



## Higher National Unit specification

### General information

**Unit title:** Ecology and Ecosystems (SCQF level 7)

**Unit code:** H93A 34

**Superclass:** RH

**Publication date:** May 2015

**Source:** Scottish Qualifications Authority

**Version:** 01

### Unit purpose

This Unit is designed to enable learners to understand key aspects of ecology and ecosystems, encompassing the abiotic and biotic factors affecting ecosystems and the structure and conservation of biological communities. Learners will also develop practical skills in techniques relevant to ecology and ecosystems. The Unit is suitable for learners studying at HNC level, and will provide the necessary underpinning knowledge and skills to enable progression to further study of environmental science at HND level or to seek employment in countryside management, game keeping or science based industries.

### Outcomes

On successful completion of the Unit the learner will be able to:

- 1 Describe key ecological principles and factors affecting ecosystems.
- 2 Describe factors affecting the development and conservation of selected ecosystems.
- 3 Perform practical activities related to ecology and ecosystems.

### Credit points and level

1 Higher National Unit credit at SCQF level 7: (8 SCQF credit points at SCQF level 7)

### Recommended entry to the Unit

Entry is at the discretion of the centre, however it is recommended that learners should have experience of Biology or Environmental Science at Higher level.

## Higher National Unit Specification: General information (cont)

**Unit title:** Ecology and Ecosystems (SCQF level 7)

### Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes for this Unit specification.

There is no automatic certification of Core Skills or Core Skill components in this Unit.

### Context for delivery

If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

The Assessment Support Pack (ASP) for this Unit provides assessment and marking guidelines that exemplify the national standard for achievement. It is a valid, reliable and practicable assessment. Centres wishing to develop their own assessments should refer to the ASP to ensure a comparable standard. A list of existing ASPs is available to download from SQA's website (<http://www.sqa.org.uk/sqa/46233.2769.html>).

### Equality and inclusion

This Unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website [www.sqa.org.uk/assessmentarrangements](http://www.sqa.org.uk/assessmentarrangements).

## Higher National Unit specification: Statement of standards

**Unit title:** Ecology and Ecosystems (SCQF level 7)

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment. Learners should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

### Outcome 1

Describe key ecological principles and factors affecting ecosystems.

#### Knowledge and/or Skills

- ◆ Key ecological concepts: ecosystem, biome, habitat, population, community, biotic, abiotic, niche, biodiversity, keystone species
- ◆ Energy flow
- ◆ Abiotic factors: edaphic, climatic, aquatic
- ◆ Interspecific and trophic relationships: predation, grazing, competition, mutualism, commensalism, parasitism
- ◆ Succession: primary, secondary
- ◆ Biogeochemical cycling: water, carbon, nitrogen
- ◆ Population dynamics

### Outcome 2

Describe factors affecting the development and conservation of selected ecosystems.

#### Knowledge and/or Skills

- ◆ Structure and typical species of selected ecosystems
- ◆ Natural factors affecting ecosystems
- ◆ Anthropogenic factors affecting ecosystems
- ◆ Conservation of ecosystems

### Outcome 3

Perform practical activities related to ecology and ecosystems.

#### Knowledge and/or Skills

- ◆ Investigating ecosystems
- ◆ Working safely, within current health and safety regulations
- ◆ Field techniques
- ◆ Recording observations and results
- ◆ Evaluation skills
- ◆ Result analysis and conclusions

## Higher National Unit specification: Statement of standards (cont)

**Unit title:** Ecology and Ecosystems (SCQF level 7)

### Evidence Requirements for this Unit

Written and/or oral recorded evidence for Outcome 1 should be assessed using a closed-book assessment under supervised conditions. The assessment will use a sampling approach to the Knowledge and/or Skills as detailed below. It is recommended that the assessment be completed within one hour.

Written and/or oral recorded evidence for Outcome 2 should be assessed using an open-book assessment.

Written and/or oral recorded evidence for Outcome 3 should be assessed by production of a full report, or by completion of an appropriate pro forma. An assessor's observation checklist could be used to record performance evidence of practical activities

#### Outcome 1

The assessment will sample 5 of the 7 Knowledge and/or Skills items. However, the item 'define five key ecological concepts' must be assessed on each occasion. Learners will not have prior knowledge of which items are being assessed. Those items which are not sampled must be covered in the alternative (re-sit) assessment.

Where an item is sampled, a learner's response will be judged satisfactory where the evidence shows that the learner can:

- ◆ Define five key ecological concepts from the following: ecosystem, biome, habitat, population, community, biotic, abiotic, niche, biodiversity, keystone species.
- ◆ Describe energy flow within one example of a food chain/food web.
- ◆ Describe two abiotic factors within ecosystems from the following: edaphic, climatic, aquatic.
- ◆ Describe three types of interspecific or trophic relationships within ecosystems from the following: predation, grazing, competition, mutualism, commensalism, parasitism.
- ◆ Describe the processes of primary and secondary succession.
- ◆ Describe biogeochemical cycling in ecosystems.
- ◆ Describe two influences affecting population dynamics from the following: density dependent and density independent factors on population size, carrying capacity, predator/prey population cycles.

#### Outcome 2

The assessment will cover all of the Knowledge and/or Skills items. A learner's response will be judged satisfactory where the evidence shows that the learner can:

- ◆ Describe the structure of two selected ecosystems to include the typical species present, with examples of producers, consumers and detritivores.
- ◆ Describe the natural factors affecting two selected ecosystems.
- ◆ Describe the anthropogenic factors affecting two selected ecosystems.
- ◆ Describe features of two selected ecosystems that call for conservation, and explain how this can be achieved.

## Higher National Unit specification: Statement of standards (cont)

**Unit title:** Ecology and Ecosystems (SCQF level 7)

### Outcome 3

Learners will perform a minimum of two practical activities, the content of which will be related to Outcomes 1–2. A learner's response will be judged satisfactory where the evidence shows that the learner can achieve all of the following:

- ◆ Follow instructions to investigate ecosystems.
- ◆ Work in a safe manner regarding current health and safety regulations.
- ◆ Use field techniques appropriate to the activity – to include sampling and measurement of biological and abiotic components of the ecosystem, and identification of species.
- ◆ Record observations and results clearly and accurately.
- ◆ Evaluate validity of results in terms of sources of errors.
- ◆ Analyse results correctly and state valid conclusions.

An assessor observation checklist will be used to record the learner's performance of the practical work in line with given instructions and health and safety requirements.

Learners may report results either by production of a full report, or by completion of an appropriate pro forma. Where a pro forma approach is deployed, the pro forma will not present information or assistance to the learners on how to correctly perform calculations, analyse experimental results or experimental errors. Learners will be expected to perform such activities independently on the basis of the experimental data.

Where a learner does not perform an assessed practical activity to the required standard, they will be given the chance to either reattempt the same practical activity, or to undertake a different practical activity of similar complexity. Where a report or pro forma does not meet required standard, then the learner will be given a single opportunity to re-draft. If the required standard is still not attained, then an alternative practical activity will be set.



## Higher National Unit Support Notes

**Unit title:** Ecology and Ecosystems (SCQF level 7)

Unit Support Notes are offered as guidance and are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

### Guidance on the content and context for this Unit

This Unit is intended as part of the framework for HNC/HND Applied Sciences, HND Applied Biological Sciences, Applied Chemical Sciences and HNC Countryside and Environmental Management but may be suitable for inclusion in other HN awards. It is designed to develop the theoretical and practical aspects of ecology and ecosystems.

#### Outcome 1 — Describe key ecological principles and factors affecting ecosystems

It is envisaged that definitions of ecological concepts would not be taught in isolation, but in context throughout the Outcome. Key ecological concepts to be defined could include ecosystem, biome, habitat, population, community, biotic, abiotic, ecological niche, biodiversity and keystone species as well as concepts included below.

Energy flow within ecosystems would include autotrophs (producers), heterotrophs (consumers), decomposers and detritivores, primary productivity, trophic levels, transfer of energy between levels, food chains and webs, pyramids and calculations of energy transfer efficiency.

Abiotic factors could include edaphic factors (soil types, profile development, pH, moisture); climate, weather and aspect; aquatic factors (light, water movement, oxygen, temperature, nutrient levels including eutrophication and thermal stratification).

Interspecific and trophic relationships could include examples of the following: predation, grazing, competition, mutualism, commensalism and parasitism.

The process of succession could include descriptions of: primary and secondary succession, pioneer species, changes over course of succession, features of the climax community.

Biogeochemical cycling in ecosystems could include the processes of water, carbon and nitrogen cycles, organic and inorganic components of cycles, appreciation of bacterial activity in nitrogen cycle and the importance of decomposition and reuse.

Population dynamics could include: density dependent and density independent factors influencing population size, concept of carrying capacity and predator/prey population cycles.

## Higher National Unit Support Notes (cont)

**Unit title:** Ecology and Ecosystems (SCQF level 7)

### **Outcome 2 — Describe factors affecting the development and conservation of selected ecosystems**

This Outcome could be taught by means of a series of introductory classes outlining the structures of some typical ecosystems, together with one or more site visits where learners would be encouraged to take note of the features, structure and species of the ecosystems, as well as land use and conservation issues.

Various natural factors which might affect the ecosystems could include: soil/rock types, exposure, aspect, climate, drainage.

Anthropogenic factors could include: past land use, recreational use, forestry, farming, effects of pollution, effects of introduced species.

Conservation efforts would include methods that are used or could be used to increase biodiversity, ameliorate pollution and protect endangered species in the ecosystems as applicable.

### **Outcome 3 — Perform practical activities related to ecology and ecosystems**

Guidance on suitable practical activities for assessment purposes is given elsewhere in this document. However, it is envisaged that learners will also participate in a range of other practical activities which will both develop their practical skills and support the theory covered in Outcomes 1 and 2.

In carrying out such activities, learners should carry out or be familiar with risk assessments on all practical activities undertaken. Opportunities should be taken to develop awareness of the sources of error and of the accuracy of measurements, as appropriate.

## **Guidance on approaches to delivery of this Unit**

Although the Outcomes in this Unit could be delivered separately, it is envisaged that combining aspects of the Outcomes together will provide the opportunity to relate the theoretical aspects of ecology to actual examples of ecosystems. For example, visits to local ecosystems as part of Outcomes 2 and 3 could provide the opportunity to give real examples to illustrate the theoretical aspects covered in Outcome 1.

Delivery of Outcome 1 covers the key ecological principles in a theoretical format, but should be illustrated with reference to as many examples as possible. Practical activities would provide the opportunity to illustrate these key principles.

Delivery of Outcome 2 could use a combination of site visits and/or research on examples of ecosystems. The ecosystems may be part of local nature reserves, parks or urban green spaces as well as woodlands, coastal ecosystems, water bodies, etc in the area. Other examples could include nationally important areas, eg uplands which could be covered by research alone on the part of the learner.

A range of ecosystems should be covered and it is recommended that several local ecosystems or local nature reserves should be visited in order to give learners the opportunity to observe real examples.

## Higher National Unit Support Notes (cont)

**Unit title:** Ecology and Ecosystems (SCQF level 7)

Delivery of Outcome 3 could involve more local fieldwork, and is suitable for delivery in conjunction with the site visits in Outcome 2. This would provide learners with the opportunity for additional practical activities and data gathering.

### Guidance on approaches to assessment of this Unit

Evidence can be generated using different types of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

Outcome 1 could be assessed by a closed-book assessment with an appropriate cut-off score that covers the sampling requirements as detailed in the Evidence Requirements. Assessment should be carried out in supervised conditions, and it is recommended that the assessment be completed within 60 minutes.

Where evidence of Outcome 1 is assessed by sampling, the whole of the content listed in the Knowledge and/or Skills must be taught and available for assessment. Learners should not know in advance the items on which they will be assessed, and different items should be sampled on each assessment occasion. Any items not sampled in the first assessment, must be included in the alternative (re-sit) assessment.

Outcome 2 could be assessed by an open-book assessment, either by completion of short reports or via presentations, detailing the development and conservation of a minimum of two selected ecosystems. Learners will decide, in consultation with their lecturer, the topics to be covered.

If presentations are chosen, an assessor observation checklist along with copies of the presentations should be retained as evidence of performance for each learner.

Where a learner does not meet the required standard they will be given the chance to either reattempt the same topics, or to undertake different topics of similar complexity. If the required standard is still not attained, then alternative topics will be set.

In Outcome 3 learners are required to undertake two assessed practical activities, the content of which will be related to Outcomes 1–2. The activities should be largely field-based exercises on the distribution of organisms within an area or ecosystem and the factors affecting their distribution. Examples of suitable activities are given below. However, this list is not prescriptive, and other activities of similar complexity may be used by the centre.

When devising suitable activities, one or more of the following features could be included in fieldwork for the activity:

- ◆ Distribution of selected species within a habitat or ecosystem.
- ◆ Effect of an abiotic factor on the distribution of species.
- ◆ Comparison of habitats or ecosystems.
- ◆ Various sampling methods — appreciation of random sampling (simple, systematic and stratified) — using quadrats, line transects, sweep netting, kick sampling, etc.
- ◆ Measurement of abiotic factors, eg light, soil pH, soil moisture, soil type, turbidity, flow rate.



## Higher National Unit Support Notes (cont)

**Unit title:** Ecology and Ecosystems (SCQF level 7)

- ◆ Consideration of biotic factors — height of surrounding vegetation, mowing or grazing regime, shading, effect of predation, competition.

Various habitats and ecosystems could be chosen, including terrestrial ecosystems such as grassland, urban green space, farmland, woodland, moorland, and aquatic ecosystems such as ponds, streams, wetlands, rocky shore or sand dunes.

Suitable activities include:

- ◆ Autecological study of a species and a biotic or abiotic factor affecting its distribution.
- ◆ The influence of light levels on distribution of species in a woodland ecosystem.
- ◆ Comparison of distribution of lichen species in different habitats or in relation to pollution levels.
- ◆ Influence of pH or other water qualities on distribution of invertebrate species.
- ◆ Distribution of species related to tidal zones.
- ◆ A stage or stages of succession observed in an ecosystem.

Assessed practical activities are suitable for group activity, though they may be performed individually. Assessors should ensure that each member of a group has participated satisfactorily in all aspects of the practical work and that they have contributed to data collection. Analysis of results and conclusions and preparation of reports and/or completion of pro formas must be the learner's own work.

An exemplar instrument of assessment with marking guidelines has been produced to indicate the national standard of achievement at SCQF level 7.

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

### Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at [www.sqa.org.uk/e-assessment](http://www.sqa.org.uk/e-assessment).

### Opportunities for developing Core and other essential skills

The delivery and assessment of this Unit will provide learners with the opportunity to develop the Core Skills of *Problem Solving* at SCQF levels 3, 4 and 5, *Information and Communication Technology (ICT)* at SCQF level 4 and *Working with Others* at SCQF level 5.

## Higher National Unit Support Notes (cont)

**Unit title:** Ecology and Ecosystems (SCQF level 7)

### ***Information and Communication Technology (ICT)— Providing/Creating Information at SCQF level 4***

Learners will be required to use the internet to search for and select suitable information in order to complete the short report or presentation on a selected ecosystem in Outcome 2.

### ***Problem Solving— Reviewing and Evaluating at SCQF level 3***

Following assessed practical activities learners will be required to review and evaluate the effectiveness of the procedures in terms of the results obtained. Learners will be required to reach conclusions on the basis of the data collected.

### ***Problem Solving— Planning and Organising at SCQF level 4***

Learners will be required to plan, organise and search for information in order to complete the short report or presentation on two selected ecosystems for Outcome 2.

### ***Problem Solving— Reviewing and Evaluating at SCQF level 5***

Learners will be required to develop an approach in order to identify, assess and explain the relevance of information in order to complete the short report or presentation on two selected ecosystems in Outcome 2.

### ***Working with Others — Working Co-operatively with Others at SCQF level 5***

There are opportunities to develop the practical activities of Outcome 3 as a co-operative activity working as part of a group.

In addition, given that the Unit embraces the principles of sustainable development, broader skills development in the areas of enterprise, employability, sustainable development and citizenship are integral to this curriculum area. Inevitably learners will improve these skills through completion of the Unit.

## History of changes to Unit

Version	Description of change	Date

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## General information for learners

### Unit title: Ecology and Ecosystems (SCQF level 7)

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

This is a 1 credit Unit at SCQF level 7, which you are likely to be studying as part of the first year of an HNC/HND programme. Before progressing to this Unit it would be beneficial to have experience of Biology or Environmental Science at Higher level, where you will have learned underpinning aspects of ecology and ecosystems. There will be a strong emphasis on the major concepts of ecology and ecosystems, and the practical skills associated with ecological fieldwork.

On completion of the Unit you should be able to:

- 1 Describe key ecological principles and factors affecting ecosystems.
- 2 Describe factors affecting the development and conservation of selected ecosystems.
- 3 Perform practical activities relating to ecology and ecosystems.

#### Outcome 1

In Outcome 1 you will cover key ecological principles and you will become familiar with the factors affecting ecosystems. You will discover how energy flow and relationships between organisms are crucial in the development and structure of ecosystems. The theoretical knowledge will be illustrated by site visits and practical work.

#### Outcome 2

In Outcome 2 you will have the opportunity to visit local ecosystems, for example woodland or grassland, to investigate the structure of the ecosystem, the species present and the factors that affect the ecosystem. You will also consider conservation issues. You will study two ecosystems in depth, which may be ecosystems you have visited or other suitable ecosystems which you have researched.

#### Outcome 3

For Outcome 3 you will undertake practical activities, for example investigating the factors that affect the distribution of species in an ecosystem or comparing habitats. During the practical activities you will have the opportunity to learn skills in fieldwork such as sampling methods, identification of species and measurement of abiotic factors. In carrying out these activities you will be able to develop your skills in observation, recording information, analysing and reporting data, as well as your ability to work safely in the field.

#### Assessment

For Outcome 1 you could take a closed-book assessment.

For Outcome 2 you could take an open-book assessment. This could be in the form of short reports or presentations on two chosen ecosystems.

Outcome 3 will take the form of two practical activities, for which you will report your results by completion of a full report, or by completion of pro forma report.

## **General information for learners (cont)**

**Unit title:** Ecology and Ecosystems (SCQF level 7)

### **Core Skills**

Although there is no automatic certification of Core Skills in the Unit, you will have opportunities to develop the Core Skills of *Problem Solving* at SCQF levels 3, 4 and 5, *Information and Communication Technology (ICT)* at SCQF level 4 and *Working with Others* at SCQF level 5.