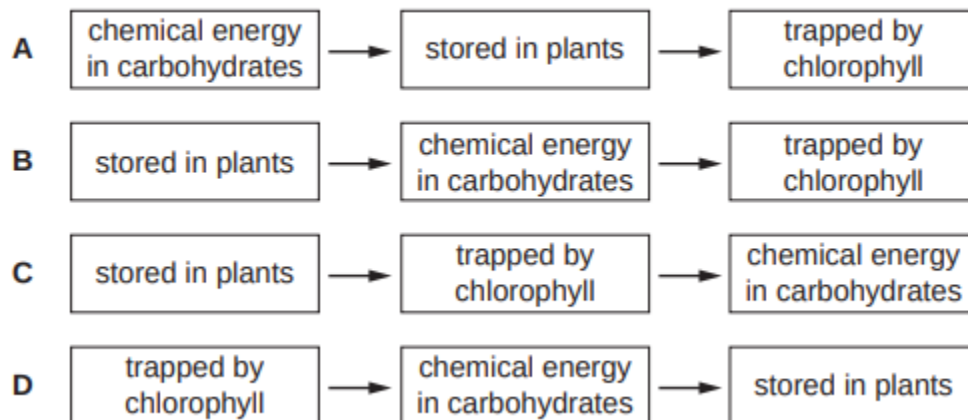
tree → small insects → small birds → birds of prey

What is the correct pyramid of numbers for this food chain?



Ans: A

Which pathway is taken by energy from the Sun?



Ans: D

Practice Questions:

Easy:

Which of the following is a biotic factor in an ecosystem?

- A) Sunlight
- B) Temperature
- C) Soil
- D) Plants

Answer: D) Plants

What is the primary source of energy in most ecosystems?

- A) Wind
- B) Soil
- C) Sunlight
- D) Water

Answer: C) Sunlight

Medium:

What is the role of decomposers in an ecosystem?

- A) They produce oxygen through photosynthesis.
- B) They break down dead organisms and recycle nutrients.
- C) They capture sunlight and convert it into energy.
- D) They regulate the population of other organisms.

Answer: B) They break down dead organisms and recycle nutrients.

Which of the following best describes a food chain?

- A) A complex network of interconnected food webs.
- B) A linear sequence of organisms where each serves as a source of food for the next.
- C) A diagram showing the energy flow within an ecosystem.
- D) A representation of the different trophic levels in an ecosystem.

Answer: B) A linear sequence of organisms where each serves as a source of food for the next.

Hard:

What is an example of a mutualistic relationship in an ecosystem?

- A) A lion preying on a zebra.
- B) A flower being pollinated by a bee.
- C) A parasite feeding on a host organism.
- D) A predator hunting its prey.

Answer: B) A flower being pollinated by a bee.

What is the process by which water is returned to the atmosphere from plants called?

- A) Transpiration

- B) Respiration
- C) Precipitation
- D) Evaporation

Answer: A) Transpiration

Which of the following is NOT a greenhouse gas?

- A) Carbon dioxide
- B) Methane
- C) Nitrogen
- D) Water vapor

Answer: C) Nitrogen

What is the primary source of phosphorus for living organisms?

- A) Atmosphere
- B) Rocks and minerals
- C) Soil
- D) Water bodies

Answer: B) Rocks and minerals

Core Questions

Core / Specimen Paper 2023/ P3 / Theory / IGCSE/ Cambridge 0610 / Q6

- 7 (a) Carbon dioxide is a greenhouse gas.

State the name of **one other** greenhouse gas.

..... [1]

- (b) Deforestation can cause an increase in the concentration of carbon dioxide in the atmosphere.

State **three** other undesirable effects of deforestation.

1

2

3

[3]

- (c) Fig. 7.1 shows a simple food web.

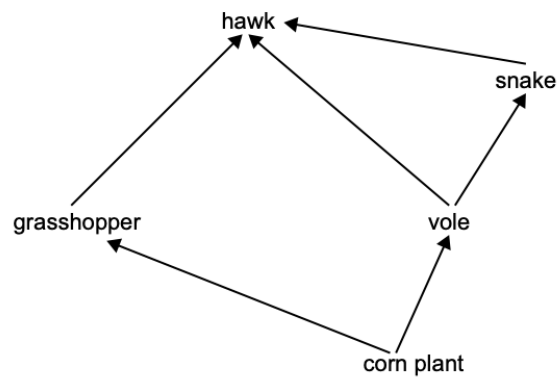


Fig. 7.1

- (i) Table 7.1 shows some of the terms that can be used to describe the organisms in the food web in Fig. 7.1.

Place ticks (✓) in the boxes to show the terms that can be used to describe each organism.

Table 7.1

organism	producer	herbivore	secondary consumer
corn plant			
vole			
grasshopper			
hawk			

[3]

- (ii) State the number of trophic levels in the food web in Fig. 7.1.

..... [1]

- (iii) Identify **one** organism that feeds at more than one trophic level.

..... [1]

- (iv) State the term used to describe an organism that gets its energy from dead or waste organic material.

..... [1]

- (v) State the principal source of energy for food webs.

..... [1]

[Total: 11]

Question	Answer	Marks	Guidance
7(a)	methane ;	1	A water vapour / nitrous oxide / CFCs / ozone
7(b)	any three from: habitat destruction ; loss of biodiversity ; extinction ; soil erosion ; flooding ; AVP ;; e.g. landslides / leaching / disruption to food chains or webs or loss of food source / desertification / reduction in rainfall	3	

0970/03

Cambridge IGCSE (9–1) – Mark Scheme
SPECIMEN

For examination
from 2023

Question	Answer	Marks	Guidance																				
7(c)(i)	<table border="1"> <thead> <tr> <th>organism</th><th>producer</th><th>herbivore</th><th>secondary consumer</th></tr> </thead> <tbody> <tr> <td>corn plant</td><td>✓</td><td></td><td></td></tr> <tr> <td>vole</td><td></td><td>✓</td><td></td></tr> <tr> <td>grasshopper</td><td></td><td>✓</td><td></td></tr> <tr> <td>hawk</td><td></td><td></td><td>✓</td></tr> </tbody> </table> ; ; ;	organism	producer	herbivore	secondary consumer	corn plant	✓			vole		✓		grasshopper		✓		hawk			✓	3	1 mark per correct column
organism	producer	herbivore	secondary consumer																				
corn plant	✓																						
vole		✓																					
grasshopper		✓																					
hawk			✓																				
7(c)(ii)	4 ;	1																					
7(c)(iii)	hawk ;	1																					
7(c)(iv)	decomposer ;	1																					
7(c)(v)	(the) Sun ;	1																					

(a) Carbon dioxide is a greenhouse gas.
State the name of one other greenhouse gas.

Methane (CH₄)

(b) Deforestation can cause an increase in the concentration of carbon dioxide in the atmosphere.
State three other undesirable effects of deforestation.

Loss of biodiversity

Soil erosion

Disruption of water cycle

(c) Fig. 7.1 shows a simple food web.

Table 7.1

Complete the table by ticking the appropriate boxes:

Organism	Producer	Herbivore	Secondary Consumer
Corn plant	✓		
Vole		✓	
Grasshopper		✓	
Hawk			✓

Additional Questions

(i) State the number of trophic levels in the food web in Fig. 7.1.

Four (4)

(ii) Identify one organism that feeds at more than one trophic level.

Hawk (feeds on vole and snake, thus acting as both a secondary and tertiary consumer)

(iii) State the term used to describe an organism that gets its energy from dead or waste organic material.

Decomposer

(iv) State the principal source of energy for food webs.

The Sun

Past paper 2022 may/june paper 3 core

- 8 (a) Fig. 8.1 is a diagram showing part of the carbon cycle.

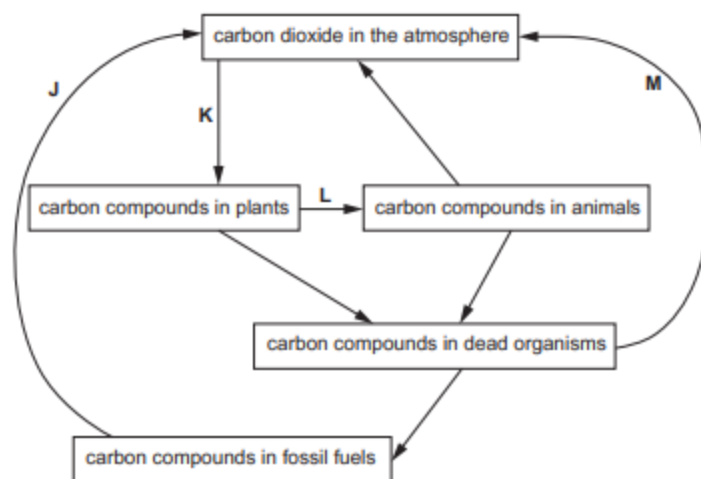


Fig. 8.1

- (i) Draw **one** arrow on Fig. 8.1 to represent respiration in plants. [1]
- (ii) Identify the processes labelled J, L and M in Fig. 8.1.

J

L

M

[3]

- (b) Photosynthesis is the process occurring at K in Fig. 8.1.

State the **two** products of photosynthesis.

1

2

[2]

- c) Explain the effect of deforestation on the concentration of carbon dioxide in the atmosphere.

.....

.....

.....

.....

.....

[2]

8(a)(i)	arrow drawn from carbon compounds in plants to carbon dioxide in the atmosphere ;
8(a)(ii)	J – combustion ; L – feeding ; M – decomposition ;
8(b)	glucose ; oxygen ;
8(c)	increase (in carbon dioxide concentration) ; <i>idea of</i> (because there is) less photosynthesis ;

- a) i) To represent respiration in plants draw arrow drawn from carbon compounds in plants to carbon dioxide in the atmosphere ;
- ii) The processes labelled are
J – combustion
L – feeding
M– decomposition
- b) the two products of photosynthesis are glucose and oxygen
- c) Deforestation leads to an increase in atmospheric carbon dioxide concentration because there is less photosynthesis occurring due to the reduction in the number of trees, which are primary carbon dioxide absorbers, resulting in decreased carbon sequestration and the release of stored carbon into the atmosphere.

Past Paper 2019 Paper 3

- 5 (a) Rabbits are herbivores.

Define the term *herbivore*.

.....
 [2]

- (b) The size of a rabbit population can increase and decrease from year to year, as shown in Fig. 5.1.

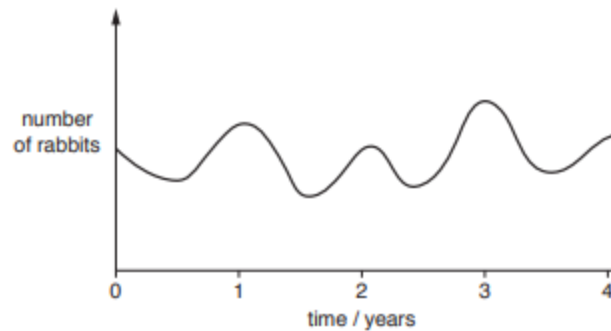


Fig. 5.1

State **two** factors that could cause an increase in a rabbit population.

- 1

 2

5(a)	animal that gets its energy ; by eating plants ;
5(b)	increased, food supply / plants; less predation / less hunting / AW ; less disease / AW ; more births / fewer deaths ;
5(c)	damage / destroy, (marine) habitats ; extinction of species ; reference to pollution (of sea) ; global warming / ref. to increase in sea temperature ; rise in sea levels / melting of ice-caps ; overfishing / disruption of food chain ;

a) A herbivore is an animal that primarily eats plants. This includes a variety of plant materials such as leaves, stems, roots, seeds, and fruits. Herbivores have specialized digestive systems that are adapted to breaking down tough plant fibers and extracting necessary nutrients. Their diets typically exclude animal proteins and rely heavily on vegetation. Examples of herbivores include rabbits, deer, cows, and many species of insects.

b) Two factors that could cause an increase in a rabbit population are:

1. Increased food supply/plants.
2. Less predation/less hunting.

c) Three ways in which the increase in the human population has affected marine ecosystems are:

1. Damage or destruction of marine habitats.
2. Pollution of the sea.
3. Overfishing/disruption of the food chain