



Cranedale Centre
Supporting the Edexcel B Biology Syllabus 2015



Our objective is to make our A Level 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 2015 Edexcel B 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 AS/A Level, topic 3 *Classification and Biodiversity* has highly relevant content covered in Cranedale field studies.

Equally at A Level, topics 8 *Origins of Genetic Variation* and 10 *Ecosystems* have numerous aspects that we are able to cover through our fieldwork investigations.

In a full field trip, teachers have the option of also undertaking 7 out of the 16 required core practicals whilst at the Centre.

Furthermore, we hope that by the end of the fieldtrip, students will have come across 8 of the 12 apparatus and techniques skills and are able to show progression in the mastery of the practical competencies outlined in the Common Practical Assessment Criteria (CPAC).

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!



Overview

Our fieldwork topics are tailored to coach students through much of the content of AS/A Level Topic 3 and A Level Topics 8 and 10 examined in Papers 1, 2 and 3. Each fieldwork topic is planned with a lab-based introduction in the morning and a full day of studies in the field (often with a wide range of field equipment). With the aid of iPads, student data can be collated, producing means, statistical calculations and graphs which allow students to instantly interpret their results in the field. This data can also be emailed back to school. Evening sessions more often take the format of practical outdoor experiences that cover unique and exciting aspects of the syllabus.

Practical Endorsement

As part of a wider field course at the Centre, students could complete practical fieldwork fulfilling the competencies of the Common Practical Assessment Criteria (CPAC). We also can provide opportunities for students to gather data from a range of environments for the additional Level 3 Extended Research Project qualification.

Practical Skills (PS)

We endeavour to foster the practical skills necessary for students so that they are able to demonstrate their competency in all aspects of the scientific enquiry; encouraging them to apply themselves and their understanding of scientific ideas to fieldwork. These skills would include, a critical appreciation of methods, application of skills, the processing and interpretation of results, evaluating their studies and considerations towards margins of error, precision and accuracy. We also aim to widen perspectives, broaden the skills and deepen the knowledge required by the A Level whilst hopefully inspiring students about Biology and future career possibilities.

Core Practical Activities

Out of the 16 'Core Practicals' each student must accomplish for A Level, Practicals 1, 2, 4, 7, 11, 15 and 16 will be able to be completed as part of a wider field course at the Centre if required.

Practical 1: Investigate a factor affecting the initial rate of an enzyme controlled reaction.

Practical 2: Use of the light microscope including eyepiece micrometer and drawing small numbers of cells

Practical 4: Investigate the effect of sucrose concentrations on pollen tube growth

Practical 7: Dissect and insect to show the structure of a gas exchange system

Practical 11: Investigate the presence of chloroplast pigments using chromatography

Practical 15: Investigate the effect of different sampling methods on estimates of the size of a population.

Practical 16: Investigate the effect of one abiotic factor on the distribution or morphology of one species.



Apparatus and Techniques (AT)

Depending upon time and topics chosen, courses at the Cranedale Centre will provide opportunities for students to develop many of the skills associated with apparatus and technique; required by all A-level Biology specifications. Of the skills required by Edexcel (Appendix 5c) the following 8 skills will be encountered during a field course:-

- 1) use appropriate apparatus to record a range of quantitative measurements (to include mass, time, volume, temperature, length and pH)
- 2) use appropriate instrumentation to record quantitative measurements, such as a colorimeter or photometer
- 4) use of a light microscope at high power and low power, including use of a graticule
- 5) produce a scientific drawing from observation with annotations
- 8) safely and ethically use organisms to measure: plant or animal responses, physiological functions
- 10) safely use instruments for dissection of an animal organ, plant organ
- 11) use sampling techniques in fieldwork
- 12) use ICT such as computer modelling, or data logger to collect data, or use software to process data

Mathematical Requirements (MS)

At least 10% of the marks assessing either AS or A-level Biology will assess mathematical skills. Depending on the time and topics chosen, a Cranedale fieldtrip offers practical experience of the following mathematical skills at AS and A-level:

- A 0.1 Recognise and make use of appropriate units in calculations
- A 0.3 Use of ratios and calculations of percentages
- A 0.4 Estimate results
- A 1.1 Use appropriate number of significant figures
- A 1.10 Standard deviation & standard error
- A 1.11 Calculating percentage error
- A 1.2 & 1.6 Mean, median and mode
- A 1.3 & MS 1.7 Constructing and interpretation of graphs, scattergraphs, bar charts, histograms
- A 1.4 Understand the principles of sampling as applied to scientific data
- A 1.4 Use words probability and chance
- A 1.9 Selecting and using a statistical test (including Chi², SRCC & T-test)
- A 2.2 Change the subject of an equation (including $NPP = GPP - R$)
- A 2.3 & 2.4 Substitute numerical values into algebraic equations (including Simpsons Index)
- A 4.1 Calculate the circumferences, surface areas and volumes of regular shapes



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

Syllabus Links Common to Most Fieldwork Days

Topic 3 (3.1) Classification

Topic 3 (3.1 i) Know that the classification system consists of a hierarchy of domain, kingdom, phylum, class, order, family, genus, species.

Topic 3 (3.1 ii) Understand the limitations of the definition of a species as a group of organisms

Topic 3 (3.2) Natural Selection

Topic 3 (3.2 i) Understand how evolution can come about through natural selection acting on variation bringing about adaptations

Topic 3 (3.2 ii) Understand how organisms occupy niches according to physiological, behavioural and anatomical adaptations

Topic 3 (3.3) Biodiversity

Topic 3 (3.3 i) Simpson's Diversity Index

Topic 10 (10.1 i) Understand what is meant by the term ecosystem and that they range in size.

Topic 10 (10.1 iv) Know the ecological techniques used to assess abundance and distribution of organisms in a natural habitat, including types of quadrat, transects, ACFOR scales, % cover and individual counts.

Topic 10 (10.1 v) Be able to select appropriate ecological techniques according to the ecosystem and organisms to be studied.

Rocky Shore Ecology

Topic 3 (3.2 ii) Understand how organisms occupy niches according to physiological, behavioural and anatomical adaptations.

Topic 10 (10.1 iv) Know the ecological techniques used to assess abundance and distribution of organisms in a natural habitat, including types of quadrat, transects, ACFOR scales, % cover and individual counts.

Topic 10 (10.1 v) Be able to select appropriate ecological techniques according to the ecosystem and organisms to be studied

Topic 10 (10.1 vi) Be able to use statistical tests to analyse data, including t-test, correlation coefficient and Spearman's rank.

CP 16: Investigate the effect of one abiotic factor on the distribution or morphology of one species taking into account the safe and ethical use of organisms.

Marine Conservation

Topic 10 (10.4) Human effects on ecosystems

Topic 10 (10.4 i) Understand data relating to human influences on ecosystems, including climate change and depletion of biological resources, including overfishing.

Topic 10 (10.4 ii) Understand the ethical and economic reasons (ecosystem services) for the maintenance of biodiversity.

Topic 10 (10.4 v) Understand the idea that sustainability of resources depends on effective management of the conflict between human needs and conservation, as illustrated by attempts to conserve fish stocks and reduce possible causes of climate change.



Marine Energetics

Topic 3 (3.2 ii) Understand how organisms occupy niches according to physiological, behavioural and anatomical adaptations.

Topic 3 (3.3 i) Know that biodiversity can be assessed within a habitat using Simpson's Biodiversity Index

Topic 10 (10.1 ii) Understand what is meant by trophic levels.

Topic 10 (10.1 iii) Understand the advantages and disadvantages of pyramids of numbers, biomass (dry) and energy as useful representations of ecosystem structure and how biomass and energy are transferred within them.

Topic 10 (10.2 i) Understand how energy is transferred between trophic levels using the terms 'net primary productivity' and 'gross primary productivity'.

Topic 10 (10.2 ii) Be able to calculate the efficiency of energy transfer between different trophic levels and account for the loss of energy at each level.

Freshwater Energetics

Topic 3 (3.2 ii) Understand how organisms occupy niches according to physiological, behavioural and anatomical adaptations.

Topic 3 (3.3 i) Know that biodiversity can be assessed within a habitat using Simpson's Biodiversity Index

Topic 10 (10.1 ii) Understand what is meant by trophic levels.

Topic 10 (10.1 iii) Understand the advantages and disadvantages of pyramids of numbers, biomass (dry) and energy as useful representations of ecosystem structure and how biomass and energy are transferred within them.

Topic 10 (10.2 i) Understand how energy is transferred between trophic levels using the terms 'net primary productivity' and 'gross primary productivity'.

Topic 10 (10.2 ii) Be able to calculate the efficiency of energy transfer between different trophic levels and account for the loss of energy at each level.

Sustainable Woodland Ecosystems

Topic 10 (10.4) Human effects on ecosystems

Topic 10 (10.4 i) Understand data relating to human influences on ecosystems, including climate change and depletion of biological resources, including overfishing.

Topic 10 (10.4 ii) Understand the ethical and economic reasons (ecosystem services) for the maintenance of biodiversity.

Topic 10 (10.4 v) Understand the idea that sustainability of resources depends on effective management of the conflict between human needs and conservation, as illustrated by attempts to conserve fish stocks and reduce possible causes of climate change.



Agricultural Energetics

Topic 8 Origins of Genetic Variation

Topic 8 (8.1 i) Understand that mutations are the source of new variations and that the processes of random assortment and crossing over during meiosis give rise to new combinations of alleles in gametes.

Topic 8 (8.2 ii) Understand how random fertilisation during sexual reproduction brings about genetic variation.

Topic 8 (8.2 i) Understand the terms, genotype and phenotype, homozygote and heterozygote, dominance, recessive, codominance and multiple alleles.

Topic 8 (8.2 ii) Be able to construct genetic crosses and pedigree diagrams

Topic 10 (10.1 ii) Understand what is meant by trophic levels.

Topic 10 (10.1 iii) Understand the advantages and disadvantages of pyramids of numbers, biomass (dry) and energy as useful representations of ecosystem structure and how biomass and energy are transferred within them.

Topic 10 (10.2 i) Understand how energy is transferred between trophic levels using the terms 'net primary productivity' and 'gross primary productivity'.

Topic 10 (10.2 ii) Be able to calculate the efficiency of energy transfer between different trophic levels and account for the loss of energy at each level.

Chalkland Succession

Topic 3 (3.2 ii) Understand how organisms occupy niches according to physiological, behavioural and anatomical adaptations.

Topic 10 (10.3 i) Understand how ecosystems can develop overtime, including use of the terms colonisation and successions and types of climax communities.

Topic 10 (10.1 iv) Know the ecological techniques used to assess abundance and distribution of organisms in a natural habitat, including types of quadrat, transects, ACFOR scales, % cover and individual counts.

Topic 10 (10.1 v) Be able to select appropriate ecological techniques according to the ecosystem and organisms to be studied.

Sand Dune Succession

Topic 3 (3.2 ii) Understand how organisms occupy niches according to physiological, behavioural and anatomical adaptations.

Topic 10 (10.3 i) Understand how ecosystems can develop overtime, including use of the terms colonisation and successions and types of climax communities.

Topic 10 (10.1 iv) Know the ecological techniques used to assess abundance and distribution of organisms in a natural habitat, including types of quadrat, transects, ACFOR scales, % cover and individual counts.

Topic 10 (10.1 v) Be able to select appropriate ecological techniques according to the ecosystem and organisms to be studied



Wetland Succession

Topic 3 (3.2 ii) Understand how organisms occupy niches according to physiological, behavioural and anatomical adaptations.

Topic 10 (10.3 i) Understand how ecosystems can develop overtime, including use of the terms colonisation and successions and types of climax communities.

Topic 10 (10.1 iv) Know the ecological techniques used to assess abundance and distribution of organisms in a natural habitat, including types of quadrat, transects, ACFOR scales, % cover and individual counts.

Topic 10 (10.1 v) Be able to select appropriate ecological techniques according to the ecosystem and organisms to be studied.

Population Studies

Topic 8 (8.2 i) Understand the terms, genotype and phenotype, homozygote and heterozygote, dominance, recessive, codominance and multiple alleles.

Topic 8 (8.3 i) Understand that selection pressures acting on the gene pool change allele frequencies in the population, including; stabilising selection, disruptive selection.

Topic 8 (8.3 ii) Understand that sometimes changes in allele frequencies can be the result of chance and not selection, e.g. genetic drift.

Topic 8 (8.3 iii) Understand that allele frequencies can be influenced by: population bottlenecks and the founder effect.

Topic 8 (8.3 iv) Understand how the Chi-squared test can be used in genetic studies and how the Hardy-Weinberg equation can be used to monitor changes in the allele frequencies in a population