Cranedale
Centre

GCSE AQA Biology at The Cranedale Centre

(September 2016 Onwards)

Our objective is to make our GCSE field courses a richly rewarding experience for students; stimulating their ecological awareness, developing enquiring minds and inspiring students to widen their ecological experience both during and after the course.

The 2016 AQA Biology specification offers many exciting new opportunities and challenges for biology students. To meet this challenge the Cranedale Centre has developed many new field studies units for students working towards a new course.

At GCSE, topic 4.7 *Ecology* has highly relevant content covered in Cranedale field studies.

Equally at GCSE, topic 4.6 *Inheritance, variance and evolution* has numerous aspects that we are able to cover through our fieldwork investigations.

Teachers also have the option of also undertaking one of the 10 compulsory core practicals, and completing work which would complement a further one of the practicals whilst at the Centre.

Furthermore, we hope that by the end of the fieldtrip, students will have come across 6 of the 8 apparatus and techniques skills and are able to show progression in the mastery of the skills associated with the 'Working Scientifically' aspects of the formal exams.

Finally, a special feature of a course at the Cranedale Centre is that we are able to shape a course to your specific needs, choices and course duration. Inevitably the key decision will not be what to include, but what to leave out!

Our fieldwork topics are tailored to coach students through the much of the content of GCSE Topic 4. Each fieldwork topic is planned with a lab-based introduction in the morning and a full day of studies in the field (with a wide range of field equipment). With the aid of iPads, student data is collated in the field, producing means and graphs which allow interpretation of their results. This data can also be emailed back to school. Evening activities more often take the format of practical outdoor experiences that cover unique and exciting aspects of the syllabus.

Cranedale Centre

Required Practical Activities

Out of the 10 'Required Practicals' each student must accomplish for AQA GCSE, Practical 9 can be completed as part of a field course at the Centre should you want to include it.

Practical 9: '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'.

We are also able to offer an activity that will complement the completion of Practical 1 through the use of a light microscope to draw a living freshwater invertebrate.

Practical 1: 'Use a light microscope to observe, draw and label a selection of plant and animal cells. A magnification scale must be included'.

Use of Apparatus and Techniques Skills (AT)

In addition, courses at the Cranedale Centre provide opportunities for students to develop many of the skills associated with apparatus and techniques now required by all GCSE Biology specifications. Of the AT skills required by AQA, the following 6 skills will be encountered during a field course:-

AT 1) use appropriate apparatus to make and record a range of measurements accurately, including length, area, mass, time, temperature, volume of liquids and gases, and pH.

AT 3) use appropriate apparatus and techniques for the observation and measurement of biological changes and/or processes.

AT 4) safe and ethical use of living organisms (plants or animals) to measure physiological functions and responses to the environment.

AT 6) application of appropriate sampling techniques to investigate the distribution and abundance of organisms in an ecosystem via direct use in the field.

AT 7) use of appropriate apparatus, techniques and magnification, including microscopes, to make observations of biological specimens and produce labelled scientific drawings.

AT 8) use of appropriate techniques and qualitative reagents to identify biological molecules and processes in more complex and problem-solving contexts including continuous sampling in an investigation.

Cranedale Centre

Mathematical Requirements (MS)

Exams will include questions allowing students to demonstrate associated mathematical skills with content knowledge and their ability to apply these mathematical skills. Depending on the time and topics chosen, a Cranedale fieldtrip offers practical experience of the following mathematical skills at GCSE:

MS 1a Recognise and use expressions in decimal form

MS 1b Recognise and use expressions in standard form

MS 1c Use ratios, fractions and percentages

MS 1d Make estimates of the results of simple calculations

MS 2b Find arithmetic means

MS 2c Construct and interpret frequency tables and diagrams, bar charts and histograms

MS 2e Understand simple probability

MS 2f Understand the terms mean, mode and median

MS 2h Make order of magnitude calculations

MS 3a Understand and use the symbols: =, <, <<, >>, >, ∝, ~

MS 3b Solve simple algebraic equations

MS 4a Translate information between graphical and numeric form

MS 4c Plot two variables from experimental or other data

Working Scientifically (WS)

Skills for working scientifically will be assessed across all GCSE papers. We endeavour to foster the practical skills necessary for students to demonstrate their competence in all aspects of scientific enquiry. This includes; a critical appreciation of methods, application of skills, the processing and interpretation of results, evaluating their studies and considerations of margins of error, precision and accuracy. Of the 27 skills students are required to be able to demonstrate, we aim to deliver the following 16 through a Cranedale field trip:

WS 1.3 Appreciate the power and limitations of science and consider any ethical issues which may arise

WS 1.4 Explain everyday and technological applications of science; evaluate associated personal, social, economic and environmental implications; and make decisions based on the evaluation of evidence and arguments

WS 1.5 Evaluate risks both in practical science and the wider societal context, including perception of risk in relation to data and consequences

WS 2.2 Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena

WS 2.3 Apply a knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment

WS 2.4 Carry out experiments appropriately having due regard for the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations

WS 2.5 Recognise when to apply a knowledge of sampling techniques to ensure any samples collected are representative

WS 2.6 Make and record observations and measurements using a range of apparatus and methods

WS 2.7 Evaluate methods and suggest possible improvements and further investigations

WS 3.1 Presenting observations and other data using appropriate methods

WS 3.3 Carrying out and represent mathematical and statistical analysis

WS 3.5 Interpreting observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form), including identifying patterns and trends, making inferences and drawing conclusions

WS 3.7 Being objective, evaluating data in terms of accuracy, precision, repeatability and reproducibility and identifying potential sources of random and systematic error

WS 3.8 Communicating the scientific rationale for investigations, methods used, findings and reasoned conclusions through paper-based and electronic reports and presentations using verbal, diagrammatic, graphical, numerical and symbolic forms

WS 4.1 Use scientific vocabulary, terminology and definitions

WS 4.4 Use prefixes and powers of ten for orders of magnitude

Cranedale Centre

Fieldwork Topics at the Cranedale Centre AQA 2016

The following is a summary of the AQA fieldwork topics that are on offer at the Cranedale Centre and gives an overall flavour of what students can expect to cover. The specific syllabus links relevant to each topic can be found in an adjoining document on our website.

Biodiversity in Freshwater

Students design and carry out fieldwork to identify how changes in biotic and abiotic factors affects the freshwater communities, meaning this is a session which can easily be used to fulfil Required Practical 9. Students will use quadrats and kick sample to measure the abundance of all freshwater species and identify them using hand-lenses and dichotomous keys. Abiotic variables including dissolved oxygen concentration, nitrate and turbidity are measured and used to conclude how and why communities differ. Students then utilise their own primary data to evaluate conflicting evidence regarding the future conservation of native species. Students also have the opportunity to use a light microscope at low power to make a scientific drawing of an olive mayfly nymph. Students highlight adaptations and then use the formula (magnification = size of image / size of actual object) to establish an appropriate scale for their individual drawings.

Freshwater Pollution

Chalk streams are globally rare habitats. Renowned for their pristine water quality and fragility they are becoming increasingly threatened by human activity. Pocklington Beck exhibits areas of superb biological richness as well as the impact of sewage treatment and fertiliser run off from nearby agricultural land. Students assess the impact of the distribution of aquatic organisms within the stream environment to assess the consequences of pollution. Students visit and kick sample control and polluted stream sites, identifying pollution-indicator species using hand-lenses and dichotomous keys. Abiotic variables are also measured including oxygen, heavy metals, ammonium, nitrate and phosphate for eutrophication, as well as temperature, pH, turbidity and conductivity. Students will discuss how human interactions have led to changes between areas of the stream and impacted upon stream biodiversity.

Rocky Shore Ecology

The peninsula of Filey Brigg (SSSI) has tremendous opportunities for students to test two shores with contrasting wave powers, meaning this is a session which can easily be used to fulfil Required Practical 9. Students design their own study, and participate in a range of classic fieldwork techniques (such as belt transects and random sampling with quadrats) to gather robust primary data. Differences in the populations of limpets and the effect of desiccation on seaweed are two of the most popular studies. Students will measure abiotic variables including refractometers for seawater salinity, anemometers for wind speed and a site-specific wave height chart to establish if these affect the communities present.

Cranedale Centre

Biomass in Marine Ecosystems

Filey Brigg (SSSI) is a biologically rich rocky shore environment which provides a dramatic and engaging ecosystem for fieldwork. Students place random quadrats within the inter-tidal zone and quantify the biomass of organisms found whilst also observing adaptations of species found. The efficiency of biomass and energy transfers between trophic levels are then quantified and the students use their own primary data to construct pyramids of biomass. Students may also be able to visit Bempton Cliffs SSSI to view spectacular seabird assemblages from 130m high chalk cliffs. As top carnivores, seabirds indicate the health of an ecosystem and students are able to evaluate evidence and data concerning climate change and conservation of iconic species such as the gannet or puffin.

Biomass in Food Production

Students will visit two contrasting agricultural-ecosystems and learn how the efficiency of food production might be improved by restricting energy transfer from food animals to the environment. Students calculate and contrast the efficiency of biomass transfer of indoor commercial breed pigs and outdoor rare breed pigs. Punnett square diagrams are completed using genetic trees of rare breed pigs that students will get to meet. Students also use observations of the characteristics of the pig herd to interpret and predict the results of a genetic cross. Students will get to meet the farmers at the two contrasting systems and hear first-hand about selective breeding of individuals and how the systems are run. Students are then encouraged to evaluate personal, social, economic and environmental implications of both farm practise.

Biodiversity and Ecosystem Change

Students will be introduced to an afforested area and a contrasting deforested peat-bog in the North York Moors National Park and will establish positive and negative human interactions in the two ecosystems and their impacts on biodiversity. Students will compare the plant and animal biodiversity of the two sites and assess the potential for carbon storage. Links to the implications of deforestation and destruction of peat bogs will be discussed, and how these are both impacting on biodiversity. The role of these two ecosystems in the carbon cycle and the importance of the cycle to living organisms will also be highlighted. Students will use their own primary data to evaluate social, environmental and economic implications and decide how ecosystems should be managed. Students summarise why conservation of these sites is important for biodiversity and how they have a role in storing carbon and reducing carbon dioxide emissions.

Cranedale Centre

Population Studies

Whilst at Cranedale, dependent upon the number of studies chosen, students are able to participate in a range of highly engaging evening fieldwork activities that explore population dynamics. These include;

Owl Pellet Dissection
Using light microscopes at low power students safely use instruments to dissect barn owl pellets to help illustrate the relationship between predators and prey. The adaptations which enable barn owls to capture prey are also highlighted.

Natural Selection in Cepaea nemoralis
Students explore the allele's effects on shell phenotype in this species which wears its genes on its banded back. Woodland and grassland habitats are sampled to investigate whether selection is at work.

Cranedale Centre

Syllabus Links covered by the Cranedale Centre AQA 2016

The following document provides the syllabus links which the Cranedale Centre will cover for each fieldwork topic.

Biodiversity in Freshwater
Topic 4 (7.1.2): Abiotic factors
Topic 4 (7.1.2): Change in an abiotic factor would affect a given community
Topic 4 (7.1.3): Biotic factors
Topic 4 (7.1.3): Change in a biotic factor might affect a given community
Topic 4 (7.1.4): Adaptations
Topic 4 (7.2.1): Range of experimental methods using transects and quadrats
Topic 4 (7.3.2): Pollution can occur in water, from sewage or fertiliser
Topic 4 (1.1.5): Carry out calculations involving magnification, real size and image size using the formula (magnification = size of image / size of real object)

Freshwater Pollution
Topic 4 (7.1.2): Abiotic factors
Topic 4 (7.1.2): Change in an abiotic factor would affect a given community
Topic 4 (7.1.4): Adaptations
Topic 4 (7.2.1): Range of experimental methods using transects and quadrats
Topic 4 (7.3.2): Pollution can occur in water, from sewage or fertiliser
Topic 4 (7.3.6): Describe both positive and negative human interactions in an ecosystem and explain their impact on biodiversity

Rocky Shore Ecology
Topic 4 (6.3.1): Individual organisms within a particular species show a wide range of variation for a characteristic
Topic 4 (7.1.2): Abiotic factors
Topic 4 (7.1.2): Change in an abiotic factor would affect a given community
Topic 4 (7.1.4): Adaptations
Topic 4 (7.2.1): Range of experimental methods using transects and quadrats
Topic 4 (7.2.4): Impact of environmental change
Topic 4 (7.2.4): Environmental changes affect the distribution of species

Biomass in Marine Ecosystems
Topic 4 (7.1.1) Suggest how organisms are adapted to the conditions in which they live
Topic 4 (7.1.4): Adaptations
Topic 4 (7.4.2): Construct accurate pyramids of biomass from appropriate data

Biomass in Food Production
Topic 4 (7.4.2): Construct accurate pyramids of biomass
Topic 4 (7.4.3): Explain how biomass is lost between the different trophic levels
Topic 4 (7.4.3): Not all ingested material is absorbed
Topic 4 (7.4.3): Calculate the efficiency of biomass transfers between trophic levels by percentages

Topic 4 (7.5.2): Efficiency of food production can be improved by restricting energy transfer from food animals to the environment
Topic 4 (6.1.6) Complete a Punnett square diagram and extract and interpret information from genetic crosses and family trees
Topic 4 (6.1.6) Use direct proportion and simple ratios to express the outcome of a genetic cross
Topic 4 (6.1.6) Understand the concept of probability in predicting the results of a single gene cross
Topic 4 (6.2.3) Selective breeding

Biodiversity and Ecosystem Change
Topic 4 (7.3.1): Explain how deforestation and global warming have an impact on biodiversity
Topic 4 (7.2.2): Explain the importance of the carbon cycle to living organisms
Topic 4 (7.2.2): Interpret and explain the processes of the carbon cycle
Topic 4 (7.3.3): 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, and animal species that live there (biodiversity)
Topic 4 (7.3.3): Understand the conflict between the need for cheap available compost to increase food production and the need to conserve peat bogs and peatlands as habitats for biodiversity and to reduce carbon dioxide emissions.
Topic 4 (7.3.4): Deforestation
Topic 4 (7.3.5): Levels of carbon dioxide in the atmosphere are increasing, and contribute to 'global warming'
Topic 4 (7.3.6): Describe both positive and negative human interactions in an ecosystem and explain their impact on biodiversity
Topic 4 (7.3.6) Protection of rare habitats

Population Studies
Topic 4 (6.1.6): Genetic inheritance
Topic 4 (6.1.6) Explain the terms allele, dominant, recessive, homozygous, heterozygous, genotype, phenotype
Topic 4 (6.3.1) Individuals with characteristics most suited to the environment are more likely to survive to breed successfully
Topic 4 (6.1.6) Understand the concept of probability in predicting the results of a single gene cross
Topic 4 (1.1.5): Carry out calculations involving magnification, real size and image size using the formula (magnification = size of image / size of real object)