B7 Ecology

What's the science story?

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.

Previous knowledge:

KS3

Year 7 – Identity

Year 9 – Photosynthesis and respiration

KS4

C9 – Chemistry of the atmosphere

Next steps…

N/A

Keywords

Ecosystem	Species	Evaporation
Abiotic	Survival	Condensation
Biotic	Environment	Biodiversity
Population	Food web	Global warming
Competition	Producer	Climate
Interdependence	Consumer	Deforestation
Adaptation	Transect	Peat bogs
Quadrat		

Working scientifically skills:

WS2: models of the water and carbon cycle

WS8: methods

WS12: errors and ensuring accurate/precise data

WS15: data interpretation; mode, median, mean

Assessments:

End of unit test (summative) (Out of 30)

Exit tickets x 2/3 (formative)

- **ET Food webs**
- **ET Quadrats**

Lesson No. and Title	Learning objectives	AQA Specification	Practical equipment
1. Abiotic and biotic factors	**4 – To define what an ecosystem is.** **6 – To describe interdependence and competition in a community.** **8 – To suggest how changes in abiotic and biotic factors affect a given community.**	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. Students should be able to explain how a change in an abiotic factor would affect a given community given appropriate data or context. 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. Students should be able to explain how a change in a biotic factor might affect a given community given appropriate data or context. 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.	

2. Adaptations	4 – To identify adaptations in given animal and plant species. 6 – To explain an adaptation for survival in relation to the environment. 8 – To predict how an adaptation may develop in response to changes in the environment.	Students should be able to explain how organisms are adapted to live in their natural environment, given appropriate information. 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.	

3. Food Chains	4 - To describe the components of a simple food chain or food web. 6 - To construct a food chain or food web. 8 - To interpret how changes in a food chain can affect populations.	Students should understand that photosynthetic organisms are the producers of biomass for life on Earth. 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. --- In relation to abundance of organisms students should be able to: • understand the terms mean, mode and median • calculate arithmetic means • plot and draw appropriate graphs selecting appropriate scales for the axes. --- 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. --- Students should be able to interpret graphs used to model these cycles.

4. Using quadrats	4 – To use quadrats to collect data. 6 – To use data to estimate the population of a given organism. 8 – To calculate the population of an organism from data provided.	A range of experimental methods using transects and quadrats are used by ecologists to determine the distribution and abundance of species in an ecosystem. In relation to abundance of organisms students should be able to: • understand the terms mean, mode and median • calculate arithmetic means • plot and draw appropriate graphs selecting appropriate scales for the axes. **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. AT skills covered by this practical activity: biology AT 1, 3, 4 and 6.	REQ PRAC: • 25m tape measure • 50cm × 50cm quadrat • pen • paper • clipboard • two bags labelled A and B, each containing number cards from 1-25
5. Transects	4 – To use a transect line and quadrats to collect valid data. 6 – To collect a full set of results. 8 – To plot and interpret a graph showing plant number against light intensity.	A range of experimental methods using transects and quadrats are used by ecologists to determine the distribution and abundance of species in an ecosystem. In relation to abundance of organisms students should be able to: • understand the terms mean, mode and median • calculate arithmetic means • plot and draw appropriate graphs selecting appropriate scales for the axes. **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. AT skills covered by this practical activity: biology AT 1, 3, 4 and 6.	REQ PRAC: • 30m tape measure • 50cm × 50cm quadrat • light meter • pen • paper • clipboard

<table>
<tr>
<td>6. The water cycle</td>
<td>4 – To recall the stages of the water cycle.
6 – To describe the processes in the water cycle in terms of particles.
8 – To explain how water is cycled in an ecosystem.</td>
<td rowspan="2">Students should:
recall that many different materials cycle through the abiotic and biotic components of an ecosystem
explain the importance of the carbon and water cycles to living organisms.
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 are not expected to study the nitrogen cycle.

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.</td>
<td>PRAC: Making water cycle model
Plastic zip bag, table spoons, beakers 250ml,</td>
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<tr>
<td>7. The carbon cycle</td>
<td>4 – To identify stages in the carbon cycle.
6 – To describe ho carbon is cycled through an ecosystem.
8 – To explain how carbon is cycled as different molecules.</td>
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8. Biodiversity and waste management	4 – To define the term biodiversity. 6 – To describe the human actions which impact on the environment. 8 – To suggest ways to reduced or manage human waste products.	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. 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.	
9. Global warming	4 – To state three greenhouse gases. 6 – To describe the greenhouse effect. 8 – To explain how global warming affects an ecosystem.	Students should be able to describe some of the biological consequences of global warming. Levels of carbon dioxide and methane in the atmosphere are increasing, and contribute to 'global warming'.	

10. Deforestation and land use	4 – To define deforestation. 6 – To describe some ways humans use land. 8 – To explain the consequences of deforestation and 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. Large-scale deforestation in tropical areas has occurred to: • provide land for cattle and rice fields • grow crops for biofuels	
11. Maintaining biodiversity and ecosystems	4 – To recall some human activities which negatively affect biodiversity. 6 – To suggest some positive actions humans can have on the ecosystems. 8 – To predict how the earth will change if more positive impacts are not made.	Students should be able to describe both positive and negative human interactions in an ecosystem and explain their impact on 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.	