Biology

AQA Biology Ecology Journey of Knowledge – Ecosystems

Context and introduction to the unit:
The Sun is a source of energy that passes through ecosystems. Materials including carbon and water are continually recycled by the living world, being released through respiration of animals, plants and decomposing microorganisms and taken up by plants in photosynthesis. All species live in ecosystems composed of complex communities of animals and plants dependent on each other and that are adapted to particular conditions, both abiotic and biotic. These ecosystems provide essential services that support human life and continued development. In order to continue to benefit from these services humans need to engage with the environment in a sustainable way. In this section we will explore how humans are threatening biodiversity as well as the natural systems that support it. We will also consider some actions we need to take to ensure our future health, prosperity and well-being.
KS3:
Independence – food chains and webs, predators and prey, adaptations, Plant reproduction, Earths atmosphere and The Carbon Cycle.

CORE KNOWLEDGE

4.7.1.1 Communities - An ecosystem is the interaction of a community of living organisms (biotic) with the non-living (abiotic) parts of their environment. To survive and reproduce, organisms require a supply of materials from their surroundings and from the other living organisms there. Plants in a community or habitat often compete with each other for light and space, and for water and mineral ions from the soil. Animals often compete with each other for food, mates and territory. Within a community each species depends on other species for food, shelter, pollination, seed dispersal etc. If one species is removed it can affect the whole community. This is called interdependence. A stable community is one where all the species and environmental factors are in balance so that population sizes remain fairly constant.

4.7.1.2 Abiotic factors - Abiotic (non-living) factors which can affect a community are: • light intensity • temperature • moisture levels • soil pH and mineral content • wind intensity and direction • carbon dioxide levels for plants • oxygen levels for aquatic animals.
4.7.1.3 Biotic factors - Biotic (living) factors which can affect a community are: • availability of food • new predators arriving • new pathogens • one species outcompeting another so the numbers are no longer sufficient to breed.

Required practical activity 7: measure the population size of a common species in a habitat. Use sampling techniques to investigate the effect of a factor on the distribution of this species WS 2.1 and 2.3
Use **quadrats**:
Place quadrats randomly or systematically.
Count individuals in the quadrat or estimate percentage cover.
Use **transects**:
Place a tape along a gradient.
Sample at intervals using quadrats or direct observation.
Random sampling: Avoid bias by using random numbers or coordinates.
Systematic sampling: Sample at regular intervals (good for environmental gradients).
Repeat sampling to increase reliability and calculate a **mean**.
Population estimate formula (for quadrats):

$$\text{Estimated population size} = \text{mean number per quadrat} \times \frac{\text{total area of habitat}}{\text{area of one quadrat}}$$

4.7.1.4 Adaptations - Organisms have features (adaptations) that enable them to survive in the conditions in which they normally live. These adaptations may be structural, behavioural or functional. Some organisms live in environments that are very extreme, such as at high temperature, pressure, or salt concentration. These organisms are called extremophiles. Bacteria living in deep sea vents are extremophiles.

Disciplinary knowledge
Required practical activity 10: investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change. WS 1.4, 1.2

Vocabulary
Decomposition, geographic, trophic levels, herbivores, carnivores, apex predator, biomass, agriculture, fisheries, biotechnology

Reading is Power
Mission deforestation

Where next?
Earths atmosphere and Using resources

AQA Biology Ecology Journey of Knowledge: Feeding Relationships

Context and introduction to the unit:
The Sun is a source of energy that passes through ecosystems. Materials including carbon and water are continually recycled by the living world, being released through respiration of animals, plants and decomposing microorganisms and taken up by plants in photosynthesis. All species live in ecosystems composed of complex communities of animals and plants dependent on each other and that are adapted to particular conditions, both abiotic and biotic. These ecosystems provide essential services that support human life and continued development. In order to continue to benefit from these services humans need to engage with the environment in a sustainable way. In this section we will explore how humans are threatening biodiversity as well as the natural systems that support it. We will also consider some actions we need to take to ensure our future health, prosperity and well-being.

KS3:
Independence – food chains and webs, predators and prey, adaptations, Plant reproduction, Earths atmosphere and The Carbon Cycle.

CORE KNOWLEDGE

4.7.2.1 Levels of organisation - Feeding relationships within a community can be represented by food chains. All food chains begin with a producer which synthesises molecules. This is usually a green plant or alga which makes glucose by photosynthesis. A range of experimental methods using transects and quadrats are used by ecologists to determine the distribution and abundance of species in an ecosystem. Producers are eaten by primary consumers, which in turn may be eaten by secondary consumers and then tertiary consumers. Consumers that kill and eat other animals are predators, and those eaten are prey. In a stable community the numbers of predators and prey rise and fall in cycles.

4.7.4.1 Trophic levels - Trophic levels can be represented by numbers, starting at level 1 with plants and algae. Further trophic levels are numbered subsequently according to how far the organism is along the food chain. Level 1: Plants and algae make their own food and are called producers. Level 2: Herbivores eat plants/algae and are called primary consumers. Level 3: Carnivores that eat herbivores are called secondary consumers. Level 4: Carnivores that eat other carnivores are called tertiary consumers. Apex predators are carnivores with no predators. Decomposers break down dead plant and animal matter by secreting enzymes into the environment. Small soluble food molecules then diffuse into the microorganism

4.7.4.2 Pyramids of biomass - Pyramids of biomass can be constructed to represent the relative amount of biomass in each level of a food chain. Trophic level 1 is at the bottom of the pyramid.

4.7.4.3 Transfer of biomass - Producers are mostly plants and algae which transfer about 1% of the incident energy from light for photosynthesis. Only approximately 10% of the biomass from each trophic level is transferred to the level above it. Losses of biomass are due to: • not all the ingested material is absorbed, some is egested as faeces • some absorbed material is lost as waste, such as carbon dioxide and water in respiration and water and urea in urine. Large amounts of glucose are used in respiration.

Disciplinary knowledge
Required practical activity 7: measure the population size of a common species in a habitat. Use sampling techniques to investigate the effect of a factor on the distribution of this species WS 2.1 and 2.3

Vocabulary
Ecosystem, community, biotic, abiotic, population, adaptations, extremophiles, food chains, abundance, distribution.

Reading is Power
Mission deforestation

Where next?
Impacts of human activity on our environment.

AQA Biology Ecology Journey of Knowledge: How Materials are Cycled.

Context and introduction to the unit:
The Sun is a source of energy that passes through ecosystems. Materials including carbon and water are continually recycled by the living world, being released through respiration of animals, plants and decomposing microorganisms and taken up by plants in photosynthesis. All species live in ecosystems composed of complex communities of animals and plants dependent on each other and that are adapted to particular conditions, both abiotic and biotic. These ecosystems provide essential services that support human life and continued development. In order to continue to benefit from these services humans need to engage with the environment in a sustainable way. In this section we will explore how humans are threatening biodiversity as well as the natural systems that support it. We will also consider some actions we need to take to ensure our future health, prosperity and well-being.
KS3:
Independence – food chains and webs, predators and prey, adaptations, Plant reproduction, Earths atmosphere and The Carbon Cycle.

CORE KNOWLEDGE

4.7.2.2 How materials are cycled - All materials in the living world are recycled to provide the building blocks for future organisms. The carbon cycle returns carbon from organisms to the atmosphere as carbon dioxide to be used by plants in photosynthesis. The water cycle provides fresh water for plants and animals on land before draining into the seas. Water is continuously evaporated and precipitated. Students should be able to explain the role of microorganisms in cycling materials through an ecosystem by returning carbon to the atmosphere as carbon dioxide and mineral ions to the soil

4.7.2.3 Decomposition - Gardeners and farmers try to provide optimum conditions for rapid decay of waste biological material. The compost produced is used as a natural fertiliser for growing garden plants or crops. Anaerobic decay produces methane gas. Biogas generators can be used to produce methane gas as a fuel.

Required practical activity 10: investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change. WS 1.4, 1.2
Aim: Investigate how temperature affects the rate of decay of fresh milk using pH change as an indicator.
Indicator of decay: Lactic acid production lowers pH as bacteria in milk ferment sugars.
Variables: Independent variable: Temperature (e.g., 5°C, 20°C, 37°C, 50°C) **Dependent variable:** pH of milk over time **Controlled variables:** Volume of milk, type of milk, time intervals, same equipment

This is a model of decay as naturally milk produces lactic acid which causes the change in pH, however, this takes too long to investigate. Therefore, we add lipase, and fatty acids cause the change in pH.

Disciplinary knowledge
Required practical activity 7: measure the population size of a common species in a habitat. Use sampling techniques to investigate the effect of a factor on the distribution of this species WS 2.1 and 2.3

Vocabulary
Biodiversity, stability, sewage, pollution, atmosphere, landfill, deforestation, global warming, field margins, hedgerows, global warming

Reading is Power
Mission deforestation

Where next?
Earths atmosphere and Using resources

AQA Biology Ecology Journey of Knowledge: Human Impact on the Environment

Context and introduction to the unit:
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KS3:
Independence – food chains and webs, predators and prey, adaptations, Plant reproduction, Earths atmosphere and The Carbon Cycle.

CORE KNOWLEDGE

4.7.3.1 Biodiversity - Biodiversity is the variety of all the different species of organisms on earth, or within an ecosystem. A great biodiversity ensures the stability of ecosystems by reducing the dependence of one species on another for food, shelter and the maintenance of the physical environment. The future of the human species on Earth relies on us maintaining a good level of biodiversity. Many human activities are reducing biodiversity and only recently have measures been taken to try to stop this reduction.

4.7.2.4 Impact of environmental change - Environmental changes affect the distribution of species in an ecosystem. These changes include: • temperature • availability of water • composition of atmospheric gases. The changes may be seasonal, geographic or caused by human interaction.

4.7.3.2 Waste management - Rapid growth in the human population and an increase in the standard of living mean that increasingly more resources are used and more waste is produced. Unless waste and chemical materials are properly handled, more pollution will be caused. Pollution can occur: • in water, from sewage, fertiliser or toxic chemicals • in air, from smoke and acidic gases • on land, from landfill and from toxic chemicals. Pollution kills plants and animals which can reduce biodiversity.

4.7.3.3 Land use - Humans reduce the amount of land available for other animals and plants by building, quarrying, farming and dumping waste. The destruction of peat bogs, and other areas of peat to produce garden compost, reduces the area of this habitat and thus the variety of different plant, animal and microorganism species that live there (biodiversity). The decay or burning of the peat releases carbon dioxide into the atmosphere.

4.7.3.4 Deforestation - Large-scale deforestation in tropical areas has occurred to: • provide land for cattle and rice fields • grow crops for biofuels.

4.7.3.5 Global warming - Levels of carbon dioxide and methane in the atmosphere are increasing and contribute to 'global warming'.

4.7.3.6 Maintaining biodiversity - Scientists and concerned citizens have put in place programmes to reduce the negative effects of humans on ecosystems and biodiversity. These include: • breeding programmes for endangered species • protection and regeneration of rare habitats • reintroduction of field margins and hedgerows in agricultural areas where farmers grow only one type of crop • reduction of deforestation and carbon dioxide emissions by some governments • recycling resources rather than dumping waste in landfill.

Disciplinary knowledge
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Vocabulary
Biodiversity, stability, sewage, pollution, atmosphere, landfill, deforestation, global warming, field margins, hedgerows, global warming

Reading is Power
Mission deforestation

Where next?
Earths atmosphere and Using resources

AQA Biology Ecology Journey of Knowledge: Achieving Food Security.

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KS3:
Independence – food chains and webs, predators and prey, adaptations, Plant reproduction, Earths atmosphere and The Carbon Cycle.

CORE KNOWLEDGE

4.7.5.1 Factors affecting food security - Food security is having enough food to feed a population. Biological factors which are threatening food security include: • the increasing birth rate has threatened food security in some countries • changing diets in developed countries means scarce food resources are transported around the world • new pests and pathogens that affect farming • environmental changes that affect food production, such as widespread famine occurring in some countries if rains fail • the cost of agricultural inputs • conflicts that have arisen in some parts of the world which affect the availability of water or food. Sustainable methods must be found to feed all people on Earth.

4.7.5.2 Farming techniques - The efficiency of food production can be improved by restricting energy transfer from food animals to the environment. This can be done by limiting their movement and by controlling the temperature of their surroundings. Some animals are fed high protein foods to increase growth.

4.7.5.3 Sustainable fisheries - Fish stocks in the oceans are declining. It is important to maintain fish stocks at a level where breeding continues or certain species may disappear altogether in some areas. Control of net size and the introduction of fishing quotas play important roles in conservation of fish stocks at a sustainable level.

4.7.5.4 Role of biotechnology - Modern biotechnology techniques enable large quantities of microorganisms to be cultured for food. The fungus Fusarium is useful for producing mycoprotein, a protein-rich food suitable for vegetarians. The fungus is grown on glucose syrup, in aerobic conditions, and the biomass is harvested and purified. A genetically modified bacterium produces human insulin. When harvested and purified this is used to treat people with diabetes. GM crops could provide more food or food with an improved nutritional value such as golden rice.

Disciplinary knowledge
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Vocabulary
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Reading is Power
Mission deforestation

Where next?
Earths atmosphere and Using resources

Trilogy

AQA Biology Ecology Journey of Knowledge – Part 1

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Where next?
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AQA Biology Ecology Journey of Knowledge: Part 2

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Reading is Power
Mission deforestation

Where next?
Earths atmosphere and Using resources