Land Capability for Forestry in Britain

The Macaulay Land Use Research Institute

The Soil Survey and Land Research Centre

The Forestry Commission

SOIL SURVEY MONOGRAPH

Land Capability Classification for Forestry in Britain

J.S. BIBBY
(Macaulay Land Use Research Institute)

R.E.F. HESLOP
(Macaulay Land Use Research Institute)

R. HARTNUP
(Soil Survey and Land Research Centre)

Edited by J.S. BIBBY and D.W. FUTTY

The Macaulay Land Use Research Institute
Aberdeen
1988

ISBN 0 7084 0467 7

Printed in Great Britain by Compass Print Ltd., Aberdeen

Contents

Preface

Much of the preparatory work for this report dates from 1975 and was stimulated by discussions in the Working Party on Hill Land Classification, established by the Department of Agriculture and Fisheries for Scotland and chaired by the then Chief Agricultural Officer for Scotland, Mr C. Mackay. Although it was accepted that the physical characteristics of land provided a good basis for land classifications and the development of an agricultural land classification went ahead, it was unfortunately not possible at that time to provide a similar classification of potential for forestry. Recently however, with problems of agricultural surpluses, and the need to develop alternative forms of land use, interest in forestry has considerably expanded. A requirement for information on the land of Britain in terms of forestry potential is clear. This classification and the guidelines it contains will allow strategic assessments at national and regional levels to be made from a knowledge of the properties of land which affect tree growth.

In view of the interest in the subject of land evaluation within the European Community, it is appropriate to comment on the relationships between this classification and the proposed framework for land evaluation (ILRI 1977). The Forestry Capability Classification applies to a major kind of land use rather than to the more tightly defined land utilisation type which features data on capital and labour intensity, size and configuration of land holdings or income levels. It is best regarded as a qualitative classification and refers to the potential of land after certain improvements (regarded as basic for modern silviculture in Britain) have been carried out. It could be regarded as a type of suitability classification, but since the comparable classification for agriculture in Britain derives from the USA and is generally referred to as 'capability', it is preferred to use this term in the title and retain 'suitability' for more tightly defined classifications for specific purposes, often carried out on limited areas and with strong socio-economic inputs. Such classifications are actively being developed in a number of fields by several organisations.

J.S. BIBBY

Acknowledgements

This publication is the result of cooperation between the Macaulay Land Use Research Institute, the Soil Survey and Land Research Centre and the Forestry Commission. During its development, many people have made contributions, either as discussions of concepts or as direct criticisms of drafts. We would like to acknowledge all the help we have received, in particular from T.C. Booth, D.W. Futty, R. Grant, G. Hatfield, J. Hunt, R.J.A. Jones, G.M.L. Locke, R. McIntosh, H.G. Miller, A. Morrison, D.G. Pyatt, A.H.A. Scott, A.J. Thomasson, D.A. Thompson and T.R.E. Thompson. We are also indebted to L. Robertson and Mrs L.A. Crosher for computation of the accumulated temperatures in Appendix 1, and to A.D. Moir and Miss P.R. Carnegie for cartographic work.

1 Land capability classification for forestry

Information on the distribution and fundamental properties of soils is collected on a national basis by the soil survey organisations based at Macaulay Institute, Aberdeen (Scotland) and at Silsoe College, Bedfordshire (England and Wales). With the addition of data on climate and characteristics of topography this information can be interpreted to provide an evaluation of the potential of land for a variety of uses. The Land Capability Classification for Agriculture (Bibby *et al.* 1982) is an example; the Land Capability Classification for Forestry, described here, is an attempt to provide a similar classification in terms of forestry. It is based on an assessment of the increasing degree of limitation imposed by the physical factors of soil, topography and climate on the growth of trees and on silvicultural practices.

The system described is designed for use at several levels depending on the amount and accuracy of the available data and on the purpose for which the information is required. Strategic and regional planning needs can be satisfied by generalised maps at scales of 1:250 000 and 1:50 000. Sufficient information is currently available for this to be attempted in Britain, and has been done for the island of Islay (Bibby and Heslop 1986). Requirements of a more detailed nature, for example planning within the forest enterprise or by estate managers dealing with integration of agriculture and forestry, will require larger scale maps (1:25 000 and 1:10 000) and more accurate base data.

The main use of the Land Capability Classification for Forestry is as an aid to decision-making at broad planning levels, as a guide for land managers and as a statement of the natural resources of the land of Britain in terms of forestry potential for educational and general interest purposes. The system is an interpretation derived from several sources and, as with all such approaches, will be subject to some degree of arbitrary decision. A careful study of the assumptions and explanations underlying the classification is advised so that the scheme is properly understood and its benefits and limitations appreciated.

2 The classification

ASSUMPTIONS AND EXPLANATIONS

1 The classification groups land according to limitations imposed by characteristics of soil, topography and climate on forestry.

2. Land is assessed on its capability to produce tree crops under skilled forest management, which includes cultivation, drainage, application of fertiliser and weed control where these are necessary.

3 The principal tree species considered are those broadleaves and conifers commonly grown in the United Kingdom.

4 Capability classes are established according to the degree of limitation imposed by the physical characters of soil, topography and climate upon growth and on the practices involved in the establishment and management of the forest crop. Within any class, management practices may differ in detail but the degree of limitation is similar.

5 Within each class, limitation types are indicated by the use of a letter suffix denoting the principal kind of limitation operating.

6 Where sufficient information is available a third level of classification, the capability unit, may be used. This is of value on maps of scale 1:25 000 and larger and includes information on specific site management requirements which may enable an estimate of yield class to be made for the most appropriate species.

7 Land which suffers from limitations which can be removed or ameliorated by measures such as drainage or ploughing appropriate to the level of management (assumption 2) is classed on the severity of the remaining limitations.

8 The system does not take account of aesthetic requirements (e.g. the need for landscaping in some areas), although it is recognised that these may be of major importance in forest design.

9 Distances to markets, type of road etc. do not influence the grading, but will have to be included in economic appraisals for planting.

10 The interpretations express current knowledge; as new experience is acquired new interpretations will be necessary and review is recommended every ten years.

11 The system is devised specifically for forestry. *Classes similarly numbered in other land use classifications are not comparable.*

THE CLASSES

Class F1 *Land with excellent flexibility for the growth and management of tree crops*

The soils are deep and well supplied with moisture, and neither climate nor site factors seriously restrict the growth of the main tree species used in Britain. A wide range of broadleaved and coniferous species can be planted.

Class F2 *Land with very good flexibility for the growth and management of tree crops*

The soils have no or only limited periods of seasonal waterlogging, but some mineral gleys may be included if, with drainage, the water-table can be controlled at depths which prevent serious waterlogging of the root system. Minor areas of shallower or wetter soils are acceptable but should not exceed 10% in total. Minor restrictions on cultivation and harvesting due to slopes or minor climatic restraints are also acceptable. Both broadleaved and coniferous species may be planted but choice is more restricted than in Class F1. In areas where available water is limited, those species with high water demand are unsuitable; in areas with water surplus soil drainage may be necessary.

Class F3 *Land with good flexibility for the growth and management of tree crops*

The soil range extends to include mineral gleys with sandy or loamy textures and flushed gleys with humose topsoils. Drainage is necessary on gley soils. Windthrow risk is not high and land management is primarily concerned with limitations imposed by drainage, sloping land or patterns of variable soils. The land is suitable for a wide range of conifers and for a restricted range of broadleaved species.

Class F4 *Land with moderate flexibility for the growth and management of tree crops*

The soils include the more fertile peaty soils and the problem mineral soils, e.g. gleys with clayey textures or soils with calcareous horizons. Ploughing difficulty may be encountered due to stony or shallow soils but this should not be more than 20% of the area. There is a risk of small areas of windthrow which should not be sufficiently severe to reduce rotation lengths or influence management practices. The land is suitable for many coniferous species and in places for the less demanding broadleaves.

Class F5 *Land with limited flexibility for the growth and management of tree crops*

The soils are primarily podzols, peaty gleys and peat, but where limitations are sufficiently severe to limit species selection, other soils may be included. Ploughing is possible but may be more difficult than in the previous classes. Sites in which the risk of windthrow affects management by modifying the thinning practice fall within this class. In the uplands species choice is limited to conifers, such as spruces, larches and pines, and to birch, alder or other hardy broadleaves.

Class F6 *Land with very limited flexibility for the growth and management tree crops*

The principal limitations are adverse climate and poor soil conditions. The soils include podzols, peaty gleys and peats, and soils affected by toxicities. Sites on which the risk of windthrow effectively prevents thinning and seriously curtails the rotation length, and sites with very severe surface terrain which imposes great difficulty in ploughing or extraction, fall within this class. Species choice is limited to lodgepole pine and Sitka spruce and to amenity broadleaves such as birch and alder.

Class F7 *Land unsuitable for producing tree crops*

Land is considered unplantable if its physical characteristics preclude the growth or establishment of tree crops by normal methods. These characters include extremes of climate (orohemiarctic and oroarctic climate zones or extremely exposed sites), wetness (flow-bog or flood sites), rockiness and extreme slopes.

THE LIMITATION TYPES

Limitation types are divisions within capability classes descriptive of the principal limitations applying to forestry. A wide range of limitations may be identified with various levels of significance to the crop performance and to management and many of these result from interaction between physical parameters. In order to provide the degree of generalisation necessary for maps of small scale, many limitations require grouping. Climate is regarded as providing the framework (limitation type symbol c). Windthrow risk is very important in British forestry and is accorded a separate subclass (symbol b). Levels of naturally available nutrients are also important and warrant the provision of a separate group (symbol n). Especially significant in the hills and uplands are tracts where mechanised cultivation is impossible (limitation type symbol t). On soils where water shortages occur regularly the limitation type symbol d is used, and for soils with serious and persistent wetness limitations the symbol w is appropriate. For areas limited by shallow or stony soils the limitation type symbol s may be used; such areas include soil pattern limitations caused by small-scale soil variation. Allocation to a limitation type is in principle governed by the importance of the various characters in limiting forestry, but some degree of arbitrary decision is unavoidable.Allocation to a limitation type is in principle governed by the importance of the various characters in limiting forestry, but some degree of arbitrary decision is unavoidable.

Climate symbol c

Although in world terms the British climate is without severe extremes and may be regarded generally as very favourable to tree growth, the principal areas in which forestry is practised are not without problems. Wind has long been recognised as a factor reducing the yield of plants and hence exposure and the strength, frequency, direction and annual distribution of gales is of importance. There is some evidence that humid areas suffer less growth restriction in windy conditions than do areas subject to soil moisture deficits but the precise nature and amount is not known (Grace 1975). Temperature and the length of growing season are also significant, and altitude has been quoted as an integrating character in this respect (Malcolm 1971, Mayhead 1973). The level of rainfall over Britain is adequate for tree growth provided the soil is capable of storing the moisture it receives (Fourt and Hinson 1970), while liability to seasonal frosts depends so largely on local topographic characteristics that it is better assessed as a microclimatic feature and only included in detailed assessments (see Capability Units).

Measures of atmospheric warmth (accumulated day-degrees C, Birse and Dry 1970, Birse 1971, Bendelow and Hartnup 1980) and exposure (Birse and Robertson 1970, Bendelow and Hartnup 1980) have been combined in map form. An interpretation of these properties has been made in terms of forest capability classes (see box graph on map).

When used in combination, the map and box graph provide guidelines for the assessment of capability class to assist correlation nationally. The method of use is as follows:

1 on the map of accumulated temperature and exposure read the appropriate rating for the site.

2 find the rating on the box graph and read off the potential capability class.

When two or more potential class designations are present, a closer estimate of actual accumulated temperature and exposure figures should be attempted using the data in Appendices 1 and 2.

3 field inspection should be undertaken to assess local shelter or aspect characteristics which may affect the classification.

The classification derived for climate is a first sieve and indicates the best class for the area if no limitations due to soil or topographic factors are present. Adjustment of the classification will be necessary according to the other guidelines dealing with these properties.

Windthrow symbol b

Windthrow in forests affects both forest management and timber production and its significance to long term planning of the forest enterprise has been increasingly recognised in recent years. Due to the prevalence of planting in the hill areas of Britain where high wind speeds and soils producing shallow rooting are most likely to occur in combination, windthrow hazard is recognised at limitation type level in this classification.

Miller (1985) has described a practical approximation for assessing windthrow hazard suitable for use at the scales envisaged for capability classification based on extensive research work by the Forestry Commission. The risk of windthrow (windthrow hazard class) is estimated on a point system, scoring for four site-related factors and summing the points. These are:

1 wind zone, derived from an analysis of tatter flag results and extreme wind values.

2 elevation zone.

3 topographic exposure, assessed by summing the angles of inclination of the skyline at the eight major points of the compass at any site ('Topex' method).

4 soil type, especially the stabilising effects expressed through rooting depth. Soils with root depths greater than 45 cm are usually those free of seasonal waterlogging, while gley soils and peats have restricted rooting depths.

The hazard classes have a relation to top height of the crop at the onset of throw. Guidance for expressing hazard class in terms of capability will be found in Chapter 4.

Nutrients symbol n

Although the application of fertilisers, principally phosphorus (P) and potassium (K), is part of regular forest practice, trees rely far more on the natural availability of nutrients than do farm crops. The presence of such nutrients is often indicated by the occurrence of certain plant species in the pre-planting vegetation cover. On organic soils nutrient availability has been related to the total content of nitrogen (N), phosphorus (P) and potassium (K). Depending on species requirements, tree crops planted on soils with shallow organic horizons may require P at planting, and those with greater depths of organic matter, including peats, may require both P and K. Peats characterised by an absence of *Molinia*, and those where *Molinia* does not grow vigorously, usually need further application of P and K. Where *Molinia* is absent and the vegetation is dominated by *Calluna, Sphagnum, Trichophorum* or *Eriophorum vaginatum*, N may also be needed. On soils with organic horizons sufficiently deep to prevent effective mixing with the mineral subsoil, the addition of nutrients provides only temporary amelioration for the least demanding species. The limitation type n is used to indicate the continuing limitation to the other species.

Work on the classification of peat types for forest use using vegetation as an indicator has been conducted by Paterson (1969), Toleman (1975) and Pyatt *et al.* (1979) and is supported by phytosociological and analytical work carried out at the Macaulay Land Use Research Institute. The broad vegetation groups used in work on plant communities are clearly associated with certain soil types although the exact nature and detail of the association may vary between climatic zones. Even when there has been much interference from man, 'replacement communities' related to the original often occur unless the interference has been such that major changes in soil properties have taken place.

On mineral soils nutrient availability is related to the volume of soil available for rooting and to the chemical composition of the parent material. Those derived from quartzites, quartzose sandstones, acid gneisses and granites are poorest. Basic igneous rocks and some shales give problems concerned with poor phosphorus availability. Lime-induced chlorosis, believed to be caused by manganese or iron deficiency, may occur in conifers growing in shallow soils on chalk; soil inversion by ploughing accentuates chlorosis. Growth problems associated with high magnesium or nickel occur on ultrabasic rocks. Toxicities due to old mine workings and spoil heaps may also be included in this limitation type.

Topography symbol t

The principal effect of topography is on mechanised operations necessary for the establishment of the crop, although harvesting and road design and construction are also affected. Occasionally minor topographic patterns are strictly limiting (bogs with open water or level areas studded with rock) but slope is the most important element of topography. Forest ploughs frequently operate at depths of up to 60 cm and for some conditions up to 90 cm (Thompson 1978). It is therefore not surprising that even low slopes can preclude two-way ploughing (about 5° is considered a realistic limit, Thompson personal communication). However, one-way ploughing on slopes above 5° presents little difficulty to a skilled operative. Ploughing reaches a limit at 35° on dry stable slopes but is less than this where topsoils are wet or where there is a danger of the soil parting from the underlying rock and the tractor 'rafting' downhill out of control. It is suggested that a practical limit for wet land is about 30°, although much depends on the characteristics of the slope. These limits apply to the mounted plough only, where the plough can be used as a brake. Trailed ploughs are mainly confined to use on slopes less than 18°. Slopes which are irregular, rocky or bouldery may reduce the limits given very considerably due to the dangers of overturning (Spencer and Gilfillan 1976). All these topographic factors produce considerable local variation, so it is necessary to realise that land is placed in this limitation type only on its general character.

Areas unsuited to ploughing by reason of steep slope but with a good soil mantle may be planted by hand. Land of this type occurs within many forests but is seldom extensive. When it is apparent that this technique is part of normal forest management in the area, the land is classed according to the range of species which can be grown and included in the topographic limitation subclass, but should be given special mention in accompanying reports. At scales of 1:25 000 or 1:10 000 it is placed in a separate capability unit.

Droughtiness symbol d

A number of soils in Britain have very low water-holding capacity, an important limitation on the choice of species. These include dune sands, where only pines may be suitable, but soil moisture deficits occur on a variety of soils in dry climates. Soil droughtiness is assessed by subtracting the climatic moisture deficit from the available water capacity of the soil (Thomasson 1979, Bibby *et al.* 1982). Where water is in short supply a variety of problems may occur, partly physiological and partly due to failure in the translocation of nutrients. Although the problem is clearly one of interaction between climate, soil properties and water supply to the root, such soils are placed in the 'd' limitation type. High soil moisture deficits result in substantially reduced yields and usually restrict the choice of species.

Wetness symbol w

In exposed areas of upland Britain soil wetness is a vital component of windthrow risk, but the limitation exists as a physiological barrier to root growth even in sheltered areas, and may reduce the range of suitable species. Sites which are subject to regular flooding, for example saltings, are obviously unsuitable, but seasonal saturation of the root zone also has serious effects and occurs widely in the surface-water gleys which are characteristic of many valley and lowland sites. In assessing wetness in mineral soils, guidance is obtained from soil maps and memoirs which describe 'drainage classes' (Scotland and older maps in England and Wales) or 'wetness classes' (newer maps in England and Wales). Wetness classes are described in Appendix 3. Little information is so far available on the periodicity of waterlogging in peat but in general terms it can be related to the degree of humification and the local rainfall regimes. Most British peats contain very large amounts of water, which together with strong acidity, provide conditions suitable for only a very limited range of trees.

Soil symbol s

Soil limitations are an important element in the limitation type designations so far described, but for some circumstances it is useful to have a separate designation to draw attention to a specific problem. Shallowness for example restricts rooting and affects forest operations. Ploughing is difficult while unduly heavy operations and trafficking in shallow areas can result in total topsoil destruction. In many areas soil patterns are complex and cause difficulty in the choice and application of treatments appropriate to each soil type and compromises have to be reached.

CAPABILITY UNITS

Capability units are the smallest divisions in the classification. They are designed for use at scales of 1:25 000 and 1:10 000 to carry information of value for detailed forest planning. The units are described in terms of their physical and chemical properties, their detailed site characteristics and their forest cropping and land management characteristics. An important feature of the unit is that it is designed to carry information on predicted yield class (Busby 1974) and hence provides a third level of ranking within the classification. Much of the information necessary to construct such detailed maps is currently being produced in the form of soil and site surveys of existing forests and new acquisitions, and by numerous projects on optimum fertiliser usage, windthrow potential, drainage etc. conducted by the Research Division of the Forestry Commission.

3 The forestry capability system illustrated in different landscapes

Plates 1 - 9 illustrate examples of the principal limitation types found in Britain.

Plates 10 - 16 show examples of the type of land assigned to various classes.

The reader is encouraged to look at the plates as general land types rather than specific examples. For this reason locations have been omitted.

Plate 1 CLIMATE (1). In the very exposed western coastal regions of Britain structural deformation of tree crowns is frequently seen. In extreme cases this leads to a serious loss of production on the windward edge of forest blocks.

Plate 2 CLIMATE (2). Exposure to high winds, particularly if they carry sea salt, leads to a very slow and patchy establishment of the crop. Serious restrictions on the range of species that can be successfully utilised occur.

Plate 3 WINDTHROW. An extensive problem in wetland sites and on shallow soils in exposed areas, windthrow risk curtails the range of species and the length of rotation and affects management through its effect on thinning options.

Plate 4 NUTRIENTS. Sitka spruce planted on unflushed peat in 1961 seriously deficient in phosphorus, potash and nitrogen. Photo: C. Taylor.

Plate 5 TOPOGRAPHY. Topographic limitations can seriously affect both site preparation and harvesting. *Photo: Forestry Commission.*

Plate 6 DROUGHTINESS. Droughtiness can severely restrict the choice of species, particularly at establishment. Here windblown sand is being planted with pine. *Photo: Forestry Commission.*

Plate 7 WETNESS. Wetness can preclude planting, as in dubh-lochan areas of peat; in other cases it may result in poor growth due to root asphyxiation.

Plate 8 SOIL. The volume of soil exploited by plant roots can be severely restricted by indurated subsoil close to the surface, or, as here, by rock.

Plate 9 SOIL. Limitations due to unfavourable soil conditions express themselves in numerous ways often in combination with other factors, e.g. droughtiness, or windblow. Here the pattern of soil results in severe restrictions on ploughing and will have implications for management.

Plate 10 CLASS 1. Conditions suited to a wide range of species affords the forester the opportunity to create interesting landscapes, which later provide options for entering a range of markets as well as being aesthetically pleasing and ecologically acceptable. Photo: Forestry Commission.

Plate 11 CLASS 2 *Although possessing slightly less favourable conditions overall (frequently related to adverse climate) a wide choice of species is available in this class and similar opportunities exist for diversification of the forest enterprise.*

Plate 12 CLASS 3. *Within Class 3, species choice is becoming restricted. A wide range of conifers is successful and blocks of broadleaved woodland using less demanding species, in this example beech, are also found.*

Plate 13 CLASS 4. On good soils at higher elevations species choice is limited. Larch and spruce are the most common forest crops, and there is still flexibility for the use of broadleaves. Photo: R. Hartnup.

Plate 14 CLASS 5. The flushed peatlands, dominated by Molinia *sp. and* Juncus *sp. (right of picture) allow effective production of Sitka spruce, and may have some capacity for broadleaved species tolerant of wetter conditions (e.g. alder and willow).*

Plate 15 CLASS 6. Acid, lightly flushed or unflushed peatlands in the higher hills are suited to very few species. Various provenances of Lodgepole pine, increasingly sown in mixtures with Sitka spruce, are the only commercial crops.

Plate 16 CLASS 7. The most extensive areas of unplantable land are those of the mountain arctic heaths, shown in this plate. They occur at increasingly lower altitudes in the north and in the west as accumulated temperatures decline and exposure increases.

4 Guidelines for the recognition of capability classes

As the classification is interpretative, guidelines for the recognition of classes are offered to maintain uniformity. These will need to be reviewed periodically as new information arises on the relationships between soil, site and climate on one hand and the significance of these relationships to forest management and tree growth on the other.

Class Fl

Climate:	see map.
Windthrow:	hazard class not worse than 2.
Nutrients:	not limiting. Soil pH less than 6.5.
Topography:	slopes less than 5°, ground non-rocky and non-bouldery.
Droughtiness:	not more than slightly droughty.
Wetness:	soils are seldom waterlogged (wetness class I or II). Soils in wetness class III are included when the potential soil moisture deficit is greater than 100 mm.
Soil:	soil depths are usually greater than 60 cm.
Soil types:	predominantly brown earths.

Class F2

Climate:	see map.
Windthrow:	hazard class generally not worse than 3. Small areas (less than 10%) of higher hazard classes are acceptable.
Nutrients:	adequate nutrient supply for most species. Soil pH less than 6.5.
Topography:	slopes less than 18°.
Droughtiness:	not more than slightly droughty.
Wetness:	soils are in wetness classes I, II, III or IV.
Soil:	soil depths are greater than 40 cm.
Soil types:	brown earths and noncalcareous gleys where the water-table can be controlled.

Class F3

Climate:	see map.
Windthrow:	hazard class generally not worse than 3 (some areas, less than 20%, of greater windthrow hazard may be included).
Nutrients:	adequate nutrient supplies for most species.
Topography:	slopes less than 18°. Some minor pattern limitations accepted.
Droughtiness:	not more than moderately droughty.

Wetness:	soils are in wetness classes I, II, III or IV, or V where improvable by drainage measures.
Soil:	soil depths are usually greater than 40 cm.
Soil types:	brown earths, noncalcareous gleys (loamy and sandy textures), and flushed gleys with humose topsoils.

Class F4

Climate:	see map.
Windthrow:	hazard class generally not worse than 4 (some areas, less than 30%, of greater windthrow hazard may be included).
Nutrients:	nutrient supplies will usually require to be supplemented on peaty soils, particularly on establishment. Shallow soils on chalk and limestone with pH more than 6.5 should not be placed in a class better than F4.
Topography:	slopes less than 35° (dry soils) or 30° (wet soils). Surface boulders (more than 60 cm) or rock outcrops should be less than 10%.
Droughtiness:	not more than moderately droughty.
Wetness:	soils are in wetness classes I, II, III, IV or V.
Soil:	soil depth sufficient for rooting.
Soil types:	soils include podzols or peaty podzols (stagnopodzols), with or without a thin iron pan but with a degree of flushing, flushed peaty gleys, fen and rush peats, and problem mineral soils (gleys with clay texture and shallow soils).

Class F5

Climate:	see map.
Windthrow:	hazard class generally not worse than 5 (some areas, less than 30%, of greater windthrow hazard may be included).
Nutrients:	nutrient supplies will require to be supplemented periodically on peaty gleys, peaty podzols (stagnopodzols) and flushed peats.
Topography:	slopes less than 35° (dry soils) or 30° (wet soils). Patterns of slope precluding complete ploughing are acceptable up to 25%. Bouldery and rocky land may be included in this class provided mechanised treatments are possible.
Droughtiness:	all classes.
Wetness:	soils can be in any wetness class.
Soil:	soil depth sufficient for rooting.
Soil types:	soils include podzols, peaty podzols (stagnopodzols), peaty gleys and peats. The peats are those characterised by vigorous or dominant *Molinia*.

Class F6

Climate: see map.
Windthrow: all hazard classes.
Nutrients: growth of unfertilised plantations will be very poor and crops will require the highest rate of fertiliser of any plantable site type, the frequency and rate of application being determined by species requirements.
Topography: slopes less than 35° (dry soils) or 30° (wet soils). Patterns of slope or rockiness precluding complete ploughing are acceptable (less than 50%).
Wetness: soils can be in any wetness class.
Droughtiness: all classes.
Soil: soil depth sufficient for rooting.
Soil types: a wide range of soil types is found, including raw dune sands, podzols and peaty podzols (stagnopodzols), unflushed peaty gleys and peats, and those affected by toxicity (shallow soils on ultrabasic drifts, spoil heaps etc.).

Class F7

Climate: see map.
Windthrow: all hazard classes.
Nutrients: nutrient supply very low. Areas of toxicity.
Topography: slopes in excess of 35° (dry soils) or 30° (wet soils) and/or patterns of slope, rock or boulders that preclude mechanisation. Sites subject to frequent flooding.
Droughtiness: all classes.
Wetness: undrainable permanently waterlogged land (swamps).
Soil: very shallow, extremely stony soils which are impossible to plough.
Soil types: lithosols, rankers, severely eroded peat, dubh-lochan peatland.

MAP SYMBOLS

The following conventions are employed when using class and subclass symbols:

1. No more than two limitation type symbols are used on a map to indicate different types of limitation affecting one class.
2. As the climatic assumptions underlying the classification are usually shown as an inset map, the use of the symbol c is restricted to the following cases:
   a) where no other factor is responsible for the determination of class level
   b) where climatic factors additional to those normally assessed are relevant, e.g. frost hollows.
3. A limitation type symbol is shown only where it has been a factor in determining class.
4. The symbol for the dominant limitation takes priority in cases where two symbols are shown.

5 References

Bendelow, V.C. and Hartnup, R. 1980. *Climatic Classification of England and Wales*. Soil Survey Technical Monograph No. 15. Harpenden.

Bibby, J.S., Douglas, H.A., Thomasson, A.J. and Robertson, J.S. 1982. *Land Capability Classification for Agriculture*. Soil Survey of Scotland Monograph. The Macaulay Institute for Soil Research, Aberdeen.

Bibby, J.S. and Heslop, R.E.F. 1986. *Land Capability Classification for Forestry of the Island of Islay, Argyll*. Aberdeen: The Macaulay Institute for Soil Research, Aberdeen (restricted circulation).

Birse E.L. 1971. *Assessment of Climatic Conditions in Scotland. 3. The Bioclimatic Sub-Regions*. The Macaulay Institute for Soil Research, Aberdeen.

Birse, E.L. and Dry, F.T. 1970. *Assessment of Climatic Conditions in Scotland. 1. Based on Accumulated Temperature and Potential Water Deficit*. The Macaulay Institute for Soil Research, Aberdeen.

Birse, E.L. and Robertson, L. 1970. *Assessment of Climatic Conditions in Scotland. 2. Based on Exposure and Accumulated Frost*. The Macaulay Institute for Soil Research, Aberdeen.

Busby, R.J.N. 1974. *Forest Site Yield Guide to Upland Britain*. Forestry Commission Forest Record 97. HMSO, London.

Fourt, D.F. and Hinson, W.H. 1970. Water relations of tree crops: a comparison between Corsican pine and Douglas fir in south-east England. *Journal of Applied Ecology* Vol. 7, 295-309.

Grace, J. 1975. Wind damage to vegetation. *Current Advances in Plant Science* No. 17.

ILRI 1977. *A Framework for Land Evaluation*. International Institute for Land Reclamation and Improvement Publication No. 22. Wageningen.

Malcolm, D.C. 1971. *Site Factors and the Growth of Sitka Spruce*. Ph.D. thesis. University of Edinburgh.

Mayhead, G.J. 1973. The effect of altitude above sea level on yield of Sitka Spruce. *Scottish Forestry* Vol 27 No. 3, 231-237.

Miller, K.F. 1985. *Windthrow Hazard Classification.* Forestry Commission Leaflet 85. HMSO, London.

Paterson, D.B. 1969. *Peat Classification for Forest Use.* Forestry Commission Research and Development Division (restricted circulation).

Pyatt, D.G., Craven, M.M. and Williams, B.L. 1979. Peatland classification for forestry in Great Britain. *Proceedings of the International Symposium on Classification of Peat and Peatlands, Hyytiala, Finland, Sept. 17-21 1979.* International Peat Society.

Spencer, H.B. and Gilfillan, G. 1976. Tractors on sloping land. *ARC Research Review* Vol. 2 No. 1, Agricultural Research Council.

Thomasson, A.J. 1979. Assessment of Soil Droughtiness. *Soil Survey Applications* (ed. M.G. Jarvis and D. Mackney). Soil Survey Technical Monograph No. 13. Harpenden.

Thompson, D.A. 1978. *Forest Ploughs.* Forestry Commission Leaflet 70. HMSO, London.

Toleman, R.D.L. 1975. *National Soil Classification.* Forestry Commission Research and Development Division (restricted circulation).

Appendix 1 Average annual accumulated temperature (above 5.6°C) at 200 stations

Station	Grid reference	Altitude (m)	Accumulated temperature (day°C)	Calculated accumulated temperature for altitude of: 0m	100m	200m	300m	400m	500m	600m
Lerwick	HU 4539	82	939	1046	906	777	658	548	449	360
Deerness	HY 5605	49	1111	1183	1033	893	764	645	536	473
Stornoway	NB 4533	3	1273	1265	1110	965	830	705	591	486
Scourie	NC 1544	14	1216	1218	1079	949	827	714	608	512
Tongue	NC 5959	12	1231	1233	1092	960	837	721	615	516
Lairg	NC 6005	140	1056	1225	1089	962	842	730	626	530
Dunrobin	NC 8500	4	1271	1259	1110	971	840	720	608	506
Wick	ND 3652	36	1121	1172	1022	881	752	632	523	424
Dunvegan	NG 2547	7	1359	1357	1199	1051	913	784	666	556
Achnashellach	NH 0349	69	1308	1400	1250	1108	975	850	734	627
Glencarron	NH 0651	152	1192	1410	1259	1116	982	857	740	631
Fort Augustus	NH 3809	21	1372	1364	1223	1090	965	847	737	635
Strathpeffer	NH 4858	61	1279	1344	1202	1068	942	824	713	611
Inverness	NH 6641	74	1344	1445	1292	1148	1012	885	766	656
Fortrose	NH 7256	21	1446	1467	1314	1169	1033	905	786	675
Kingussie	NH 7600	256	1107	1455	1312	1176	1048	927	814	708
Gordon Castle	NJ 3559	32	1420	1461	1306	1160	1022	893	773	662
Logie Coldstone	NJ 4404	185	1171	1421	1277	1140	1012	891	777	762
Banff	NJ 6864	40	1386	1442	1286	1138	1000	871	750	639
Craibstone	NJ 8710	92	1217	1350	1198	1056	923	798	683	577
New Pitsligo	NJ 8856	160	1188	1423	1270	1125	989	861	743	633
Aberdeen	NJ 9408	24	1337	1364	1212	1069	935	810	694	587
Ardtornish	NM 7047	15	1430	1449	1288	1137	996	864	741	628
Fort William	NN 1073	52	1425	1456	1310	1172	1041	919	804	696
Crieff	NN 8622	132	1425	1621	1464	1316	1175	1042	917	800
Pitlochry	NN 9458	122	1435	1595	1446	1305	1171	1044	924	812

Perth	NO 1023	24	1517	1540	1388	1244	1107	979	858	746
Braemar	NO 1591	339	1006	1424	1285	1152	1026	908	797	694
Kettins	NO 2339	67	1332	1417	1271	1133	1002	880	766	659
Balruddery	NO 3032	84	1306	1418	1269	1127	995	870	754	646
Cupar	NO 3714	64	1418	1506	1354	1210	1074	946	826	715
Dundee	NO 4331	45	1438	1499	1346	1202	1066	983	818	707
Leuchars	NO 4620	10	1436	1439	1286	1142	1007	880	761	652
St Andrews	NO 5016	4	1434	1430	1278	1135	1000	874	756	647
Arbroath	NO 6443	28	1372	1405	1252	1109	974	847	730	621
Eallabus	NR 3363	22	1441	1466	1313	1168	1032	905	786	675
Rothesay	NS 1064	61	1449	1549	1380	1221	1072	932	802	682
Glenbranter	NS 1197	37	1387	1418	1267	1125	991	866	749	640
Turnberry	NS 2005	19	1594	1633	1459	1294	1139	994	859	734
Greenock	NS 2775	61	1580	1681	1513	1354	1203	1062	929	805
Helensburgh	NS 3083	89	1458	1592	1431	1279	1135	1000	874	756
Cardross	NS 3577	40	1423	1467	1314	1169	1032	904	785	674
Kilmarnock	NS 4338	37	1574	1636	1472	1316	1169	1031	902	781
Paisley	NS 4764	32	1662	1714	1549	1392	1243	1103	971	847
Renfrew	NS 5066	9	1503	1511	1356	1209	1071	941	819	706
Dungavel	NS 6537	243	1121	1483	1326	1179	1040	909	788	675
Stirling	NS 7993	46	1577	1639	1481	1330	1188	1054	928	810
West Linton	NT 1551	250	1119	1483	1331	1186	1050	923	803	692
Eskdalemuir	NT 2302	242	1086	1437	1286	1143	1009	883	766	656
Boghall	NT 2465	195	1304	1600	1440	1289	1146	1011	885	767
Edinburgh (Blackford Hill)	NT 2570	135	1450	1660	1495	1340	1192	1054	924	802
Kirkcaldy	NT 2793	42	1502	1561	1405	1257	1117	985	861	746
North Berwick	NT 5584	36	1473	1521	1365	1216	1077	946	832	709
Wolflee	NT 5809	164	1219	1461	1309	1166	1031	904	785	675
Kelso	NT 7435	60	1410	1492	1341	1198	1063	936	817	706
Marchmont	NT 7448	152	1321	1548	1392	1244	1105	974	851	736
Berwick upon Tweed	NU 0053	23	1403	1437	1289	1141	993	845	697	549
Colmonell	NX 1285	52	1517	1615	1442	1278	1124	981	847	723

Appendix 1 Average annual accumulated temperature (above 5.6°C) at 200 stations (continued)

Station	Grid reference	Altitude (m)	Accumulated temperature (day°C)	Calculated accumulated temperature for altitude of: 0m	100m	200m	300m	400m	500m	600m
Kirkcowan	NX 3261	61	1455	1563	1395	1237	1088	948	818	698
Cally	NX 5954	37	1479	1542	1377	1221	1074	937	809	691
Dumfries	NX 9873	43	1504	1570	1409	1257	1113	979	852	735
Ruthwell	NY 0769	20	1511	1539	1382	1234	1094	963	840	725
Keswick	NY 2624	77	1644	1774	1618	1462	1306	1151	995	839
Newton Rigg	NY 4931	170	1398	1662	1513	1364	1216	1067	918	770
Appleby	NY 6819	134	1431	1632	1488	1343	1199	1055	910	766
Bellingham	NY 8091	258	1204	1567	1430	1294	1157	1021	884	748
Chopwell Wood	NZ 1458	135	1441	1654	1504	1354	1205	1056	906	757
Morpeth	NZ 2091	99	1357	1515	1369	1222	1076	930	784	637
Ushaw	NZ 2244	181	1478	1766	1614	1461	1309	1157	1005	852
Durham	NZ 2642	102	1527	1685	1536	1388	1239	1090	941	793
Houghall	NZ 2841	48	1547	1626	1479	1333	1186	1040	893	746
Tynemouth	NZ 3768	32	1600	1655	1498	1341	1184	1027	870	713
Douglas	SC 3878	84	1582	1733	1567	1402	1236	1070	905	739
Blackpool	SD 3236	19	1784	1812	1650	1487	1325	1162	1000	838
Southport	SD 3518	10	1781	1793	1631	1469	1307	1146	984	822
Morecambe	SD 4365	7	1791	1798	1644	1490	1336	1182	1028	874
Hutton (Lancs)	SD 5127	24	1699	1742	1584	1425	1267	1108	950	791
Darwen	SD 6922	220	1530	1865	1713	1561	1409	1258	1106	954
Stonyhurst (Lancs)	SD 6939	114	1596	1778	1626	1473	1321	1169	1017	864
Bolton	SD 7211	104	1693	1869	1711	1553	1396	1238	1080	922
Burnley	SD 8833	139	1533	1755	1603	1451	1299	1147	995	843
Huddersfield (Oakes)	SE 1118	232	1553	1914	1763	1612	1461	1310	1159	1008
Ilkley	SE 1148	96	1616	1771	1619	1468	1316	1164	1012	861
Bradford (Lister Park)	SE 1435	133	1613	1830	1676	1522	1368	1214	1060	906
Huddersfield (Ravensknowle)	SE 1616	99	1682	1845	1691	1538	1384	1230	1077	923

Wakefield	SE 3320	35	1822	1883	1722	1561	1401	1240	1079	918
Pontefract	SE 4522	77	1694	1823	1661	1500	1338	1177	1015	854
Ampleforth	SE 5979	95	1590	1745	1595	1444	1294	1144	993	843
York	SE 6052	17	1828	1856	1695	1534	1374	1213	1052	891
Holyhead	SH 2482	7	1845	1860	1681	1502	1324	1145	966	787
Aber	SH 6573	18	1896	1931	1760	1589	1418	1248	1077	906
Llandudno	SH 7882	3	1926	1934	1766	1599	1431	1264	1096	928
Colwyn Bay	SH 8679	35	1907	1969	1801	1633	1465	1298	1130	962
Rhyl	SJ 0080	9	1875	1888	1723	1559	1394	1230	1065	900
Hoylake	SJ 2188	7	1865	1879	1717	1554	1392	1229	1067	905
Welshpool	SJ 2307	77	1726	1815	1660	1523	1378	1232	1086	941
Liverpool (Bidston)	SJ 2990	60	1774	1881	1715	1550	1384	1218	1053	887
Hawarden Bridge	SJ 3169	5	1903	1914	1751	1589	1426	1263	1101	938
Manchester (Whitworth Park)	SJ 8596	38	1883	1948	1788	1628	1467	1307	1147	987
Macclesfield	SJ 9174	152	1641	1859	1713	1568	1423	1277	1132	987
Buxton	SK 0674	306	1303	1741	1601	1461	1321	1182	1042	902
Mayfield (Ashbourne)	SK 1646	113	1567	1743	1594	1445	1296	1147	998	849
Belper School	SK 3447	61	1743	1846	1693	1539	1386	1232	1079	926
Sheffield	SK 3487	130	1799	2021	1860	1699	1539	1378	1217	1056
Sutton Bonington	SK 5126	47	1774	1850	1696	1542	1387	1233	1079	925
Mansfield	SK 5462	108	1732	1914	1755	1597	1438	1279	1120	962
Nottingham (Castle)	SK 5740	58	1875	1973	1807	1642	1476	1310	1145	979
St Ann's Head	SM 8003	43	1890	1973	1794	1614	1435	1255	1076	896
Haverfordwest	SM 9115	38	1764	1832	1665	1497	1330	1163	995	828
Tenby	SN 1400	19	1947	1981	1810	1639	1468	1297	1126	955
Rhayader	SN 9869	230	1454	1817	1664	1510	1357	1203	1049	896
Hereford	SO 4740	89	1799	1953	1793	1633	1472	1312	1152	992
Ross on Wye	SO 6023	67	1922	2042	1878	1714	1551	1387	1223	1059
Malvern	SO 7846	115	1946	2147	1983	1819	1656	1492	1328	1164
Worcester (Perdiswell)	SO 8252	28	1893	1937	1781	1625	1469	1313	1156	1000
Cheltenham	SO 9420	65	1970	2088	1927	1765	1604	1443	1281	1120

Appendix 1 Average annual accumulated temperature (above 5.6°C) at 200 stations (continued)

Station	Grid reference	Altitude (m)	Accumulated temperature (day°C)	Calculated accumulated temperature for altitude of: 0m	100m	200m	300m	400m	500m	600m
Birmingham (Edgbaston)	SP 0486	163	1807	2081	1918	1755	1592	1429	1266	1103
Birmingham (Spark Hill)	SP 1082	129	1848	2064	1904	1744	1583	1423	1263	1103
Leamington Spa	SP 3265	49	1935	2019	1857	1694	1532	1369	1207	1045
Coventry	SP 3379	73	1836	1952	1792	1633	1473	1314	1154	995
Rugby	SP 5075	118	1747	1947	1787	1628	1468	1309	1149	990
Oxford	SP 5107	63	1988	2100	1936	1771	1607	1443	1278	1114
Woburn	SP 9636	90	1764	1912	1754	1595	1437	1279	1121	962
Bude	SS 2106	15	1983	2011	1839	1667	1495	1323	1151	979
Ilfracombe	SS 5248	7	2141	2158	1982	1806	1630	1454	1278	1102
Barnstaple	SS 5635	7	2012	2021	1851	1681	1511	1341	1171	1001
Swansea	SS 6492	9	2105	2123	1954	1785	1615	1446	1277	1108
Cullompton	ST 0207	61	2008	2111	1945	1780	1614	1448	1283	1117
Cardiff	ST 1979	61	1931	2043	1878	1713	1548	1384	1219	1054
Newport (Gwent)	ST 2885	80	1965	2071	1917	1763	1608	1454	1300	1146
Long Ashton	ST 5370	49	1977	2057	1892	1727	1562	1398	1233	1068
Frampton	ST 6582	48	1917	2004	1844	1684	1523	1363	1203	1043
Bath	ST 7565	20	2034	2071	1908	1744	1581	1417	1254	1090
Shaftesbury	ST 8623	207	1722	2070	1906	1742	1578	1414	1250	1086
Larkhill (Wilts)	SU 1445	131	1771	1978	1821	1663	1506	1348	1191	1033
Marlborough	SU 1969	129	1685	1890	1734	1578	1422	1265	1109	953
Porton (Wilts)	SU 2137	110	1751	1831	1704	1577	1450	1323	1196	1069
Southampton	SU 4212	19	2091	2128	1958	1788	1619	1449	1279	1109
Calshot	SU 4902	2	2104	2106	1935	1764	1593	1421	1250	1079
Reading (Shinfield)	SU 7369	60	1926	2027	1867	1706	1546	1386	1225	1065
Petersfield	SU 7423	227	1729	2113	1948	1782	1617	1452	1286	1121
Long Sutton	SU 7547	145	1845	2088	1926	1763	1601	1438	1276	1114

South Farnborough	SU 8755	68	1949	2066	1901	1736	1571	1407	1242	1077
Scilly	SV 9112	49	2184	2285	2084	1884	1683	1482	1282	1081
Penzance	SW 4730	16	2236	2270	2081	1891	1702	1513	1323	1134
Falmouth	SW 8032	50	2159	2252	2069	1886	1703	1520	1337	1155
Newquay	SW 8161	55	2015	2116	1935	1753	1572	1390	1209	1027
Fowey	SX 1251	15	2149	2178	1998	1819	1639	1460	1280	1100
Plymouth Hoe	SX 4854	35	2078	2140	1969	1798	1627	1457	1286	1115
Tavistock	SX 4875	144	1863	2123	1951	1779	1606	1434	1262	1090
Newton Abbot	SX 8373	114	1964	2168	1996	1825	1653	1481	1310	1138
Teignmouth	SX 9473	6	2188	2197	2023	1850	1676	1503	1329	1155
Exmouth	SY 0382	59	1954	2059	1888	1717	1546	1375	1204	1033
Sidmouth	SY 1287	7	2005	2017	1850	1684	1517	1351	1184	1018
Portland Bill	SY 6869	9	2050	2079	1899	1719	1539	1359	1180	1000
Weymouth	SY 6879	4	2144	2154	1982	1810	1637	1465	1293	1121
Bournemouth	SZ 0792	42	2052	2130	1962	1794	1626	1458	1290	1122
Newport (IOW)	SZ 5090	18	2010	2041	1874	1706	1539	1372	1204	1037
St Catherine's Point	SZ 5176	45	1957	2037	1866	1695	1524	1353	1182	1011
Ryde	SZ 6093	3	2152	2160	1990	1820	1649	1479	1309	1139
Portsmouth	SZ 6499	2	2226	2230	2061	1892	1723	1554	1385	1216
Bognor Regis	SZ 9399	7	2022	2034	1869	1703	1538	1373	1207	1042
Scarborough	TA 0488	35	1786	1851	1687	1524	1360	1196	1032	869
Hull	TA 0830	2	1861	1864	1703	1541	1380	1219	1057	896
Cleethorpes	TA 3108	7	1765	1773	1613	1454	1294	1134	975	815
Spurn Head	TA 4111	8	1781	1798	1627	1457	1286	1116	945	774
Cranwell	TF 0049	61	1743	1845	1688	1530	1373	1215	1058	900
Skegness	TF 5763	4	1731	1739	1581	1423	1265	1107	949	791
Hunstanton	TF 6740	30	1830	1879	1716	1553	1389	1226	1063	900
Norwich	TG 2209	33	1908	1962	1796	1631	1465	1299	1134	968
Cromer	TG 2339	54	1873	1968	1800	1632	1464	1295	1127	959
Sprowston	TG 2512	28	1814	1859	1697	1534	1372	1209	1047	885
Yarmouth	TG 5203	1	1878	1879	1714	1549	1384	1220	1055	890
Luton	TL 0823	116	1794	1982	1824	1666	1508	1350	1193	1035

Appendix 1 Average annual accumulated temperature (above 5.6°C) at 200 stations (continued)

Station	Grid reference	Altitude (m)	Accumulated temperature (day°C)	0m	Calculated accumulated temperature for altitude of: 100m	200m	300m	400m	500m	600m
Rothamsted	TL 1313	128	1731	1944	1782	1619	1457	1294	1132	970
St Albans	TL 1801	82	1797	1930	1769	1608	1448	1287	1126	965
Cambridge	TL 4557	12	1922	1933	1774	1616	1457	1299	1140	982
Halstead	TL 8130	42	1953	2025	1858	1690	1523	1356	1188	1021
Dovercourt	TM 2430	14	1987	2013	1846	1678	1511	1344	1176	1009
Felixstowe	TM 3135	3	1999	2002	1840	1677	1515	1352	1190	1028
Bungay	TM 3389	24	1873	1913	1751	1590	1428	1267	1105	944
Lowestoft	TM 5595	24	1841	1883	1717	1552	1386	1220	1055	889
Wisley	TQ 0658	45	1998	2075	1913	1750	1588	1425	1263	1101
Worthing	TQ 1503	7	2084	2100	1931	1762	1593	1424	1255	1086
Hampstead	TQ 2686	137	1842	2069	1905	1742	1579	1415	1252	1088
Camden Square	TQ 2984	33	2243	2302	2130	1959	1787	1615	1444	1272
Croydon	TQ 3164	66	2034	2149	1982	1816	1649	1482	1316	1149
Addington	TQ 3564	144	1872	2110	1948	1787	1625	1463	1301	1140
Greenwich	TQ 3977	45	2047	2122	1957	1793	1628	1464	1299	1134
East Ham	TQ 4283	4	2138	2144	1978	1812	1645	1479	1313	1147
Tunbridge Wells	TQ 5939	106	1859	2037	1875	1713	1551	1389	1227	1065
East Malling	TQ 7157	37	1836	1898	1742	1585	1429	1272	1116	959
Hastings	TQ 8010	45	2044	2128	1956	1784	1611	1439	1267	1095
Shoeburyness	TQ 9586	3	2015	2020	1848	1676	1503	1331	1159	987
Wye	TR 0647	49	1878	1964	1803	1642	1482	1321	1160	999
Dungeness	TR 0917	6	2044	2052	1856	1659	1463	1266	1070	873
Canterbury	TR 1659	41	2039	2104	1939	1773	1608	1443	1278	1112
Dover	TR 3241	5	2044	2052	1883	1714	1545	1376	1207	1038
Margate	TR 3771	15	2127	2153	1981	1809	1636	1464	1292	1120
Beachy Head	TV 5895	153	1776	2042	1873	1704	1535	1366	1197	1028

Appendix 2 Average annual wind speed (m/s) at 72 stations

Station	Grid reference	Altitude (m)	Wind speed
Lerwick	HU 4539	93	7.30
Kirkwall	HY 4807	41	6.70
Stornoway	NB 4430	37	7.40
Dounreay	NC 9967	34	7.10
Halkirk	ND 1152	83	4.80
Wick	ND 3652	45	6.30
Benbecula	NF 7855	16	7.50
Duirnish	NG 7731	38	5.10
Fort Augustus	NH 3508	58	2.50
Shin	NH 5797	24	3.60
Dalcross	NH 7652	21	3.40
Kinloss	NJ 0662	17	4.70
Lossiemouth	NJ 2170	31	4.60
Dyce	NJ 8812	71	4.30
Tiree	NL 9944	27	7.90
Corpach	NN 0876	23	3.70
Rannoch	NN 4257	307	5.20
Tummel Bridge	NN 7759	161	2.30
Auchterhouse	NO 3439	251	4.30
Leuchars	NO 4620	24	4.90
Bell Rock	NO 7627	39	7.90
Millport	NS 1754	15	5.30
Hunterston	NS 1851	12	4.70
Prestwick	NS 3626	21	4.70
Paisley	NS 4764	57	3.30
Abbotsinch	NS 4866	16	4.40
Renfrew	NS 5166	22	4.40
Cumbernauld	NS 7776	166	5.40
Lowther Hill	NS 8910	736	8.50
Turnhouse	NT 1573	42	4.40
Eskdalemuir	NT 2302	251	3.70
Edinburgh (Blackford Hill)	NT 2570	151	5.00
West Freugh	NX 1054	25	5.00
Sellafield	NY 0303	25	4.89
Chapelcross	NY 2269	94	4.40

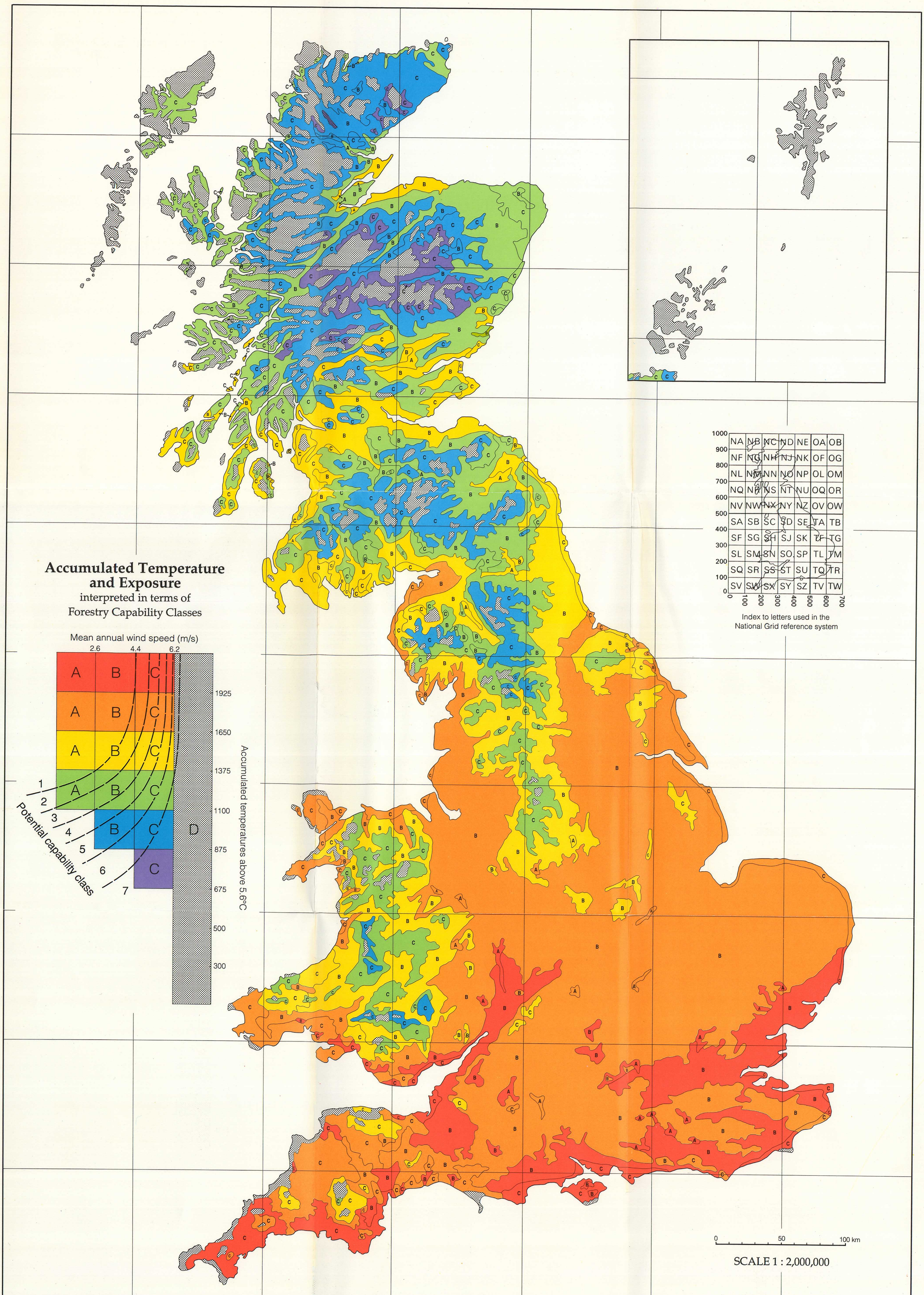
Appendix 2 **Average annual wind speed (m/s) at 72 stations (continued)**

Station	Grid reference	Altitude (m)	Wind speed
Carlisle	NY 3860	41	4.48
Spadeadam	NY 6072	292	5.04
Great Dun Fell	NY 7132	857	9.94
Durham	NZ 2741	119	4.17
South Shields	NZ 3768	22	4.68
Squires Gate	SD 3232	26	6.28
Fleetwood	SD 3348	34	4.53
Southport	SD 3721	19	4.63
Valley	SH 3176	26	6.90
Ringway	SJ 8285	80	4.58
Keele	SJ 8245	215	3.35
Manchester	SJ 8499	82	4.23
Sheffield	SK 3487	162	2.68
Aberporth	SN 2452	135	6.59
Pershore	SO 9750	47	4.72
Edgbaston	SP 0586	196	4.07
Elmdon	SP 1884	105	4.63
Port Talbot	SS 7987	28	5.10
Larkhill	SU 1445	145	4.43
Boscombe Down	SU 1740	130	5.15
Porton	SU 2137	120	4.58
Abingdon	SU 4899	90	3.90
Calshot	SU 4902	15	5.30
South Farnborough	SU 8755	97	3.91
Mount Batten	SX 4953	64	5.61
Portland Bill	SY 6869	60	8.39
Hurn	SZ 1298	23	4.43
Bedford	TL 0560	94	5.15
Cardington	TL 0846	69	5.61
Garston	TL 1202	94	3.04
Rothamsted	TL 1313	141	3.04
Stansted	TL 5323	108	4.38
Mildenhall	TL 6878	30	3.91
Hampton	TQ 1369	42	3.81
Kew	TQ 1776	28	3.81
Gatwick	TQ 2741	69	3.81
London Weather Centre	TQ 3182	93	5.15

Appendix 3 Soil wetness classes

Wetness class	General properties of the soil profile and site
I	The profile normally lacks gley features[1] within 70 cm or an impermeable horizon within 80 cm depth. Many strongly gleyed, permeable soils, with efficient drainage systems also occur in this class.
II	The profile normally lacks gley features within 40 cm or an impermeable horizon within 60 cm depth.
III	The profile normally lacks gley features or an impermeable horizon within 40 cm depth.
IV	The profile normally has gley features and an impermeable horizon within 40 cm depth, but lacks a humose or peaty topsoil greater than 20 cm thick.
V	The profile normally has prominent gley features within 40 cm depth and is usually wet within 70 cm depth. Commonly the topsoil is humose or peaty and the natural vegetation has numerous hydrophilous species.
VI	The profile normally has a peaty topsoil, a prominently gleyed mineral subsoil and is usually wet within 40 cm depth. The natural vegetation consists predominantly of hydrophilous species.

[1] Greyish soil colours with associated ochreous mottling resulting from reduction and mobilisation of iron compounds under anaerobic conditions.



Accumulated Temperature and Exposure
interpreted in terms of
Forestry Capability Classes
Mean annual wind speed (m/s)
2.6
4.4
6.2
A B C
A B C
A B C
A B C
B C
C
D
1925
1650
1375
1100
875
675
500
300
Accumulated temperatures above 5.6°C
1
2
3
4
5
6
7
Potential capability class
NA NB NC ND NE OA OB
NF NG NH NJ NK OF OG
NL NM NN NO NP OL OM
NQ NR NS NT NU OQ OR
NV NW NX NY NZ OV OW
SA SB SC SD SE TA TB
SF SG SH SJ SK TF TG
SL SM SN SO SP TL TM
SQ SR SS ST SU TQ TR
SV SW SX SY SZ TV TW
1000
900
800
700
600
500
400
300
200
100
0
0 100 200 300 400 500 600 700
Index to letters used in the National Grid reference system
0
50
100 km
SCALE 1 : 2,000,000