SCQF level 6
Unit Specification

Environmental Science: Living Environment

SCQF: level 6 (6 SCQF credit points)

Unit code: J261 76

Unit outline

The general aim of this Unit is to develop skills of scientific inquiry, investigation, analytical thinking and independent working, along with knowledge and understanding of the living environment. Learners will apply these skills when considering the applications of the living environment on our lives, as well as the implications on society and the environment. This can be done by using a variety of approaches, including investigation and problem solving.

The Unit covers the key areas of investigating ecosystems and biodiversity; interdependence; human influences on biodiversity.

Learners will research issues, apply scientific skills and communicate information related to their findings, which will develop skills of scientific literacy.

Learners who complete this Unit will be able to:

1 Apply skills of scientific inquiry and draw on knowledge and understanding of the key areas of this Unit to carry out an experiment/ practical investigation

2 Draw on knowledge and understanding of the key areas of this Unit and apply scientific skills

This Unit is available as a free-standing Unit. The Unit Specification should be read in conjunction with the *Unit Support Notes*, which provide advice and guidance on delivery, assessment approaches and development of skills for learning, skills for life and skills for work. Exemplification of the standards in this Unit is given in *Unit Assessment Support*.

Recommended entry

Entry to this Unit is at the discretion of the centre. However, learners would normally be expected to have attained the skills, knowledge and understanding required by one or more of the following or equivalent qualifications and/or experience:

- National 5 Environmental Science Course or relevant component Units
- National 5 Geography Course or relevant component Units
- National 5 Biology Course or relevant component Units

In terms of prior learning, relevant experiences and outcomes may also provide an appropriate basis for doing this Unit.

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. For further information, please refer to the *Unit Support Notes.*

Standards

Outcomes and assessment standards

Outcome 1

The learner will:

1 Apply skills of scientific inquiry and draw on knowledge and understanding of the key areas of this Unit to carry out an experiment/practical investigation by:

1.1 Planning an experiment/practical investigation
1.2 Following procedures safely
1.3 Making and recording observations/measurements correctly
1.4 Presenting results in an appropriate format
1.5 Drawing valid conclusions
1.6 Evaluating experimental procedures

Outcome 2

The learner will:

2 Draw on knowledge and understanding of the key areas of this Unit and apply scientific skills by:

2.1 Making accurate statements
2.2 Solving problems

Evidence Requirements for the Unit

Assessors should use their professional judgement, subject knowledge and experience, and understanding of their learners, to determine the most appropriate ways to generate evidence and the conditions and contexts in which they are used.

The key areas covered in this Unit are:

- investigating ecosystems and biodiversity
- interdependence
- human influences on biodiversity

The *Unit Support Notes* (Appendix) provide details of skills, knowledge and understanding sampled in the Unit assessment.

The following table describes the evidence for the Assessment Standards.

Assessment Standard	Evidence required
Planning an experiment or practical investigation	A plan that must include: ♦ a clear statement of the aim ♦ a dependent and independent variable ♦ variables to be kept constant ♦ observations and/or measurements to be made ♦ necessary equipment and/or materials ♦ a clear and detailed description of how the experiment or practical investigation should be carried out, including safety considerations
Following procedures safely	Record showing that the learner was observed following procedures safely.
Making and recording observations/measurements correctly	Raw data recorded in a relevant format, for example a table. Repeated measurements, where appropriate. Where measurements are repeated, averages must be calculated.
Presenting results in an appropriate format	One format from: line graph, bar graph, scatter graph or other appropriate format
Drawing a valid conclusion	A conclusion that includes reference to the aim, and is supported by the data.
Evaluating experimental procedures	Two evaluative statements, with justifications, about the procedures used.
Making accurate statements and solving problems	Achievement of at least 50% of the total marks available in a holistic assessment. The assessment must **not** be split into smaller sections, such as individual key areas.

Exemplification of assessment is provided in *Unit Assessment Support*.

Assessment Standards thresholds

Outcome 1
Learners are not required to show full mastery of the Assessment Standards to achieve Outcome 1. Instead, five out of the six Assessment Standards for Outcome 1 must be met to achieve a pass. Learners must be given the opportunity to meet all Assessment Standards.

Outcome 2
Learners are assessed using a holistic test that covers Assessment Standards 2.1 and 2.2. To gain a pass for Outcome 2, learners must achieve 50% of more of the total marks available in the assessment.

Transfer of evidence

Evidence for the achievement of Outcome 1 for this Unit can be used as evidence of Outcome 1 in the SCQF level 6 Units: *Environmental Science: Earth's Resources* (J264 76) and *Environmental Science: Sustainability* (J266 76).

Evidence for the achievement of Outcome 2 for this Unit is **not** transferable between the SCQF level 6 Units: *Environmental Science: Earth's Resources* (J264 76) and *Environmental Science: Sustainability* (J266 76).

Re-assessment

SQA's guidance on re-assessment is that there should be only one or, in exceptional circumstances, two re-assessment opportunities. Re-assessment must be carried out under the same conditions as the original assessment and must be of equal demand.

Outcome 1
Learners can either re-draft their original Outcome 1 report or carry out a new experiment/practical investigation.

Outcome 2
Learners must have a full re-assessment opportunity that consists of a holistic assessment. For Outcome 2, learners must achieve 50% of the total marks available in the re-assessment.

Development of skills for learning, skills for life and skills for work

It is expected that learners will develop broad, generic skills through this Unit. The skills that learners will be expected to improve on and develop through the Unit are based on SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work* and drawn from the main skills areas listed below. These must be built into the Unit where there are appropriate opportunities.

1 Literacy

1.2 Writing

2 Numeracy

2.1 Number processes
2.2 Money, time and measurement
2.3 Information handling

4 Employability, enterprise and citizenship

4.6 Citizenship

5 Thinking skills

5.3 Applying
5.4 Analysing and evaluating
5.5 Creating

Amplification of these is given in SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work.* The level of these skills should be at the same SCQF level of the Unit and be consistent with the SCQF level descriptor. Further information on building in skills for learning, skills for life and skills for work is given in the *Unit Support Notes.*

Appendix: Unit Support Notes

Introduction

These support notes provide advice and guidance on developing skills, knowledge and understanding for the unit assessment. They should be read in conjunction with:

- *Unit Assessment Support*

Developing skills, knowledge and understanding

Teachers and lecturers are free to select the skills, knowledge and understanding, and contexts that are most appropriate for delivery in their centres.

Skills, knowledge and understanding for the Unit assessment

The following information provides details of skills, knowledge and understanding sampled in the Unit assessment.

Living Environment

1 Investigating ecosystems and biodiversity

Learners should be familiar with the definitions of the following terms, and be able to use them appropriately:

Abiotic, adaptation, biodiversity, biological oxygen demand, biotic, biotic index, capture-mark-recapture, density, dissolved oxygen concentration, distribution, diversity index, ecosystem, ecosystem diversity, frequency, genetic diversity, interquartile range, Lincoln index, percentage cover, quadrat, qualitative data, quantitative data, random sampling, relative abundance, reliability, simple random sampling, Simpson's biodiversity index, species, species diversity, species richness, standard deviation, stratified random sampling, systematic random sampling, transect, Trent biotic index, validity

This list is not exhaustive, and terms listed here may apply in more than one area.

a. Assessing biodiversity

- **Biodiversity classifications**
  Ecosystem diversity, species diversity, genetic diversity

- **Species richness and relative abundance**

b. Sampling plants and animals

- **Qualitative techniques**
  Construction and use of paired statement keys

- **Quantitative techniques**
  An understanding of the assessment of density; relative abundance; percentage cover; frequency; distribution (biotic and biodiversity indices, to include Simpson's biodiversity index for terrestrial species, Trent biotic index for aquatic species, and Lincoln index for capture-mark-recapture). Learners are not required to learn formulae.

- **Sampling techniques**
  Transect (point, line, and belt); quadrat, including use for assessing density, percentage cover, frequency, and relative abundance; capture-mark-recapture; evaluation of invasive and non-invasive sampling techniques.

- **Randomisation and statistical analysis in sampling**
  Random sampling (simple, systematic, and stratified); determination of mean, median, and mode; determination of standard deviation and interquartile range; reliability and validity of results. Learners are not required to learn formulae.

c. Measuring abiotic factors

- **Aquatic**
  Temperature, water flow rate, dissolved oxygen content, biological oxygen demand (BOD), pH, salinity, tidal effects

- **Terrestrial**
  Temperature, light intensity, soil (moisture, pH, and nutrients), wind velocity (speed and direction), precipitation, slope

- **Effects of abiotic factors on the frequency and distribution of organisms**

2 Interdependence

Learners should be familiar with the definitions of the following terms, and be able to use them appropriately:

Assimilation, autotroph, biomass, carnivore, carrying capacity, climax community, community, competition, density-dependent, density-independent, ecological efficiency, ectotherm, edaphic, endotherm, exponential population growth model, grazing, gross primary productivity, herbivore, heterotroph, interdependence, inter-specific competition, intra-specific competition, logistic population growth model, net primary productivity, niche, omnivore, parasitism, population, population crash, population dynamics, population oscillation, population overshoot, predator-prey cycle, primary productivity, primary succession, respiration, secondary productivity, secondary succession, seral stages, succession, trophic, trophic level

This list is not exhaustive, and terms listed here may apply in more than one area.

a. Succession

- **Seral succession in primary and secondary succession**

- **Influence of climate, abiotic, and edaphic factors on succession**

- **Characteristics of a climax community**
  Stable community, high biodiversity, complex food webs, high biomass

b. Energy conversion, transfer and loss in food chains and webs

- **Primary productivity — gross and net**
  Gross primary productivity (GPP) is the rate at which autotrophs produce biomass in a given area and time period. Approximately half the GPP is used by plants for their own respiration. The remainder is either stored or utilised by plants for new biomass production, and is available for consumption by

heterotrophs.
Net primary productivity (NPP) = GPP – respiration

- **Secondary productivity and ecological efficiency**
  Secondary productivity is the assimilation of food into new biomass through the transfer of organic material between trophic levels.

  Ecological efficiency is the percentage of biomass produced by one trophic level that is transferred and incorporated into biomass at the next trophic level. On average, only 10% of the energy that enters a trophic level is passed on to the next trophic level. The remainder is used for respiration and movement, and is lost from the system as heat and indigestible waste. An ecological efficiency of 10% limits most food chains to four or five links, which explains why the volume of biomass typically reduces at each trophic level.

- **Impact of endotherms and ectotherms on energy transfer**
  Endotherms use internally-generated heat to maintain body temperature independent of external temperature change. A high metabolic demand to keep the body warm leaves a minimum of energy for biomass accumulation.

  Ectotherms rely on external environments for temperature control instead of generating their own body heat.

  Ectotherms are more ecologically efficient than endotherms, passing on up to 15% of residual energy to the next trophic level in comparison to approximately 7% by endotherms. Therefore, food chains containing several ectotherm species, particularly marine food chains, are often longer in length.

c. Population dynamics

- **The effects of density-dependent factors on the stability of ecosystems**
  Density-dependent factors reduce a population when numbers are high and allow the population to increase when numbers are low,

  Biotic interactions can act as density-dependent controls on the size of a population, including predator-prey cycles, grazing, competition (inter-specific and intra-specific), and parasitism.

- **Population growth — exponential and logistic population models**
  Population growth depends on the birth rate and death rate. As long as there are sufficient resources available, there will be an increase in the population over time.

  Changes in population growth in response to changes in limiting factors (such as resource availability and/or biotic factors) can be modelled.

  In the exponential growth model, a population increases over time regardless of resource limits or abiotic factors. A graph showing exponential population growth will have a characteristic J-shaped curve.

In nature, exponential growth is not sustainable as eventually a population will exceed resource availability and/or be affected by density-dependent factors.

In the logistic growth model, a population may growth exponentially until it reaches the carrying capacity of the environment, then will slow. A graph showing logistic population growth will have a characteristic S-shaped curve.

In nature, logistic growth is more sustainable than exponential growth, as resource availability and biotic factors ensure that a population growth rate exceeding the carrying capacity can only ever be temporary. Scientists have observed that population oscillations mean that most populations seldom reach the carrying capacity and remain relatively stable overall.

- **Population oscillations — carrying capacity, population overshoot, population crash**
  As populations approach their carrying capacity, there will be insufficient resources to support more offspring. The population may temporarily exceed (overshoot) the carrying capacity and start to die off (crash) because of insufficient resources. The environment will then start to recover due to reduced population pressure, and after a period of time will be able to support increased population growth. This results in a series of population overshoots and crashes known as oscillations.

- **The effects of density-independent factors on the stability of ecosystems**
  Density-independent factors affect the size of a population independent of the population density. These factors tend to be natural disasters.

3 Human influences on biodiversity

Learners should be familiar with the definitions of the following terms, and be able to use them appropriately:

Base flow, diffuse pollution, environmental assessment, environmental impact assessment (EIA), environmental monitoring, groundwater, habitat, habitat destruction, habitat fragmentation, hydrograph, initiative, invasive non-native species (INNS), keystone species, lag time, legislation, marine protected area (MPA), native species, non-native species, peak discharge, peak rainfall, plagioclimax, point pollution, policy, pollution, reforestation, rewilding, runoff, site of special scientific interest (SSSI), strategic environmental assessment (SEA), strategy

This list is not exhaustive, and terms listed here may apply in more than one area.

a. Species reduction or increase through human activities and the influence on biodiversity

- **Habitat fragmentation, destruction, rewilding**

Habitat fragmentation results in the reduction of a large habitat area into smaller, scattered remnants and can have implications for biodiversity, including ecosystem diversity, species diversity, and genetic diversity. Loss of keystone species in particular can have a disproportionate impact on an ecosystem. Fragmentation impacts can include reduction in the total area of the habitat, reduction in the average size of each patch of habitat, and isolation of fragments.

Habitat destruction leaves natural habitat unable to support species and communities within it. This reduces biodiversity, sometimes to the point of extinction.

Rewilding involves activities that initiate or accelerate the recovery of habitats or ecosystems with respect to their health, integrity, and sustainability. These activities can include erosion control, reforestation, use of local native species, removal of non-native species, removal of invasive plants, reintroduction of native species and keystone species, and creation of wildlife or habitat corridors to link habitat fragments.

- **Harvesting practices**
  Introduction of sustainable harvesting practices to limit over-exploitation of resources and reduce impacts on habitats, species, and biodiversity.

- **Reintroduction of nationally extinct species, both current and potential**
  Success, failure, and conflict

- **Point and diffuse pollution of air, land and water**
  Point source pollution is discharged from a single location, usually from a pipe, chimney, or other outlet. Discharges are often individually minor but can combine to form diffuse pollution and have a significant environmental impact.

  Diffuse pollution arises from land use activities spread across large areas that have no specific point of discharge. This includes runoff from farmland, forestry activities, urban areas, roads and sealed surfaces, and industrial premises.

- **Plagioclimax**
  Moorland management for grouse, including muirburn and conservation grazing.

- **Conservation practices**
  Protecting wildlife sites; targeting action on priority species and habitats; embedding consideration of biodiversity in policy and decision-making; engaging people and encouraging behaviour change.

b. Environmental assessment and monitoring

- **Purpose of environmental assessment and monitoring**
  Environmental impact assessment (EIA) aims to protect the environment by ensuring that a local planning authority has full knowledge of possible significant

environmental effects of a proposed development, and mitigation for these, which are taken into account in the decision-making process.

Strategic environmental assessment (SEA) aims to provide a high level of protection of the environment from development. It is mandatory for plans and/or programmes that relate to large-scale changes in land use.

Environmental monitoring describes the processes and activities that need to take place in order to characterise and assess the quality of an environment over time.

- **Use and interpretation of hydrographs in environmental monitoring**
  Peak rainfall; peak discharge; lag time; base flow; factors affecting base flow, including runoff, groundwater, and soil water.

- **Main roles of key environmental agencies in Scotland**
  NatureScot (NS); Scottish Environment Protection Agency (SEPA); Forestry and Land Scotland (FLS) and Scottish Forestry (SF); Marine Directorate.

  Roles common to the named agencies include enforcing legislation; advising Scottish ministers, local authority planners, landowners, land managers, land users, and voluntary organisations; shaping national policies; educating the public; research and monitoring.

  Marine Scotland was renamed the Marine Directorate in 2023. The agency's statutory functions remain unchanged.

  Forestry in Scotland is managed by two agencies:
  — Forestry and Land Scotland looks after, manages, and promotes Scotland's national forests and land, and provides timber supplies.
  — Scottish Forestry is responsible for forestry policy, support and legislation.

- **Key role of sites of special scientific interest (SSSIs) and marine protected areas (MPAs)**

- **Implementation of government policy leading to legislation and initiatives**
  A policy is a plan of action that focuses on a specific target. The methods and principles needed to achieve the policy are set out in a strategy. Legislation and initiatives are then implemented in order to achieve the aims of the strategy and policy. Focus should be on the need for policy, legislation and initiatives. There is no requirement to know specific legislation.

Apparatus and techniques

In addition to the skills, knowledge and understanding listed above, learners must have knowledge of the following pieces of apparatus and techniques. Where it is not possible to carry out a fieldwork technique, learners should be made aware of the purpose and methodology of the technique through teaching.

Apparatus

- beaker
- balance
- measuring cylinder
- dropper/pipette
- test tube
- stopwatch
- funnel
- crucible
- oven
- microscope
- quadrat
- transect
- thermometer
- anemometer
- rain gauge
- floats
- test kits: soil pH, soil nitrate and/or nitrite
- ID cards or keys: plants and animals

Techniques

- qualitative techniques — identification of species using paired statement keys
- quantitative techniques used for sampling plants and animals
- random sampling — simple, systematic, stratified
- measuring abiotic factors
- assessing distribution of species using transect, quadrat, and biotic and biodiversity indices
- assessing population of species using capture-mark-recapture
- interpreting case study documentary evidence, including Ordnance Survey map content, sketch maps, photographic evidence, tabular data, and/or short passages of text. The ability to read and provide grid references is not required.

Reporting experimental and/or fieldwork

Learners should be familiar with the following:

- setting an aim and/or hypothesis
- selecting information: quantitative and qualitative, discrete and continuous
- planning, designing, and undertaking experimental/field work procedures safely
- summarising experimental/fieldwork procedures
- drawing labelled diagrams of experimental/fieldwork apparatus
- presenting data in tabular form, with appropriate headings and units of measurement
- presenting data in graphical form: bar graph, line graph, scatter graph, or other graphical form appropriate to environmental science, with appropriate scales, labels, keys and units, and including a line of best fit (straight or curved) if appropriate, to represent the trend observed in experimental/field work data
- processing data (using calculations and units, where appropriate)
- comparing and/or analysing data sets
- drawing valid conclusions from the data and giving explanations supported by evidence/justification, and related to the aim
- evaluating experimental/field work procedures and suggesting and justifying improvements
- citing and referencing sources of data/information

Calculations

Learners should be familiar with the following methods of calculation:

- measures of average: mean, median
- measures of spread: standard deviation, interquartile range
- ratio
- percentage increase and decrease
- calculations involving number substitution in formulae

Administrative information

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Superclass: QA

History of changes to National Unit Specification

Version	Description of change	Authorised by	Date
2.0	Page 1 – the description of key areas under 'Unit outline' has been revised to give more information Page 3 – in Outcome 1.3, the word 'accurately' has been replaced by 'correctly'; information has been added on Transfer of Evidence Page 4 -the Evidence requirements have been rewritten to better explain what is required	Qualifications Development Manager	April 2014
3.0	Assessment Standards 2.2 & 2.3 removed	Qualifications Development Manager	June 2014
3.1	Assessment standard threshold added	Qualifications Manager	September 2018
4.0	Unit code updated	Qualifications Manager	July 2019
5.0	Refined guidance on Evidence Requirements; removed option for assessment-standard-specific evidence for Outcome 2. Added 'Assessment Standards thresholds' heading to existing information. Refined guidance on re-assessment. Some changes made to the format throughout the document to improve accessibility. Required knowledge, understanding, and skills added to the unit support notes. **What you need to do differently**	Qualifications Manager	August 2025

Version	Description of change	Authorised by	Date
	♦ If you are already assessing outcome 2 holistically at the end of the unit, by using the assessment as a single test with marks and a cut-off score, you don't need to do anything differently. ♦ If you have been assessing outcome 2 atomistically, by assessing each key area and each problem-solving skill separately, you must change to using the holistic approach for outcome 2. You must do this by administering the test in a single sitting, at the end of the unit, and applying the marks and cut-off score in the unit assessment support pack.		