# Scheme of work

## Combined Science: Trilogy - Foundation

## Biology – Ecology

This resource provides guidance for teaching the Ecology topic from our new GCSE in Combined Science; Trilogy (Biology) 8464. It has been updated from the draft version to reflect the changes made in the accredited specification.

There has been a small change to the wording of the required practical in section 4.7.2.1. In additions some minor changes have been made to the specification in sections 4.7.1.1 Communities, 4.7.2.1 Levels of organisation, 4.7.2.2 How materials are cycled, 4.7.3.4 Deforestation and 4.7.3.5 Global warming and 4.7.3.6 Maintaining biodiversity. These alterations have not required changes to the scheme of work.

The scheme of work is designed to be a flexible medium term plan for teaching content and development of the skills that will be assessed.

It is provided in Word format to help you create your own teaching plan – you can edit and customise it according to your needs. This scheme of work is not exhaustive; it only suggests activities and resources you could find useful in your teaching.

### 4.7 Ecology

### 4.7.1 Adaptations, interdependence and competition

| **Spec ref.** | **Summary of the specification content** | **Learning outcomes**  *What most students should be able to do* | **Suggested timing (hours)** | **Opportunities to develop scientific communication skills** | **Opportunities to develop and apply practical and enquiry skills** | **Self/peer assessment**  **Opportunities and resources**  *Reference to past questions that indicate success* |
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| 4.7.1.1 | Communities | An ecosystem is the interaction of a community of living organisms 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.  Tropical rainforests and ancient oak woodlands are stable communities. | 1 | Define ecosystem, community and habitat.  Examine the range of biodiversity in a tropical rainforest and woodland and how organisms are interdependent within each ecosystem. | Investigate the different communities within the school boundaries. | [Exampro user guide Powerpoint](http://filestore.aqa.org.uk/resources/science/AQA-GCSE-SCIENCE-EXAMPRO-UG.PPTX) |
| 4.7.1.2 | Abiotic factors | 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. | 1 | Students research the range of temperatures and altitudes where life is commonly found.  Give students the list of abiotic factors in the learning outcomes and ask them to sort out whether these factors are relevant/important/critical to different organisms eg: deer, grasses, dandelions, spiders, seals, fish, seaweed, pigeons etc.  Relate the abiotic factors with the biodiversity of the area. | Investigate the effect of abiotic factors on the behaviour of woodlice using light/dark and dry/damp choice chambers.  Investigate how the size of nettle or similar leaves is affected by the amount of light falling on the leaves using a transect. |  |
| 4.7.1.3 | Biotic factors | 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, such as the introduction of grey squirrels into southern Britain outcompeted the native red squirrels. | 1 | Define the characteristics that all living things have in common (MRSGREN).  Define biotic factors and describe how changes in the biotic factors can keep a balance in an ecosystem.  Describe an example of a new species outcompeting others: the red/grey squirrel problem and how a new strain of squirrels (the black squirrel) might alter populations of greys.  There are also similar examples of the American Bullfrog and the common frog, as well as Chinese knotweed. | Students can investigate an area of the school grounds within a quadrat and list the biotic and abiotic factors. | Give students pictures of different ecosystems and ask them to describe the biotic and abiotic factors within them. |
| 4.7.1.4 | Adaptations | 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. | 1 | Label the adaptions for an animal and plant adapted for desert conditions.  Label the adaptions for an animal and plant adapted for arctic conditions.  Describe a range of different extremophiles and the environments in which they live. | Examine the adaptations of a range of animals and plants for different environments using secondary sources.  If camel/polar bear done at KS3, students should choose different organism ie kangaroo rat, thorny devil, Mojave yucca in the desert; elephant seal, killer whale, Dry as flowers in low temperatures. |  |

### 4.7.2 Organisation of an ecosystem

| **Spec ref.** | **Summary of the specification content** | | **Learning outcomes**  *What most students should be able to do* | **Suggested timing (hours)** | | **Opportunities to develop scientific communication skills** | **Opportunities to develop and apply practical and enquiry skills** | **Self/peer assessment**  **Opportunities and resources**  *Reference to past questions that indicate success* |
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| 4.7.2.1 | Levels of organisation  **Required practical: Field investigations**  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. | 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 which makes glucose by photosynthesis.  Producers are eaten by primary consumers, which in turn may be eaten by secondary consumers and then tertiary consumers.  Consumers that 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. | | 1 | Recall and define predators and prey, herbivore, carnivore, omnivore from KS3.  Recall food webs and how energy is transferred around an ecosystem.  Students should record how the numbers of prey and predators develop and plot population graphs of these.  Create a graph that illustrates the changes in a predator prey relationship.  Provide a range of population graphs and ask pupils to describe/explain /predict what has happened or will happen to populations as predators or prey change.  [GCSE Bitesize – Predator and Prey Populations](http://www.bbc.co.uk/schools/gcsebitesize/science/edexcel_pre_2011/environment/populationsandpyramidsrev5.shtml)    [Wolves versus Moose graph](https://1millionmonkeystyping.files.wordpress.com/2014/02/differential-3.jpg)    [Prey to Predator Cycle graph](https://localannarbor.files.wordpress.com/2015/02/predator-prey-model.jpg) | | Students can simulate the changing numbers of predators and prey using print outs of foxes and rabbits, or similar predator/prey duos.  Distribute three pictures of prey across a table.  With closed eyes, a pupil throws a picture of a predator into the prey on a table. If the predator touches a prey, it eats to survive another throw.  If it doesn’t, it starves and the preys reproduce (double the number of prey). Repeat with new predator (into six preys this time). The predator can only reproduce if it catches three preys.  Repeat this simulation for around ten generations (if the deer are wiped out, then reintroduce three new deer).  Students should record how the numbers of prey and predators develop and plot population graphs of these. |  | |
| 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 are not expected to study the nitrogen cycle.  Students should be able to explain the role of microorganisms in cycling materials through an ecosystem.  Decay of dead plants and animals by microorganisms returns carbon to the atmosphere as carbon dioxide and mineral ions to the soil. | | 2 | Recall the water cycle from KS2. Label a diagram to show the stages, highlighting the changes from gas to liquid.  Draw and label the carbon cycle, including the processes.  Draw and label a diagram of the decay cycle. | | Students can draw an outline of the water cycle on clear ziplock bags, add a small quantity of water and then stick to sunny windows.  The water should evaporate within the bag and then condense to run back down into the bag (precipitation).  Ask students to discuss what is good and not so good about the model and how they would improve it.  Students model the movement of carbon around the cycle by using balloons to simulate the carbon.  Give students different roles, such as rabbits, foxes, trees, algae (in the sea), microbes.  The processes such as respiration combustion and photosynthesis will be the students who walk different numbers of balloon around the cycle. |  | |

### 4.7.3 Biodiversity and the effect of human interaction on ecosystems

| **Spec ref.** | **Summary of the specification content** | **Learning outcomes**  *What most students should be able to do* | **Suggested timing (hours)** | **Opportunities to develop scientific communication skills** | **Opportunities to develop and apply practical and enquiry skills** | **Self/peer assessment**  **Opportunities and resources**  *Reference to past questions that indicate success* | |
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| 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 gases such as sulphur dioxide, which contributes to acid rain  • on land, from landfill and from toxic chemicals such as pesticides and herbicides, which may be washed from land into water.  Pollution kills plants and animals which can reduce biodiversity. | 1 | Colour in a local map where the land is being used by humans (ie it is no longer ‘wild’).  Students should examine the range of organisms living in peat bog areas, including the carnivorous plants such as sundews.  Describe how peat is formed in waterlogged soil and how it locks away carbon dioxide. Students should plot a graph to show how peat bog wetlands have disappeared or been damaged. | Students should list the resources (ie food and water) they have used and the things they have thrown away over the last 24 hours. Include how many times they have flushed a toilet.  Students can find out how long different materials in a bin take to decay and plot a bar graph to show different times. | |  |
| 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. | 1 | Students should give advantages and disadvantages to chopping down the trees in the Lorax.  Compare the advantages and disadvantages of deforestation  [WWF – Deforestation](http://www.worldwildlife.org/threats/deforestation)  Create a line graph to show the amount of deforestation in the Amazon over in the last 30 years.  Data from :  [National Geographic – Amazon deforestation slows as Brazil tightens prevention](http://voices.nationalgeographic.com/2009/11/13/amazon_deforestation_slows/)  [Mongabay.com – Calculating Deforestation figures for the Amazon](http://rainforests.mongabay.com/amazon/deforestation_calculations.html)  Describe the outcomes of large scale deforestation. | Use a map to identify local quarries, towns, farming land and waste dumps.  Demonstrate burning peat into limewater to highlight how much carbon dioxide is produced. | |  |
| 4.7.3.4 | Deforestation | Large-scale deforestation in tropical areas has occurred to:   * provide land for cattle and rice fields to provide more food * grow crops from which biofuels, based on ethanol, can be produced.   This destruction of large areas of trees has:   * increased the release of carbon dioxide into the atmosphere (because of burning and the activities of microorganisms) * reduced the rate at which carbon dioxide is removed from the atmosphere by photosynthesis and ‘locked up’ in wood for hundreds of years * led to reduction in biodiversity of both plant species and the animals that live there. | 1 | Ask students to describe the causes and consequences of global warming.  Create a poster describing the greenhouse effect and how it contributes to global warming.  Students can examine the data for the increased levels of carbon dioxide in the atmosphere and describe the consequences of it, including low of habitat, migration pattern changes and changes in species.  Examine data for polar bear populations, distribution of mosquitos across Europe and tufted duck migratory patterns. | Use excerpts from Dr Seuss book ‘The Lorax’.  Students should examine how areas of the Amazon rainforest have changed due to deforestation. | |  |
| 4.7.3.5 | Global warming | Levels of carbon dioxide and methane in the atmosphere are increasing, and contribute to ‘global warming’.  Biological consequences of global warming include:   * loss of habitat when low-lying areas are flooded by rising sea levels * changes in the distribution of species in areas where temperature or rainfall has changed * changes to the migration patterns of animals | 1 | Define biodiversity.  Explain how waste, deforestation and global warming have an impact on biodiversity.    In groups of four, students can research and summarise biodiversity in different ecosystems, highlighting:   * the need for biodiversity * the threats to biodiversity * the evidence for biodiversity reduction * the steps being taken to preserve biodiversity. | Students can role play the effect of greenhouse effect.  Students can be the Earth and Sun, some heat and some greenhouse gases. In the first instance, have only one greenhouse gas. Heat students walk to the Earth, most escape back into space, but the greenhouse gas pupil traps one heat.  Repeat this with many greenhouse gas students, this time many more will be trapped. | |  |
| 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 due to the interdependencies 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. | 2 | Describe the different programmes put in place to reduce the human impact on the environment.  Examine pictures of artificial reefs that have been designed to encourage biodiversity and compare the range of organisms before and after.  Examine pictures of hedgerows compared to wire fences and describe what organism might be supported in hedgerows.  Write a job description for someone with the responsibility for protecting biodiversity.  Discuss what pressures there may be on maintaining biodiversity in certain areas. |  | |  |
| 4.7.3.6 | Maintaining biodiversity | Scientists and concerned citizens have put in place programmes to reduce these negative effects on ecosystems and biodiversity.  These include:   * breeding programmes for endangered species * protection and regeneration of rare habitats such as coral reefs, mangroves, and heathland * 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. | 1 |  | Students can collect different waste materials and make a 3D collage to highlight the impact of human waste.  Find out the range of different careers that exist to protect biodiversity. | |  |