Ecosystems Overview

A Level

Part A Ecosystem levels

Match the terms to the descriptions below.

[ ]: a group of individuals of one species that live in the same geographical area.

[ ]: the place (or type of place) where an organism lives

[ ]: all the individuals that could potentially interbreed to produce fertile offspring. Usually comprises many populations.

[ ]: all the populations (of different species) that live in the same geographical area.

[ ]: a community plus its physical environment.

Items:

Phylum **Community** **Population** **Kingdom** **Habitat** **Ecosystem** **Species**

Part B Ecosystem examples

Which of the following could be considered ecosystems? Select all that apply.

- [ ] a field
- [ ] a forest
- [ ] a city
- [ ] a human
- [ ] a coral reef
- [ ] a tree
- [ ] a rock pool

Part C Ecological niche

Which of the following things are part of the ecological niche of a species? Select all that apply.

- [ ] the types of interactions that species has with other species in the ecosystem
- [ ] the habitat in which that species lives
- [ ] the maximum population size of the species that can be sustained in a given ecosystem
- [ ] the trophic level of that species
- [ ] the genetic diversity of that species
- [ ] the biotic and abiotic conditions that the species is best adapted to

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Trophic Levels

A Level

A trophic level is the position in a food web that an organism occupies. An organism may occupy multiple trophic levels within a food web.

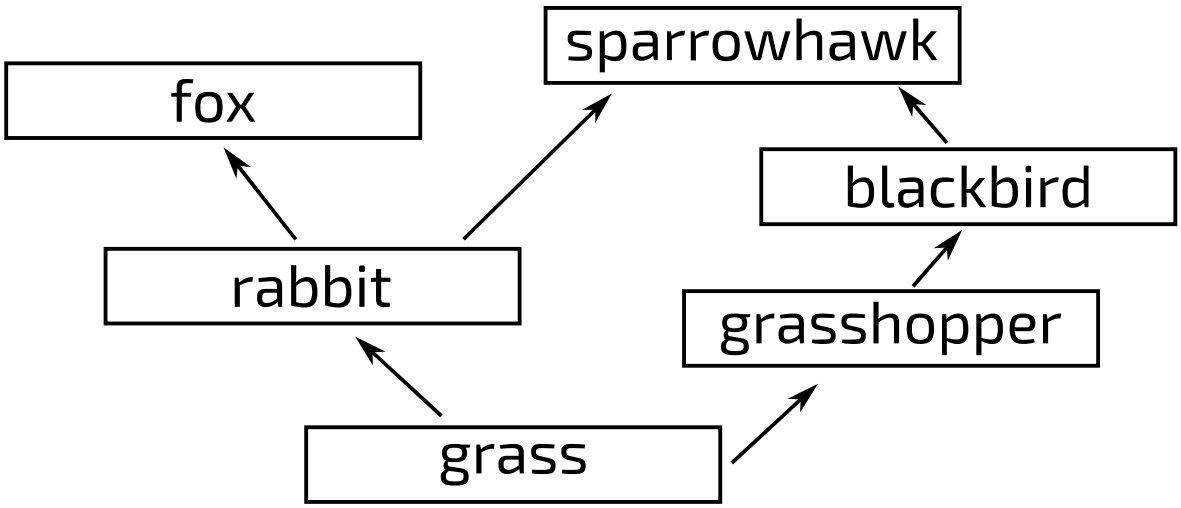

Figure 1: Part of a food web. Arrows represent direction of energy/biomass transfer.

Part A Producers

Which organisms in **Figure 1** are producers? Select all that apply.

- [ ] grass
- [ ] grasshopper
- [ ] rabbit
- [ ] blackbird
- [ ] fox
- [ ] sparrowhawk

Part B Primary consumers

Which organisms in **Figure 1** are primary consumers? Select all that apply.

- [ ] grass
- [ ] grasshopper
- [ ] rabbit
- [ ] blackbird
- [ ] fox
- [ ] sparrowhawk

Part C Secondary consumers

Which organisms in **Figure 1** are secondary consumers? Select all that apply.

- [ ] grass
- [ ] grasshopper
- [ ] rabbit
- [ ] blackbird
- [ ] fox
- [ ] sparrowhawk

Part D Tertiary consumers

Which organisms in **Figure 1** are tertiary consumers? Select all that apply.

- [ ] grass
- [ ] grasshopper
- [ ] rabbit
- [ ] blackbird
- [ ] fox
- [ ] sparrowhawk

Part E Nutrient cycling

What is the name of the type of organisms that extract nutrients from higher trophic levels and make them available to producers?

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Barn Owl Diet

A Level

A study was carried out into the food sources of barn owls. Owls regurgitate the undigested remains of their prey as pellets. Analysis of these pellets was used to identify the food eaten by one owl, over a period of 2 weeks. **Figure 1** shows the number of animals in the owl's diet.

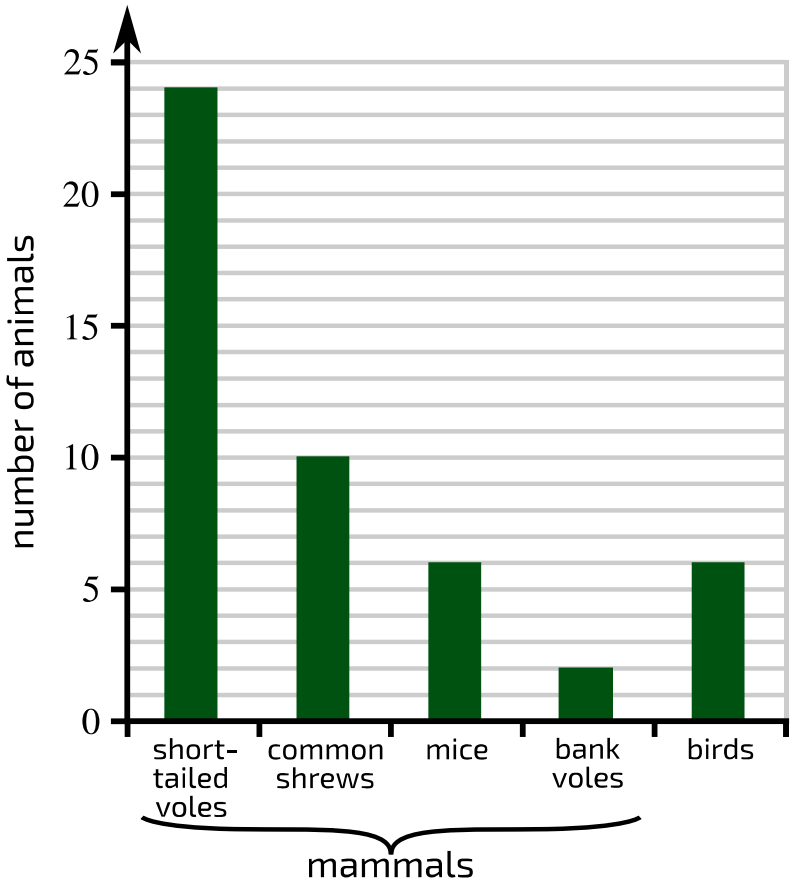

Figure 1: Animals eaten by one barn owl over a two-week period. Data was obtained by analysing owl pellets.

Part A Mammals vs birds

What percentage of animals eaten by the owl were mammals?

What percentage of animals eaten by the owl were birds?

Part B Mice percentages

What percentage of animals eaten by the owl were mice?

What percentage of mammals eaten by the owl were mice? Give your answer to 1 decimal place.

Part C Mice population changes

A second study was carried out over the following 2 weeks to find the change in the population of mice in the owl's habitat. The table below shows the data obtained for the second study.

number of births	242
number of deaths	207
number joining from another population	11
number leaving to join another population	21

Calculate the mean increase in the population of mice per week in the second study.

Which of the following statements is correct?

- the increase in the number of mice will result in **more** mice being eaten by the barn owl
- the increase in the number of mice will result in **fewer** mice being eaten by the barn owl
- there is insufficient evidence to predict how the increase in the number of mice will affect how many mice are eaten by the barn owl

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Energy Transfer Efficiency

A Level

The diagram in **Figure 1** shows a simple food chain.

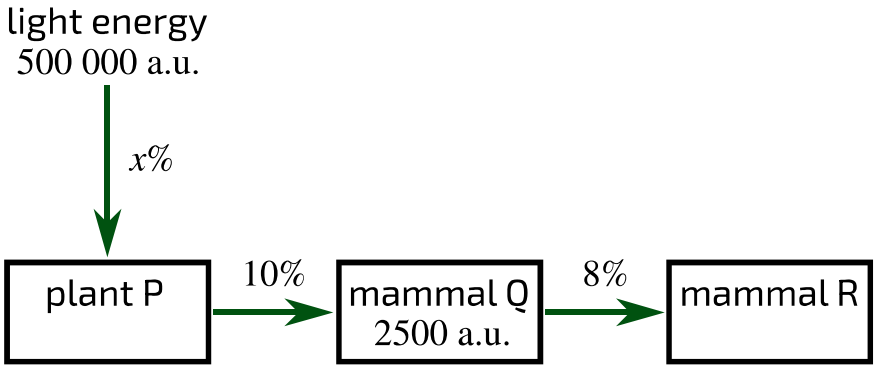

Figure 1: A food chain where energy from light is transferred in turn to P, Q and R. The numbers represent energy available and are in arbitrary units (a.u.), and the percentages represent efficiency of energy transfer.

The energy transfer between trophic levels is not 100% efficient.

Part A Efficiency

For the food chain in **Figure 1**, calculate the efficiency of energy transfer x.

Give your answer as a percentage.

Part B Energy transfer P to Q

Which of the following could explain the inefficiency of energy transfer from P to Q? Select all that apply.

- [ ] CO_2 levels are limiting the rate of photosynthesis
- [ ] energy is lost as heat
- [ ] some wavelengths of light are not used
- [ ] some of the light is reflected by the leaves rather than absorbed
- [ ] cellulose is not digested and is lost in faeces
- [ ] bones are either not consumed or not digested

Part C Energy transfer Q to R

Which of the following could explain the inefficiency of energy transfer from Q to R? Select all that apply.

- [ ] CO_2 levels are limiting the rate of photosynthesis
- [ ] energy is lost as heat
- [ ] some wavelengths of light are not used
- [ ] some of the light is reflected by the leaves rather than absorbed
- [ ] cellulose is not digested and is lost in faeces
- [ ] bones are either not consumed or not digested

Part D Available energy in mammal R

Calculate the available energy in mammal R.

What percentage of the initial available light energy in the ecosystem is available in mammal R?

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Ecological Interactions

A Level

Organisms within a species and organisms of different species interact with each other in many different ways within an ecosystem.

Part A Definitions

Match the interaction types to the definitions in the table below.

Interaction type	Definition
	organisms of **different** species competing for the same resource(s)
	organisms of **the same** species competing for the same resource(s)
	one organism killing and consuming another organism
	an interaction between two organisms that is beneficial for one organism but harmful for the other
	an interaction between two organisms that is beneficial for both organisms
	an interaction between two organisms that is neutral (i.e. neither beneficial nor harmful) for both organisms

Items:

mutualism **commensalism** **interspecific competition** **predation** **intraspecific competition** **parasitism**

Part B **Examples**

Match the interaction type to the example below.

A European garden spider (*Araneus diadematus*) spins a web and waits for an insect to land on it. When this happens, the spider kills and eats the insect. This is an example of [ ].

A male red deer (*Cervus elaphus*) challenges another male red deer, and the two males fight until one concedes defeat. The winner gains the opportunity to mate with the females. This is an example of [ ].

Grey squirrels (*Sciurus carolinensis*) and red squirrels (*Sciurus vulgaris*) eat the same food and occupy the same habitats. The UK population of red squirrels decreased after the introduction of grey squirrels. This is an example of [ ].

Species of the *Plasmodium* genus (single-celled eukaryotes) are transmitted between female *Anopheles* mosquitoes and humans (*Homo sapiens*). Once inside a human's blood, *Plasmodium* cells invade the red blood cells and multiply, using up the nutrients in the red blood cells and eventually causing them to burst - as well as inducing various other symptoms. This is known as malaria. This interaction between *Plasmodium* and humans is an example of [ ].

A honey bee (*Apis mellifera*) lands on a sunflower (*Helianthus annuus*) and drinks nectar from the sunflower, which deposits pollen on the bee. The honey bee then flies to another sunflower to drink nectar from there, transferring pollen to that flower. This interaction is an example of [ ].

A house sparrow (*Passer domesticus*) creates a nest in an oak tree (*Quercus robur*). The sparrow gains shelter and some protection from predators. The oak tree is not affected in any significant way. This is an example of [ ].

Items:

commensalism **parasitism** **predation** **inter-specific competition** **intra-specific competition** **mutualism**

Part C Extinction consequences

If a population of a particular animal species ("species X") goes extinct in an ecosystem, which of the following species will likely be negatively affected?

- [ ] an animal species that parasitises species X
- [ ] a plant species that is pollinated by species X
- [ ] a plant species that is predated on by species X
- [ ] an animal species that competes with species X for food
- [ ] an animal species that predates on species X

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Ecological Succession

A Level

Ecosystems are dynamic i.e. the species that are part of the ecosystem can change over time. This is called succession.

Part A Primary succession

Reorder the steps of primary succession into the correct order on the right (top = beginning, bottom = last).

Note that some of the steps may not be part of primary succession.

Available items

- soil is formed by erosion and decomposition
- colonisation by increasingly larger plants (e.g. trees) occurs until the climax community (e.g. a woodland) is formed
- a new surface is produced that does not contain any living organisms e.g. volcanic eruption produces new igneous rock
- colonisation by secondary colonisers (e.g. mosses) and tertiary colonisers (e.g. grasses, ferns) occurs and an intermediate community is formed
- colonisation of the lifeless surface by pioneer species (e.g. lichen) occurs and a pioneer community is formed
- an existing, stable community undergoes a severe disturbance (e.g. forest fire, flooding, deforestation etc.), but the soil remains
- the soil is recolonised by the same species that previously lived in the area, until the climax community (e.g. a woodland) is formed

Part B Secondary succession

Reorder the steps of secondary succession into the correct order on the right (top = beginning, bottom = last).

Note that some of the steps may not be part of secondary succession.

Available items

- a new surface is produced that does not contain any living organisms e.g. volcanic eruption produces new igneous rock
- an existing, stable community undergoes a severe disturbance (e.g. forest fire, flooding, deforestation etc.), but the soil remains
- the soil is recolonised by the same species that previously lived in the area, until the climax community (e.g. a woodland) is formed
- colonisation of the lifeless surface by pioneer species (e.g. lichen) occurs and a pioneer community is formed

Part C Primary vs secondary succession

Which of the following statements are true? Select all that apply.

- [ ] secondary succession involves the recolonisation of a disrupted ecosystem
- [ ] primary succession involves the recolonisation of a disrupted ecosystem
- [ ] secondary succession involves the colonisation of an area/surface that has never been colonised before
- [ ] primary succession is faster than secondary succession
- [ ] primary succession involves the colonisation of an area/surface that has never been colonised before
- [ ] primary succession is slower than secondary succession

Part D Deflected succession

In some cases, an ecosystem never reaches its natural climax community (e.g. woodland). Instead, the ecosystem remains in an intermediate community (e.g. grassland). This is called deflected succession.

Which of the following processes could cause deflected succession?

- [ ] soil formation
- [ ] recolonisation by climax species
- [ ] grazing by herbivores
- [ ] colonisation by pioneer species
- [ ] planting crops

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