

SUSTAINABLE MANAGEMENT OF SCOTS PINE IN THE NORTHERN PERIPHERY



SILVICULTURAL GUIDANCE NOTE 2 - **Site Assessment**

Introduction

This Guidance Note is one of a series produced as part of the **Northern Periphery Programme** (NPP) **“Developing Scots Pine”** project. These Notes seek to add value to the future Scots pine resource by encouraging growers to invest in economically effective and ecologically sustainable forest management leading to the production of high quality timber. The publication **“Growing Scots Pine for Quality Timber”** (Worrell and Ross, 2004) provides a useful overview of the issues involved.

The establishment of new Scots pine forests, and the regeneration or replanting of existing stands, require a careful assessment of the site conditions. Information collected at this stage will inform the assessment of species suitability, the potential for the use of natural regeneration, choice of ground preparation techniques, plant specifications, fertiliser and weed control requirements, thinning regime, rotation length and harvesting systems. This Guidance Note gives an overview of the factors that should be considered when determining the suitability of a site for growing high quality Scots pine timber and highlights relevant publications and decision support tools.

General site requirements for Scots pine

The most suitable sites for growing Scots pine for high quality timber production are well-drained moderately acidic mineral soils, such as podzols or upland brown earths and deeper ironpans. Exposed sites and those with poor drainage should be avoided, along with the more fertile, loamy, gley and calcareous soils, shallow iron pans, and deeper peat / organic soils. Although Scots pine is widely considered suitable for planting at up to 450 metres above sea level (a.s.l.), sites above 300 m are less suitable for high quality timber production as growth rates are known to decline above this altitude, stem form is likely to be poor and timber mechanical properties have been shown to be negatively influenced by site elevation (Macdonald et al., 2010). A minimum soil depth of 60 cm above any rock, iron pan or other compacted layer will be required to provide sufficient rooting for stand stability. On exposed sites, restricted rooting is often considered to be a more significant constraint than exposure itself. The factors that should be considered when assessing a site’s suitability for growing high quality Scots pine timber include characteristics of existing Scots pine stands on the site or nearby, climate, soil and site access.

Existing Scots pine stands in the area

A preliminary indication of a site’s suitability for growing high quality Scots pine timber may be obtained from observation of Scots pine trees already growing on the site or immediately adjacent (on a similar site type) to the area being considered. However, any nearby stand will be a result not only of the inherent site factors but also of the previous management, including seed origin. A grower cannot therefore be certain that an existing stand is a definitive guide to future quality, but it will give an idea of the potential of a site.

The ideal external tree characteristics that will enable production of the larger log sizes and higher quality grades of timber suitable for construction and joinery grade markets are:

- Vigorous growth
- Good stem straightness
- Low branch diameters
- A long butt log clearly present (ideally to 4.8 m)
- Low rate of stem taper

A systematic assessment of the timber quality characteristics of an existing stand, including stem straightness assessment and evaluation of mechanical properties using portable acoustic tools, can be made using the techniques described in a recent **Research Note** on this subject (Macdonald et al., 2009) and summarised in **Guidance Note 5** of this series.

In addition to information about the growth and timber quality potential of a site, observation of an existing stand can provide evidence of any tree health problems that might be prevalent in the area, such as pine stem rust (*Peridermium pinii*) or red band needle blight (*Dothistroma septisporum*). Further information about diseases and pests which may threaten the health of Scots pine can be found in **Guidance Note 6** of this series and on the **Forest Research website**.



Figure 1: Mature Scots pine showing external characteristics of high quality timber

Climate and soil

Assessment of the climatic factors that are likely to influence Scots pine growth and timber quality can be conducted as a desk-based exercise, using relevant maps and decision support tools. Assessment of soil quality will require a site visit during which it is important to walk the site carefully to establish variations in conditions and it may be necessary to dig holes in several places to check the soil types present.

The **Ecological Site Classification** (ESC) (Pyatt et al., 2001) and the **Establishment Management Information System** (EMIS), which can both be accessed through the **Forest Research Decision Support Services portal**, can be used to obtain the necessary climate information and to assess the impact of both climatic factors and soil quality on potential tree growth.

Assessment of species suitability in ESC and EMIS is represented by three classes: very suitable, suitable or unsuitable. In very suitable conditions the species is expected to grow in the upper third of the Yield

Class range for that species (in the case of Scots pine, Yield Class 12 or 14) without undue risk of disease to an age well above that of financial maturity and of producing viable seed for natural regeneration. In suitable conditions growth is expected to be in the middle third of the Yield Class range (8 or 10 for Scots pine) and the species should still be capable of growing to biological maturity, although natural regeneration will be unreliable. In both these categories there is an expectation of achieving a reasonable crop of timber. Where a species is considered unsuitable there is a risk that it will not produce merchantable sawlog material. These assessments are indicative rather than prescriptive, and should be taken as an initial evaluation upon which to build. It should also be borne in mind that whilst climatic factors cannot be altered, forest management can be used to improve soil conditions for growth using appropriate cultivation, drainage and fertiliser application.

Climate

Accumulated Temperature

Growing season warmth, which is a major determinant of tree growth rate, can be expressed as Accumulated Temperature above 5°C (AT5), which ranges in Britain from 0 – 2000 day-degrees. ESC calculates AT for sites on the basis of grid reference and provides an indication of species suitability for different ranges of AT. For Scots pine a site is classified as very suitable if it has an AT5 value of >975 and as suitable with an AT5 value of 575-975. A recent survey of Scots pine timber quality in north Scotland assessed 87 stands with AT5 values ranging from 817 – 1272, with an average of 1075 (Macdonald et al. 2010). 80% of stands were classified as very suitable for Scots pine in terms of AT5. Higher values of AT5 were associated with higher values of timber stiffness, which was assessed in standing trees using portable acoustic tools. To maximise the growth and timber quality of Scots pine, sites that fall within the very suitable range of AT5 values should be selected.

Moisture Deficit

Moisture deficit (MD) is the monthly maximum accumulated excess of evapotranspiration over rainfall in the summer months – a higher value indicates a greater frequency of summer droughts. ESC calculates MD for sites on the basis of grid reference. Sites that are classed as moist (MD 90-120 mm) or dry (MD >160 mm) are considered very suitable for growing Scots pine. Sites that where MD is in the range 60-90 mm are considered suitable for native provenances and those that where MD is less than 60 mm are classed as suitable only for west coast native provenances.

Windiness

Wind is a limiting factor to tree growth at higher elevations and near many coasts in Britain (Pyatt et al., 2001). It also has a significant impact on stand stability and therefore restricts management options. Windiness in British forestry is assessed using the DAMS system (Quine and White, 1994), which is based on tatter flag data collected across the country. DAMS scores for a site (3-36; very sheltered to very exposed) can be obtained from a grid reference from the ESC or from the **ForestGALES** decision support system. ESC suggests that sites with a DAMS score of up to 14 can be considered very suitable for Scots pine and that sites with a DAMS score up to 18 are classed as suitable.

Acid grassland sites may also be suitable for timber production. Typical plant indicators will be wavy hair-grass (*Deschampsia flexuosa*) and sheep fescue (*Festuca ovina*), and there may be patches of heathland species also present. Note that bracken (*Pteridium aquilinum*) may proliferate on these sites and, where already present in significant quantities, is likely to require control to prevent shading and mechanical damage to young trees. Former grazing and rough grazing ground may be difficult to assess as heather species will have been browsed off and grass growth encouraged due to prolonged enrichment by droppings. In some cases it may be possible to assess ground in comparison with adjacent ungrazed areas.

On variable sites, or where there is doubt about site suitability for Scots pine, the use of indicator vegetation can be supported by classification of soil type and identification of impediments to rooting using the procedures outlined by Kennedy (2002).

Site access

High quality timber production requires good access both to the site and across the site for machinery to enable economic thinning, harvesting, and extraction of timber. Steep sites where motor-manual felling and cable-crane extraction are required are less likely to be economic, as are those where extraction distances to the nearest forest road are excessively long. The size of the site to be planted is also important: on more difficult or remoter terrain a larger area will need to be planted to justify the movement of harvesting machinery and so forth. Consideration should also be given to the suitability of the public road network for timber transport.

Decision Support System

To support the establishment and management of Scots pine forests in the Northern Periphery area of Scotland, Forest Research has developed the “Scots Pine Management Support System”. This programme links existing decision support tools (**Ecological Site Classification (ESC)**, **Establishment Management Information System (EMIS)** and **ForestGales**) with newly developed Scots pine timber quality models to evaluate the impact of site factors and management alternatives on the volume and quality characteristics of Scots pine timber.

The Scots Pine Management Support System is an online tool that users can access either from a link on the project web-page (www.pineinfo.eu) or by following this link: <https://www.eforestry.gov.uk/forestdss/?app=spdss>. Use of the DSS is free, although users are required to register when they access the programme for the first time (in this way registered users can be informed of any updates to the programme).

Users can choose from two initial options:

1. **Establishing Scots pine forests** - for guidance on planting a new area of Scots pine woodland or restocking an existing, mature forest by replanting or natural regeneration.
2. **Managing Scots pine forests** - for guidance on management of existing Scots pine forests.

Throughout the programme the user is provided with links to relevant sources of additional information, including these silvicultural guidance notes.

Site assessment - summary of key points

- It is important to conduct a thorough assessment of a site's suitability for growing high quality Scots pine timber: information collected at this stage will inform many future management decisions.
- Whilst some climate data can be obtained prior to visiting the site, a careful on-site inspection is required to assess soil quality and establish the variation in conditions across the site
- Existing Scots pine stands on adjacent sites can provide a useful indication of the potential for growing high quality Scots pine timber
- Climatic factors that will influence Scots pine growth can be assessed as a desk-based exercise, using decision support tools such as the **Ecological Site Classification (ESC)** and the **Establishment Management Information System (EMIS)**
- Sites at high elevation (>300 m asl) and those with shallow or poorly drained soils should be avoided
- The most suitable sites for growing Scots pine for high quality timber production are those with well-drained, moderately-acidic mineral soils
- Soil suitability for growing Scots pine can be assessed from the presence of indicator plants: species such as *Calluna vulgaris*, *Erica cinerea*, and *Vaccinium myrtillus* are indicative of a site with good potential for timber production

References

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- Macdonald, E., Connolly, T., Gardiner, B. (2010) A Survey of Scots Pine Timber Quality in the Northern Periphery Programme Area of Scotland. Proceedings of Wood Structure & Properties 2010 Conference, Podbanske, Slovakia. ISBN 978-80-968868-5-2
- Pyatt, D.G., Ray, D., Fletcher, J. (2001) An Ecological Site Classification for Forestry in Great Britain. Forestry Commission Bulletin 124. Forestry Commission, Edinburgh.
- Quine, C.P. and White, I.M.S. (1994). Using the relationship between rate of tatter and topographic variables to predict site windiness in upland Britain. *Forestry*, 67: 245-256
- Worrell, R. and Ross, I. 2004. Growing Scots pine for high quality timber (2nd Edition). Cairngorms National Park Authority, Grantown-on-Spey, Scotland.

Further reading

- Mason, W.L., Hampson, A. and Edwards, C. (2004). Managing the Pinewoods of Scotland. Forestry Commission, Edinburgh.

For further information about the “Developing Scots Pine” project, visit: www.pineinfo.eu

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