



Higher National Unit specification

General information for centres

Unit title: Forestry: Forest Science

Unit code: F3YW 34

Unit purpose: This Unit is designed to give the candidate knowledge of the environmental and plant physiological factors and processes that affect tree growth.

The Unit is relevant to candidates requiring underpinning knowledge of tree growth in a general or specific context.

On completion of the Unit the candidate should be able to:

- 1 Analyse factors that affect tree growth.
- 2 Produce a collection of woody plants.
- 3 Explain plant physiology, tree growth and development.
- 4 Explain temperate woodland ecosystems in the United Kingdom.

Credit points and level: 2 HN credits at SCQF level 7: (16 SCQF credit points at SCQF level 7*)

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

Recommended prior knowledge and skills: Access to this Unit is at the discretion of the centre. It would be beneficial if candidates had some previous knowledge of earth or biological science evidenced by a Standard Grade or equivalent.

Core Skills: There are opportunities to develop the Written Communication component of the Core Skill of *Communication* to SCQF level 5, although there is no automatic certification of Core Skills or the Core Skills components.

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.

General information for centres (cont)

This Unit is included as mandatory in the frameworks of the following Group Awards:

- ◆ HNC Forestry
- ◆ HND Forestry
- ◆ HNC Arboriculture and Urban Forestry
- ◆ HND Arboriculture and Urban Forestry

The delivery of this Unit could be integrated with F3YC 34 *Establishment of Woodland* to enhance the learning experience of the candidate.

Assessment: The assessment for this Unit could take the form of:

- 1 A project report to display and apply the acquired climatic and soil knowledge (Outcome 1).
- 2 A woody plant collection project involving a collection of wood plant species and cultivars. (Outcome 2).
- 3 Restricted response questions for Outcomes 3 and 4.

Higher National Unit specification: statement of standards

Unit title: Forestry: Forest Science

Unit code: F3YW 34

The sections of the Unit stating the Outcomes, Knowledge and/or Skills, and Evidence Requirements are mandatory.

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. Candidates 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

Analyse factors that affect tree growth

Knowledge and/or Skills

- ◆ Geographic factors
- ◆ Weather and climatic factors
- ◆ Geological factors
- ◆ Soil information

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ analyse geographic information and use this to recommend forestry practice appropriate to a given site. The analysis must include consideration of location, latitude, altitude, aspect, terrain, slope.
- ◆ interpret weather and climatic information and use this to recommend forestry practice appropriate to a given site. This must include consideration of precipitation, temperature, exposure.
- ◆ interpret geological information, and use this to recommend forestry practice appropriate to a given site. The analysis must include consideration of solid geology, drift geology, their characteristics. The information must come from maps.
- ◆ analyse the soil information from a soil survey on site and relevant maps. The soil survey must include vegetation cover, soil profile diagrams, soil horizon identifications and descriptions, identification of soil types and soil influence on tree species and operation choice. Candidates will use this to produce a soil map.

Higher National Unit specification: statement of standards (cont)

Unit title: Forestry: Forest Science

Assessment Guidelines

The evidence of achievement for Outcome 1 could take the form of a project report on a given or an agreed site, supported by appropriate maps, tables and diagrams, that detail the climatic, geological and soil conditions on that site and their influences in relation to tree growth (suggested word limit of 1,200 words or equivalent).

The report could be laid out in the following sections:

- ◆ site location and general description
- ◆ local climatic factors and influences
- ◆ geology of the site
- ◆ soil types of the site
- ◆ summary of species choice for the site based on the above factors

The evidence may be gathered through team work by small groups but the information presented in the report must be the individual candidate's own interpretation of the information gathered as a result of the information search and site visits.

Higher National Unit specification: statement of standards (cont)

Unit title: Forestry: Forest Science

Outcome 2

Produce a collection of woody plants

Knowledge and/or Skills

- ◆ Plant classification systems
- ◆ Morphological characteristics of plants
- ◆ Botanical keys

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they produce a collection of 60 woody plant species or cultivars, accurately labelled according to the binomial system. The collection must demonstrate that the candidate has understood the morphological characteristics, genus, and species of plants. Candidates can use a botanical key to complete these Evidence Requirements.

Assessment Guidelines

It is suggested that the project could be split between 25 conifer and 35 broadleaved species/cultivars.

It is suggested that this project is given to the candidate along with the course joining instructions, where possible, and submitted within the first four weeks of starting the Unit. This will give the candidate the opportunity for self study and allow them to collect and prepare specimens at the most appropriate time of year.

Higher National Unit specification: statement of standards (cont)

Unit title: Forestry: Forest Science

Outcome 3

Explain plant physiology, tree growth and development

Knowledge and/or Skills

- ◆ Photosynthesis and respiration
- ◆ Mineral nutrients
- ◆ Uptake and transport of water, mineral nutrients and metabolites
- ◆ Plant growth substances
- ◆ Vegetative cell division
- ◆ Shoot and root systems
- ◆ Structure of flowers

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can correctly:

- ◆ explain C3 photosynthesis and respiration and the factors affecting the performance of these processes
- ◆ identify the mineral nutrients essential for plant growth and metabolism and explain the role(s) each perform
- ◆ explain the processes, tissues and organs involved in the uptake and transport of water, mineral nutrients and metabolites
- ◆ identify the main plant growth substances and explain the role(s) each fulfil
- ◆ explain vegetative cell division (mitosis) as it relates to the activity of apical and lateral meristems
- ◆ explain how the shoot and root systems of a woody plant develop from meristematic activity and cell differentiation
- ◆ describe the structure of flowers and explain the processes leading to the development of seeds and the concept of seed years

Assessment Guidelines

Please see Assessment Guidelines after Outcome 4.

Higher National Unit specification: statement of standards (cont)

Unit title: Forestry: Forest Science

Outcome 4

Explain temperate woodland ecosystems in the United Kingdom

Knowledge and/or Skills

- ◆ Climax communities and the process of succession
- ◆ Abiotic and biotic factors
- ◆ Distribution of ecosystems
- ◆ Biodiversity, habitats, communities and food webs
- ◆ Decomposition process

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can correctly

- ◆ describe the common woodland ecosystems found in the United Kingdom.
- ◆ explain the abiotic and biotic factors involved in the development of UK woodland systems.
- ◆ explain the term 'biodiversity' and the role of individual species within woodland communities. These must include habitats, communities and food webs.
- ◆ explain the process of succession and identify the key species of two climax communities.
- ◆ explain the importance of the decomposition process and the organisms involved to woodland ecosystems and the communities they support. This must include consideration of decomposers and nutrient cycling.

Assessment Guidelines

It is recommended that Outcomes 3 and 4 be assessed holistically in one assessment event. This could take the form of restricted response questions covering the Knowledge and Skills for each Outcome. Elements **within** each knowledge and skill item could be sampled with a different elements being sampled on each occasion. If sampling is carried out this should be done on a closed-book basis.

Administrative Information

Unit code: F3YW 34
Unit title: Forestry: Forest Science
Superclass category: SB
Original date of publication: August 2008
Version: 01

History of changes:

Version	Description of change	Date

Source: SQA

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Higher National Unit specification: support notes

Unit title: Forestry: Forest Science

This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 80 hours.

Guidance on the content and context for this Unit

This Unit is designed as a mandatory part of the following SQA Group Awards:

- ◆ HNC Forestry
- ◆ HND Forestry
- ◆ HNC Arboriculture and Urban Forestry
- ◆ HND Arboriculture and Urban Forestry

There are opportunities for integration with F3YC 34 *Establishment of Woodland* to assist in the contextualisation of the assessment for Outcome 1.

The content of this Unit should provide the candidate with an understanding of the basics of the underpinning scientific principles in relation to the factors that influence tree growth in the UK.

This Unit should give the candidates the opportunity to visit one or more woodland sites to collect and assess information.

This Unit should encourage actual site assessment.

The following support notes cover the mandatory requirements of the Unit and recommended aspects that could be covered in teaching and learning.

Outcome 1

- ◆ earth's atmosphere
- ◆ earth's circulatory system
- ◆ continental and maritime climates
- ◆ seasonal effect
- ◆ latitude, altitude, aspect, proximity to sea
- ◆ prevailing wind, exposure, rainfall, snow, frost, drought, evapo-transpiration
- ◆ characteristics of weather systems, high pressure and low pressure air masses, frontal systems
- ◆ interpretation of weather station and weather forecast information
- ◆ influence of weather on tree growth: exposure, drought, waterlogging, establishment, disease, fire
- ◆ influence of weather on woodland /forest operations: rain, wind, frost, snow
- ◆ elements, compounds, crystals, minerals (eg mica, quartz, feldspar)
- ◆ identification of sedimentary, igneous and metamorphic rocks: basic identification of sandstone, limestone, conglomerate, schist, gneiss, granite, basalt, slate, shale, marble, flint, fossils
- ◆ origins of sedimentary, igneous and metamorphic rocks
- ◆ drift geology: peat, glacial and river deposits, wind deposits
- ◆ processes of soil formation: physical, chemical, biological and their interaction, the time factor, glaciation

Higher National Unit specification: support notes (cont)

Unit title: Forestry: Forest Science

- ◆ forest soil classification and its importance: dig soil pits, horizon and profile description and interpretation and record findings
- ◆ soil structure, texture and properties: do tests for texture, structure and pH, identify rootability and stoniness and significance of soil colour and smell
- ◆ identification of soil types by means of their horizons and soil profiles
- ◆ soil type and its influence on woodland operations: texture, structure, wetness, dryness, nutrient status
- ◆ soil type and its influence on choice of plant species

Outcome 2

- ◆ classification of living organisms: Animalia, Plantae, Fungi, Monera, Protoctista
- ◆ Linnaeus, binomial system: genus, species, cultivars; meaning of scientific names
- ◆ leaves, flowers and buds, their arrangement on stems, bark
- ◆ requirements for nutrients, moisture, pH, light

Outcome 3

- ◆ C3 photosynthesis (water + carbon dioxide in presence of light energy = sugar), effect of light intensity and quality, temperature, carbon dioxide concentration
- ◆ respiration, gross and net, aerobic and anaerobic
- ◆ macronutrients, micronutrients, trace elements: their role in plant metabolism; deficiencies, visual symptoms
- ◆ transpiration, stomata, water and mineral nutrient uptake, translocation of metabolites
- ◆ abscisic acid, auxin, cytokinins, ethylene and gibberellins: their role in plant growth and development
- ◆ idealised meristematic cell, the process of mitosis, cell division in 3 planes
- ◆ structure of shoot and root apices, structure of cambial layer
- ◆ structure of leaves and buds, phyllotaxy, shoot and root elongation
- ◆ development of secondary xylem and phloem
- ◆ structure of flowers; sepals, petals, stamens, stigma, ovary, ovules
- ◆ pollination process and agencies, fertilisation process, development of fruits and seeds, mast years
- ◆ seed dispersal, seed dormancy, germination process, effect of temperature, moisture and light
- ◆ structure of DNA; double helix, base sequences
- ◆ stages of meiosis; haploid, diploid
- ◆ definition of gene, chromosome, Mendelian inheritance
- ◆ genotypic and phenotypic variation; genetic variation within natural range, ecotypes; seed origin and provenance, their significance in forestry practice
- ◆ tree breeding including progeny testing; hybrid larch; seed orchards

Higher National Unit specification: support notes (cont)

Unit title: Forestry: Forest Science

Outcome 4

- ◆ process of succession, pioneer and climax woodland plant communities
- ◆ woodland types, biotic and abiotic influences, grasslands, moorland
- ◆ concept of habitat, species diversity, food webs
- ◆ the decomposers, nutrient cycling (N, P, K)

Please note that the examples given are for guidance and should not be considered as an exhaustive list.

Guidance on the delivery and assessment of this Unit

Outcome 1

It is suggested that the assessment for this Outcome could be designed to integrate with and form the initial section for the holistic assessment report required in the Unit: F3YC 34 *Establishment of Woodland*. The two Units should run concurrently, where possible, as their subject matter is related. The tutors should jointly agree to use the same site and scenario and agree the assessment brief so that the report is a simulation of actual reports made in the work environment. The assessment is an integral and important learning process for the candidate in preparation for the work place.

The report could be set on a site that could be planted with new forest/woodland cover, a restocking site or established woodland that needs to be redesigned for a specified purpose that would require some replanting.

It is suggested that the site be tailored to meet the needs of the candidates by the design of the assessment reflecting the aims of the award they are studying and prevailing industry needs (ie Forestry or Arboriculture or Community/Urban Forestry).

It is suggested that this assessment should be made available to the candidate midway through the Unit delivery so that data collection and analysis can start in good time.

Likely scenarios for this report could be:

- (a) A report on a given site that displays enough diversity of terrain and vegetation type that would require the candidate, individually or as part of a small team, to utilise maps and site visits to visually survey the area and establish the geology, topographical features, altitude, location and aspect of the area.

It is suggested that the site should require the digging and interpretation of the soil profiles of at least three soil pits that would determine expected different soil types, and therefore the presumption of differing forest operations and species choice.

Higher National Unit specification: support notes (cont)

Unit title: Forestry: Forest Science

The exercise would also require the use and interpretation of climatic data and site factors to determine site micro-climates.

The report should be supported with a location map, a soil map and, if appropriate, a tree species map.

- (b) As above, but in the case of a Distance/Open Learning candidate, for a site of the candidate's choice ie at their work or close to their home, with the caveat that the site has to be agreed as suitable beforehand by the Unit tutor and that there is prior agreement for candidate and possible tutor access to the site by the landowner.

Outcome 2

The evidence for Outcome 2 will take the form of a personal collection of 60 woody plant species or cultivars, accurately labelled according to the binomial system. It is suggested that the project could be split between 25 conifer and 35 broadleaved species/cultivars.

The candidates should be encouraged to collect leaf samples and also twig, flower/cone and fruit samples where appropriate. The leaf samples should be pressed and mounted and given their Latin and common names and the location they were found.

Candidates should be advised to seek permission for sample collection.

It is suggested that this project is given to the candidate along with the course joining instructions, where possible, and submitted within the first two weeks of starting the Unit. This will give the candidate the opportunity for self study and allow them to collect and prepare specimens at the most appropriate time of year.

Outcomes 3 and 4

It is recommended that Outcomes 3 and 4 be assessed holistically as restricted response questions.

Opportunities for developing Core Skills

There are opportunities to develop the Written Communication component of the Core Skill of *Communication* to SCQF level 5 through research and reporting activities.

Higher National Unit specification: support notes (cont)

Unit title: Forestry: Forest Science

Open learning

All Outcomes are appropriate for open and distance learning approaches, and it would be good practice to provide candidate packs and tutor input and support at all stages. Centre-devised supervision agreements should detail any conditions to ensure authenticity of evidence.

Candidates with disabilities and/or additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (www.sqa.org.uk).

General information for candidates

Unit title: Forestry: Forest Science

This Unit is designed to provide you with a basic knowledge of the underlying scientific principles for the establishment, maintenance and growth of woodland/forest trees. The Unit will provide you with the required skills and knowledge to assess a site for its woodland potential and will involve practical site work to help achieve this.

The Outcomes that you will acquire on completion of the Unit are as follows:

Outcome 1 will give you a basic knowledge of geology and soils in relation to their influence on tree growth and the woodland/forest environment and the skills needed to identify rock groupings and soil types in the field. The Unit will also enable you to understand the principles of climate and weather and how it influences tree growth and the woodland/forest environment.

Outcome 2 examines the naming and categorising of plants and animals, leading to the identification of common woody plants and an appreciation of the uses and cultural needs. You will be asked to compile a leaf collection as the assessment for this Outcome and you may be required to do this prior to attending the centre.

Outcome 3 will give you a basic understanding of tree physiology and the factors which influence and control tree growth in relation to environmental factors. It will also provide you with a basic understanding of the growth of the component parts of woody plants from germination to a mature plant, producing seed. In addition, the Unit will provide you with a basic understanding of genetic variation in trees and its relation to choice of planting stock.

Outcome 4 will provide you with a basic understanding of the dynamic processes contributing to woodland ecology and the biodiversity of woodland communities.

This Unit is a mandatory component of the following SQA Group Awards:

- ◆ HNC Forestry
- ◆ HND Forestry
- ◆ HNC Arboriculture and Urban Forestry
- ◆ HND Arboriculture and Urban Forestry

Overall, the knowledge and skills acquired in this Unit will help you understand the influencing factors of tree growth, tree physiology and develop your tree and plant recognition and identification skills.

For candidates already in employment this Unit provides an opportunity to extend existing knowledge and skills and lays a sound grounding for further study in the biological sciences.

This Unit will give you the opportunity to develop the Written Communication component of the Core Skill of *Communication* to SCQF level 5.

You will be assessed in this Unit through establishing a collection of woody plants, and producing a report on tree growth and answering questions on botany.