



Higher National Unit Specification

General information

Unit title: Forest Mensuration and Thinning Control (SCQF level 7)

Unit code: completed by SQA

Superclass: HX5N 34

Publication date: May 2018

Source: Scottish Qualifications Authority

Version: 02

Unit purpose

This unit is designed to develop the relevant knowledge and skills required to measure and forecast the volumes of both felled and standing forest crops and also to plan and carry out thinning operations. The unit would be useful to learners involved in the measurement of timber and standing crops in a forest supervisory/management capacity.

Outcomes

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

- 1 Measure the volume of felled trees and timber.
- 2 Measure the volume of a standing forest crop.
- 3 Apply a thinning regime to a standing forest crop.
- 4 Evaluate the uses of production forecasting in forestry.

Credit points and level

2 Higher National Unit credit(s) at SCQF level 7: (16 SCQF credit points at SCQF level 7)

Recommended entry to the unit

Entry to this unit is at the discretion of the delivering centre, however, learners would benefit from having studied (or being in the process of studying) unit *Forest Harvesting* (HX5P 34) or equivalent.

Higher National Unit Specification: General information (cont)

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Core Skills

Achievement of this Unit gives automatic certification of the following Core Skills component:

Complete Core Skill None

Core Skill component Critical Thinking at SCQF level 5

There are also opportunities to develop aspects of Core Skills which are highlighted in the Support Notes of this Unit specification.

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.

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.

Higher National Unit Specification: Statement of standards

Unit title: Forest Mensuration and Thinning Control (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

Measure the volume of felled trees and timber.

Knowledge and/or skills

- ◆ Measurement methods and conventions for felled timber
- ◆ Individual felled tree volumes
- ◆ Individual log volumes
- ◆ Stack volume
- ◆ Formulae and ready reckoner tables
- ◆ Calculation methods

Outcome 2

Measure the volume of a standing forest crop.

Knowledge and/or skills

- ◆ Measurement conventions for standing timber
- ◆ Measurement method for standing timber
- ◆ Mensuration equipment
- ◆ Field data
- ◆ Volume estimates

Outcome 3

Apply a thinning regime to a standing forest crop.

Knowledge and/or skills

- ◆ Thinning regimes
- ◆ Thinning cycle, intensity and yield
- ◆ Tree selection and marking methods
- ◆ Yield calculation methods
- ◆ Thinning control

Higher National Unit Specification: Statement of standards (cont)

Unit title: Forest Mensuration and Thinning Control (SCQF level 7)

Outcome 4

Evaluate the uses of production forecasting in forestry.

Knowledge and/or skills

- ◆ Reasons for production planning
- ◆ Sources of data
- ◆ Constraints
- ◆ Methods of predicting crop growth and yield
- ◆ Factors influencing felling age and retention
- ◆ Production plans, industry timber demand and marketing

Evidence requirements for this unit

Learners will need to provide evidence to demonstrate their knowledge and/or skills across all outcomes by showing that they can:

Outcome 1

For felled single trees, logs and stack volume:

- ◆ Select an appropriate measurement method
- ◆ Measure and record the necessary measurements while adhering to the measurement conventions
- ◆ Analyse the measurements and carry out the necessary calculations
- ◆ Present the results in a clear and accurate manner. Learners must indicate the source of figures and the nature of the calculation

The evidence will cover the following:

- ◆ Length and mid diameter of four felled trees (including at least one that is greater than 10m in length)
- ◆ Length and top diameter of five logs
- ◆ One stack volume

The exercise should include:

- ◆ Mid-diameter
- ◆ Length
- ◆ Top diameter
- ◆ Over bark or under bark
- ◆ Stack length, height samples, depth (log length)
- ◆ Stack volume: solid volume ratio
- ◆ Use of ready-reckoner and or tables

Higher National Unit Specification: Statement of standards (cont)

Unit title: Forest Mensuration and Thinning Control (SCQF level 7)

Learners should be allowed to use formulae and other ready-reckoner tables and can use a calculator and/or a computer programme. Where formulae and other ready-reckoner tables are used, they must be identified and referenced.

Outcome 2

- ◆ Measure the volume of standing forest trees and crops using appropriate measuring equipment and applying appropriate measuring conventions. Learners will gather field data using sample plots

The learner must:

- ◆ Select an appropriate measurement method for the crop to be measured
- ◆ Accurately measure and record the necessary measurements. Measurements must include:
 - diameter at breast height (DBH)
 - basal area
 - tree height
- ◆ Measuring equipment must include:
 - girth tape or callipers
 - relascope
 - hypsometer or clinometer
- ◆ Analyse the measurements and carry out the necessary calculations to estimate basal area, top height, tariff number and volume
- ◆ Use appropriate tariff tables in the calculation of volume estimates
- ◆ Differentiate between measuring an individual tree and stands of trees
- ◆ Present the results in a clear and accurate manner per hectare and per tree stand

Outcome 3

- ◆ Explain the reasons for thinning a given forest crop. This must include reference to the following:
 - competition
 - production
 - early return
 - amenity
 - access
 - conservation
- ◆ Explain the components of a thinning regime. This must include:
 - thinning type
 - thinning cycle
 - thinning intensity
- ◆ Select an appropriate thinning regime for a standing crop
- ◆ Select the appropriate thinning grade and estimate the required target volume

Higher National Unit Specification: Statement of standards (cont)

Unit title: Forest Mensuration and Thinning Control (SCQF level 7)

- ◆ Select and mark the appropriate trees to be removed to achieve target thinning yield. Learners must be able to identify four of the following tree categories in relation to thinning:
 - wolf trees
 - whips
 - suppressed
 - sub-dominant
 - co-dominant
 - dominant
- ◆ Measure and record the necessary measurements. Learners must assess the sampling intensity and individual plot size for the crop to be thinned and measure the required:
 - top height sample trees
 - basal area
 - diameter breast height
- ◆ Analyse the measurements and carry out the necessary calculations to demonstrate the accurate calculation of thinning yield and that a control stage has been carried out that relates to the thinning yield sample

Outcome 4

- ◆ Evaluate the uses of production forecasting in forestry
- ◆ Explain:
 - what is meant by production forecasting in a forestry context
 - the reasons for production planning including budgeting, industry needs, operational programming
 - where data comes from including compartment records and forest plans
 - the use in production forecasting of yield models, tables and computer software
 - relevant constraints
- ◆ Evaluate the uses of production forecasting in forestry to assess:
 - crop growth
 - yield
 - felling ages
 - reasons for retaining crops
 - industry timber demands and marketing
- ◆ This must include the steps to be followed in a forestry production plan forecast and the limitations of production forecasting in forestry



Higher National Unit Support Notes

Unit title: Forest Mensuration and Thinning Control (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 80 hours.

Guidance on the content and context for this unit

The unit could be undertaken as a standalone unit by learners who are in employment or full-time/part-time learners.

The content of this unit should provide the learner with the necessary knowledge and skills to measure both standing and felled trees and timber; an understanding of the use of production forecasting; and the necessary knowledge and skills to carry out a full thinning control exercise.

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

Outcome 1

- ◆ measurement conventions for mid diameter, top diameter, length
- ◆ use of Huber's formula
- ◆ Smalian's formula
- ◆ solid and stack volume
- ◆ air space conversion factors
- ◆ volume to weight conversion factors

Outcome 2

- ◆ measurement conventions for diameter at breast height
- ◆ use of sample plots (selection of number of plots and plot size)
- ◆ total height; top height; timber height
- ◆ tariff numbers
- ◆ tariff tables; tariff system
- ◆ precision levels
- ◆ bias issues
- ◆ basal area
- ◆ form height
- ◆ form factor
- ◆ use of relascope, clinometer and hypsometer
- ◆ callipers
- ◆ stratification applications
- ◆ net and gross area
- ◆ general yield class

Higher National Unit Support Notes (cont)

Unit title: Forest Mensuration and Thinning Control (SCQF level 7)

Outcome 3

- ◆ thinning intentions/goals
- ◆ silvicultural characteristics
- ◆ shade tolerance
- ◆ silvicultural systems
- ◆ thinning regimes
- ◆ tree categories
- ◆ marginal thinning intensity
- ◆ harvesting considerations
- ◆ principles of control
- ◆ subsequent thinnings
- ◆ stocking considerations
- ◆ delayed thinnings

Outcome 4

- ◆ an aid to management — planning
- ◆ resource allocation and requirements
- ◆ satisfying market commitments
- ◆ justification and security of supply for new and future markets
- ◆ description of the future growing stock
- ◆ database
- ◆ working blocks
- ◆ long term retentions
- ◆ yield models (including computer software)
- ◆ felling ages
- ◆ cutting regimes
- ◆ production class
- ◆ local yield class
- ◆ assortment tables

Guidance on approaches to delivery of this unit

The approach to the delivery of the unit will be determined by the background knowledge and experience of the learner. It may be possible for a learner to have assessment on demand, although this may have to link into the normal assessment timetable and arrangements.

Timetabled delivery of the unit should include classroom sessions, to introduce concepts and procedures, and field-based practical sessions during which learners will become familiar with a range of forest measurement techniques. It is essential for the learner to consolidate the necessary field skills and knowledge to permit the development of the level of competence expected by the forest industry.

It would be good practice for learners to also receive support materials and have access to textbooks and other industry publications.

Higher National Unit Support Notes (cont)

Unit title: Forest Mensuration and Thinning Control (SCQF level 7)

In Outcome 1 learners will be introduced to general forest measurement conventions and will learn how to assess the volume of logs, felled trees and stacks of timber. During the lecture sessions learners' understanding of basic geometry concepts should be supported (circles, Pi, calculating areas and volumes). Learners should have the opportunity to practise log, felled tree and timber stack measurement techniques during field-based exercises before completing the Outcome 1 assessment.

In Outcome 2 the assessment of standing tree volume is considered. Lectures will firstly take learners through the measurements of tree diameter and height that are required to calculate the volume of a single tree, and introduce the concept of tariff number. Stand volume assessment methods will then be presented, covering different approaches including full tariff, abbreviated tariff and the use of relascope sweeps with stand volume charts or form factor. Sampling strategies and the size of sample plots that are appropriate to different stand types will be considered. The concept of yield class as a measure of stand productivity will be introduced. At each stage learners should be given the opportunity for ample supervised practice of both the field measurement techniques using a range of available equipment and the calculations needed to estimate stand volume, average tree sizes, etc. Learners will normally work in small groups to collect the data for Outcome 2 assessment, but all calculations and reports must be completed on an individual basis.

Outcome 3 covers the topic of thinning and the practice of thinning control. The concepts of thinning type, cycle, intensity and yield will be introduced during the lectures. Learners will then normally use the same forest stand assessed in Outcome 2 to plan and implement a thinning regime — completing pre-thinning checks, determining thinning yield, marking trees to be removed and assessing the volume of marked trees to compare with target thinning volume. As with Outcome 2 learners should have adequate time for supervised practice of the required procedures in a forest setting.

Outcome 4 on production forecasting is likely to be classroom based. Lectures and supporting materials should cover the purpose of production forecasting in forestry at a range of scales both geographically and in time (eg, comparing GB-wide forecasts of timber availability with production planning for an estate or forest). Learners should be encouraged to explore sources of published production forecast information. The use of forestry growth and yield models should be covered, and where possible learners should be given the opportunity to use forest yield software (computer-based version of yield models). The limitations of yield models, and the factors affecting forest management choices relating to the timing of thinning and felling should be considered. Learners should complete exercises to forecast volume availability from forest stand data provided, using yield tables or forest yield software.

Open learning

This unit could be delivered via distance learning, provided learners are able to participate in the field-based practical work required. This could be through specific study days organised for distance learners at the delivery centre. Alternatively, learners could undertake the required practical work independently using sites agreed with the unit tutor, and providing suitable evidence (eg, photos, verification from employer). The latter option is likely to be most appropriate for (but need not be restricted to) learners already working in the forestry, arboriculture or related sectors.

Higher National Unit Support Notes (cont)

Unit title: Forest Mensuration and Thinning Control (SCQF level 7)

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.

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.

Outcome 1

Evidence could be generated in a real or a simulated, supervised work situation, with an explanatory report (approximately 400 words or equivalent) submitted on the findings.

Learners will be allowed to refer to the forestry commission mensuration handbook, other standard ready-reckoner tables and can use a calculator and or appropriate computer programme.

Learners could work in pairs to collect the field data, but all analysis and calculation must be done on an individual basis.

Outcome 2 and Outcome 3

It is recommended that Outcomes 2 and 3 are assessed by linked practical exercises (and reports) completed on the same study site: the data collected in Outcome 2 will form the basis for learner planning for Outcome 3.

The assessment could be either a real or a simulated, supervised work situation, with a project report (approximately 1,200 words or equivalent).

Learners could work in groups to collect the field data, (given forest area, ground conditions, past treatments, plot size and sampling density, top height, tree stocking, diameter breast height, basal area, tariff number) but the report must be done on an individual basis. Follow up questions may be used to authenticate the individual work of learners.

One measurement method could be used to establish the standing volume of the crop, but all learners will be required to make use of a range of tree measuring equipment.

Learners could select and apply an appropriate thinning regime to the same forest crop and carry out a thinning control exercise (thinning sample plot measurement and thinning yield calculation, adjustment of marking related to the thinning yield result).

Each learner could submit a report (either separately for each outcome, or a single report) describing the work carried out, including the data collected and presenting the necessary calculations.

Outcome 4

The assessment of this outcome could be by restricted response questions.

Higher National Unit Support Notes (cont)

Unit title: Forest Mensuration and Thinning Control (SCQF level 7)

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.

Opportunities for developing Core and other essential skills

There is no automatic certification of Core Skills or Core Skills components in this unit, however there may be opportunities to develop the Core Skills of *ICT*, *Communication*, *Working with Others* and *Numeracy* at SCQF level 5.

This Unit has the Critical Thinking component of Problem Solving embedded in it. This means that when learners achieve the Unit, their Core Skills profile will also be updated to show they have achieved Critical Thinking at SCQF level 5.

History of changes to unit

Version	Description of change	Date
02	Core Skills Component Critical Thinking at SCQF level 5 embedded.	31/05/18

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General information for learners

Unit title: Forest Mensuration and Thinning Control

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 unit is designed to enable you to develop timber measurement skills that will have wide ranging applications within the forest industry — although it will initially be set primarily within the context of forest harvesting. The unit also covers thinning control and production forecasting. In the case of thinning control you will develop the knowledge and skills to carry out a marking of thinnings and apply the necessary controls. In terms of production forecasting you will have a clear understanding of its purpose and use.

You will cover the background knowledge of the topics, but will also have the opportunity to develop the necessary field skills and work towards an industry level of competence. The assessments will be relevant and set in an applied context and will very much reflect the skills required and expected by the forest industry. The learning and assessment approach will encourage the development and consolidation of your applied practical skills.

There are four outcomes in this unit.

Outcome 1 covers the different measurement conventions to be applied and how to measure individual felled tree volumes; individual log volumes and stacks of felled timber. You will be able to use appropriate formulae and ready-reckoner tables and carry out the necessary calculations and present the information in a clear and understandable manner.

Outcome 2 covers the different measurement conventions to be applied and how to measure the volume of standing forest crops, using a range of methods. You will be able to use a range of measurement equipment, including — girth tapes, hypsometers and relascopes. You will be able to carry out the necessary calculations and present the information in a clear manner and have an understanding of the many applications of such information.

Outcome 3 covers the reasons for thinning a forest crop and what makes up the components of a thinning regime. You will be able to select an appropriate thinning regime for a forest crop. You will select and mark trees to be removed — in accordance with the selected thinning regime and carry out a full and valid thinning control.

Outcome 4 covers the reasons for production forecasting and the sources of data and the constraints to be considered. You will have an understanding of the methods of predicting crop growth and yield and the factors influencing felling age and retention. You will also be able to relate production forecasting to a number of applications and uses.

Overall, the knowledge and skills acquired in this unit will help you understand and carry out forest measurement tasks accurately.

General information for learners (cont)

Unit title: Forest Mensuration and Thinning Control If you are already in employment this unit provides an opportunity to extend existing knowledge and skills and lays a grounding for further study in forest management.

This unit may give you the opportunity to develop the Core Skills of *ICT, Communication, Working with Others* and *Numeracy* at SCQF level 5.

The assessment for this unit is likely to be a mix of practical exercises, reports and restricted response questions.

This Unit has the Critical Thinking component of Problem Solving embedded in it. This means that when you achieve the Unit, your Core Skills profile will also be updated to show you have achieved Critical Thinking at SCQF level 5.