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COEDWIGAETH

FORESTRY  
COMMISSION

**Cyfrifiad Coedlannau  
a  
Choed**

**Census of Woodlands  
and  
Trees**

**1979 — 1982**



**RHAGAIR**

Awdurdodwyd y Cyfrifiad hwn o Goedlannau a Choed Heb Fod Yn Goedlannau gan y Comisiynwyr Coedwigaeth yn ôl eu hawdurdod dan Ddeddf Coedwigaeth 1967. Wedi gwaith paratoadol ar y dulliau i'w defnyddio, dechreuwyd ar y gwaith maes ar gyfer y Cyfrifiad ym mis Medi 1979. 31 Mawrth 1980 yw dyddiad cyfeirio y Cyfrifiad.

Ymgwymerwyd â'r gwaith arolwg a pharatoi'r Adroddiad gan Gangen Arolygon Maes Adran Ymchwil a Datblygu y Comisiwn Coedwigaeth. Mae'r Gangen yn ddiolchgar am gymorth perchnogion a deiliaid y tir a ddewiswyd i'w samplu, swyddogion y Cynghorau Sir, staff yr Arolwg Ordnans, Arolwg Pridd Cymru a Lloegr, Adran Amaethyddiaeth y Swyddfa Gymreig, y Comisiwn Cefn Gwlad a'r Cyngor Gwarchod Natur. Yn ychwanegol dymuna'r Gangen hefyd ddiolch i staff Gwarchodaethau'r Comisiwn Coedwigaeth a staff Cangen Ystadegau a Chyfrifo a Changhennau eraill yr Adran Ymchwil a Datblygu.

Dylid cyfeirio ymholiadau ynglŷn â'r cyhoeddiad hwn i'r Swyddfa Hysbysrwydd yn y cyfeiriad isod.

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**PREFACE**

This Census of Woodlands and Non-Woodland Trees was authorised by the Forestry Commissioners, as empowered by the Forestry Act, 1967. After preparatory work on the methods to be employed, field work for the Census started in September 1979. The reference date for the Census is 31 March 1980.

The survey work and the compiling of the Report was undertaken by the Field Surveys Branch of the Forestry Commission Research and Development Division. The Branch is grateful for the assistance of owners and occupiers of the land selected for sampling, officers of the County Councils, staffs of the Ordnance Survey, the Soil Survey of England and Wales, the Welsh Office Agriculture Department, the Countryside Commission and the Nature Conservancy Council. In addition the Branch also wishes to thank the Forestry Commission Conservancy staff and staffs of the Statistics and Computing Branch and other Branches of the Research and Development Division.

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## CENSUS OBJECTIVES AND METHODS

### OBJECTIVES

The general objectives of the Census were to take stock of the timber resources of Great Britain and to assess the environmental status of trees in the rural and urban landscape by counties or other administrative areas in England and Wales. Scotland was assessed by Forestry Commission Conservancies, using methods that varied slightly from those used in England and Wales. Details will appear in the Scottish reports.

The Census was divided into two main sections, the Woodland Survey and the Non-Woodland Tree Survey.

The first objective for the Woodland Survey was to provide an estimate of the total woodland area within a county. The data for Forestry Commission woodlands and for those in Dedication and Approved Woodland Schemes are on record so the survey was concerned only with "Other" woodland, but all three categories of ownership are included in this Report. The second objective was to provide estimates of woodland types, species, age classes and timber volumes.

The first objective for the Non-Woodland Tree Survey was to estimate the number of trees by their occurrence. For purposes of assessing their place in the landscape, trees were considered in terms of three categories; Isolated, Clumps and Linear Features. The last two terms are new to Census terminology so some words of explanation are required. A Clump is a small wood or group of trees in close canopy less than 0.25 hectare (ha) in extent. A Linear Feature is a line or strip of woody growth in close canopy, 20 metres (m) or less in overall width and more than 25 m long. The second objective for the Survey was to provide information on species, size classes, standing timber volumes and health of non-woodland trees.

### METHODS

The Woodland Survey, which covered woodlands of 0.25 ha and over, was based on a three stage sampling system using the Ordnance Survey (O.S.) 1:50 000 maps, aerial photographs and ground surveys. The Non-Woodland Tree Survey was based on a two stage sampling system using aerial photographs and ground surveys.

Ground survey was used to collect data that could not be obtained from aerial photographs, and also to allow for changes that had occurred since the photographs were taken.

#### The Woodland Survey

For woodlands, the "woodland plates" (copies of the plates which print the solid green areas on O.S. 1:50 000 maps) prepared by the Ordnance Survey were marked to show Forestry Commission and Dedicated and Approved Woodlands. The boundaries of the remaining areas, "Other" woodland, were digitised to give a serial number, National Grid Reference and the area of each block. These blocks were stratified into six size classes; 0.25-1.99, 2.0-9.99, 10.0-19.99, 20.0-49.99, 50.0-99.99 and > 99.99 ha. As changes were likely to have occurred since the date of the O.S. survey, a random sample within each size class was selected from the list of digitised woods for aerial survey. The true boundaries were established for these and the areas re-calculated. The relationship between the areas so found and the digitised areas was used to establish a revised woodland area estimate for the county with a standard error no greater than  $\pm 5$  per cent. The area of extra woodland not recorded on the O.S. 1:50 000 maps was estimated in the course of the Non-Woodland Tree Survey as described below.

A sub-sample of woods was selected for ground survey. The size of this sub-sample was chosen to give an area estimate with a standard error of not more than  $\pm 15$  per cent on the most widely represented forest type. Stands were identified within this sub-sample of woods. Each of these stands was assessed for crop type, species, age, stocking, composition of the shrub layer (where present), top height and basal area (from which volumes were derived).

#### The Non-Woodland Tree Survey

Preparatory work indicated that stratification could make the sampling of Non-Woodland Trees more efficient. Accordingly the land area of England and Wales was classified into 16 soil groups, further divided into three degrees of potential soil moisture deficit (see Appendix 3). A pilot survey was carried out to assess the variability of the tree population using the soil groups within a set of adjoining counties as a basis for selection. Three samples in each group were selected at random. The size of each sample unit was a National Grid 500 m square (0.25 square kilometres). From the pilot data, sampling strata for the

main survey were derived by combining those soil groups that produced a similar mean number of trees and a similar variance. The sample size in each stratum was determined to obtain, at minimum cost, an estimate of the number of measurable isolated trees for a county, with a standard error not exceeding  $\pm 25$  per cent. A standard error limit of  $\pm 30$  per cent was also set for the number of trees of the most widely represented species of isolated tree in the county.

In the light of experience and also because of the need to contain costs, the size and groupings of samples for the main survey of England and Wales were changed after the survey of the first six counties (Berkshire, Devon, Humberside, Kent, Merseyside and Norfolk). Initially six sample 500 m National Grid squares were clustered together to form a strip 0.5 kilometre (km) wide by 3.0 km long (1.5 square kilometres). Subsequently the width of the strip was reduced to 0.25 km; this was done by reducing the dimensions of each sampling unit to measure 250 m by 250 m. These smaller units of 6.25 ha each were amalgamated into strips or clusters of 12 to give a total length of 3 km. This method of clustering samples was adopted in order to make it easier to obtain the required aerial photographic cover. To aid the final estimation and provide sufficient coverage, it was found necessary to have at least four sample clusters per stratum and 20 per county. The sample clusters were selected at random.

All isolated trees, clumps and linear features were marked on stereo pairs of aerial photographs of each sample unit. Numbers of isolated trees were recorded and their crown diameters measured. The areas of clumps and the widths and lengths of linear features were also measured.

For the ground survey, a random sub-sample of two squares was chosen from each cluster of twelve. Each tree within these squares was assessed for species, health, location (roadside, waterside etc.) and also measured for diameter, total height and, for broadleaves only, timber height. Measurements of the widths and lengths of linear features and the areas of clumps were taken and each was assigned to a forest type. In addition any isolated extra woodland (not coloured green on the O.S. 1:50 000 map) was assessed for area and forest type.

A measurable tree was defined as having a diameter at breast height (dbh) of not less than 7 centimetres (cm), a persistent axis, and not pruned in such a way as to restrict its growth (an exception was made for pollarded trees). Trees less than 7 cm dbh were recorded if they were at least 1.5 m tall, had a persistent axis and were individuals rather than coppice shoots. In the case of highway and windbreak planting, any tree species, as opposed to shrub species, in clumps and linear features were included regardless of height.

An assessment of timber length was made for all measurable broadleaved trees in the ground survey. Timber length was defined as the height above the ground to 7 cm top diameter in young trees and from ground level to 15 cm top diameter in mature trees, or to the spring of the crown, whichever occurred first. To be assessed for volume, broadleaved trees were required to have a minimum of 2 m of straight timber. Trees with obvious stem rot, stem damage and twisted or deformed butts were given a timber length of zero. Forked trees with good growth in the upper stem were assigned a timber length derived from the length of the strongest fork. For conifer species, the volume was derived from the total height and the breast height diameter of the individuals.

## **Analysis of Results**

The data collected in the Woodland Survey were used to provide population estimates for "Other" woodland. These were added to the Forestry Commission and Dedicated and Approved Woodland data. For Non-Woodland Trees the survey data were used to provide an estimate of the total population. The results are presented in the following tables and diagrams, together with explanatory notes and comments.

Data relating to trees and woodlands in National Parks (N.P.) and Areas of Outstanding Natural Beauty (A.O.N.B.), although not given separately in this report, are stored in computer files.

**GENERAL COMMENTS ON TABLE ENTRIES**

In the 1947 Census, High Forest types were distinguished using a threefold classification into Coniferous, Mixed and Broadleaved. "Mixed" covered High Forest stands in which one group of species (coniferous or broadleaved) occupied 20 per cent or more of the stock. Since the 1960's, the convention adopted in describing High Forest types has been to distinguish only two: Mainly (that is more than 50 per cent) Coniferous and Mainly Broadleaved. This classification is now well established both at home and internationally.

When reading the numerical values within the Tables, it should be noted that the variances for the figures quoted can be large. For example, the aim of the Non-Woodland Tree Survey was to obtain a standard error not exceeding  $\pm 25$  per cent of the total number of isolated trees. The variance for any one species, however, may be bigger than this, and when a species is poorly represented the variance can be very large indeed. Equally, the fact that nil (—) entries appear against a particular species, size class, health class or volume does not necessarily mean that there are no trees of that species or category on the ground, but rather that these species or categories were so sparse that they were not picked up at the sampling intensity used.





# **Part One**

## **Woodlands**

COMMENTARY ON THE RESULTS FOR WOODLANDS  
IN WALES

General

The tables and report for Wales contain summaries and comments on the 1980 Survey, and comparisons with the 1947 and 1965 Census Surveys.

Previous Surveys

The 1947 Census involved a complete assessment of all woods more than 2 ha in extent, and gave a detailed analysis by county and country of the position following the extensive wartime fellings. This was followed in 1951 by a sample survey of woods between 0.4 and 2.0 ha (1-5 acres). In 1965, Census results were required by marketing regions based on groups of counties, and samples of woodlands greater than 0.4 ha (1 acre) were visited and assessed for crop and volume estimates. Owing to both the method and intensity of sampling adopted in 1965 the estimate of total woodland at that time is less precise than that for 1980.

Woodland Area

The reported woodland area at each of the three Surveys is shown below and adjustments have also been made to bring the results to a common base by adding an allowance for woods between 0.25 and 2.0 ha in the case of the 1947 results and 0.25-0.4 ha for the 1965 results.

Year	Area of land and inland water ha	Area of woodland ha	Minimum area of woodland ha	Estimated area of woodland 0.25 ha and over	Per cent of land area
1947	2 076 081	128 300	2.0	141 000	6.8
1965	2 076 083	200 603	0.4	202 000	9.7
1980	2 076 402	240 784	0.25	241 000	11.6

The total areas of land and inland water were obtained from the Ordnance Survey at the time of each Census, and the changes in land area are a result of continuous resurvey and remeasurement.

The estimated total area of woodland blocks of 0.25 ha and greater in 1947 has been calculated using the survey figure for woods of 0.4-2.0 ha obtained in 1951 (11 100 ha) together with an allowance for woods of 0.25-0.4 ha which is estimated to amount to a further 1 200 ha. This total of 12 300 ha in woods of between 0.25 and 2.0 ha in 1951 can be compared with the current figure of 14 118 ha, a difference of 1 800 ha. The major reasons for this difference are probably as follows.

- a. The estimate of the area of small woods in 1951 was based on two independent one per cent samples of 6 inch to one mile O.S. maps. The maps used were the latest available but in most cases were editions that dated from the nineteen twenties and thirties and in some cases were pre 1914.
- b. Some fragmentation of larger blocks will undoubtedly have occurred as a consequence of the increased pace of housebuilding, road widening, clearance for powerlines etc since 1947.
- c. Woodland arising as a result of colonisation usually occurs initially as scattered small blocks and much of it would post-date the map editions used.

If the overall position is now examined it will be seen that if the various Report figures are adjusted on the basis of the 1980 estimate of small woods the total woodland area has increased by about 98 thousand hectares between 1947 and 1980. If, however, the 1951 estimate of small woods is used the increase over the same period is 100 thousand hectares. It will be seen that the use of differing estimates for the area of woods between 0.25 and 2.0 ha has made very little difference to the overall increase.

The details of Forestry Commission and Dedicated and Approved woodlands were obtained from records while the remaining area in private ownership, termed "Other", was based upon the representation of woods on the Ordnance Survey 1:50 000 maps. Any changes to the boundaries of existing woodlands were accounted for during the course of survey. In addition, the sample units of the non-woodland survey were used to locate and estimate the area of any isolated blocks that were not depicted on the maps ('extra' woodland).

It is estimated that 7 900 ha of woodland shown on the maps no longer existed at the time of survey, whereas there were approximately 11 900 ha of 'extra' woodland. Therefore it is probable that, allowing for both gains and losses, the maps underestimated the area of woodlands by 4 thousand hectares. However, because the estimate of extra woodland is of low precision, it has not been combined with the results of the main Woodland Survey.

Woodland Ownership

Of the total area of 241 thousand hectares in 1980 139 thousand hectares were in Forestry Commission ownership and 102 thousand hectares in the hands of private owners. An analysis of woodland ownership in percentage terms is given below.

Year	Forestry Commission Per cent	Private Per cent
1947	29	71
1965	58	42
1980	58	42

This table shows the substantial increase in the percentage of the woodland area owned by the Forestry Commission between the years 1947 and 1965. Since then the woodland area has risen more slowly and the percentage ownership has remained unchanged. Most of the increase since 1947 is accounted for by afforestation, although there has been some restocking of felled or derelict land acquired from private ownership after the Second World War. The Forestry Commission owns 59 per cent of the woodland in the South Wales Conservancy and 56 per cent in the North Wales Conservancy.

There was a decrease in the area of private woodlands between 1947 and 1965 as ground was acquired by the Forestry Commission for restocking, or cleared for agriculture or other land uses. However, although there has been a substantial increase in the area under private ownership since 1965, borne out by the areas of new planting and restocking indicated in Tables 3b and 3c, the percentage holding has remained unaltered.

Distribution of Forest Types

Forest Type by Area and Ownership

Area in thousands of hectares

Forest Type	Forestry Commission		Private Woodland		Total		Per cent of total woodland area
	Area	Per cent of total	Area	Per cent of total	Area	Per cent of total	
Mainly Coniferous High Forest	129.9	77	38.1	23	168.0	100	70
Mainly Broadleaved High Forest	6.1	10	53.2	90	59.3	100	25
Total High Forest	136.0	60	91.3	40	227.3	100	95
Coppice with Standards	—	—	0.1	100	0.1	100	—
Coppice	—	—	1.8	100	1.8	100	1
Scrub	1.0	12	7.2	88	8.2	100	3
Cleared	1.8	55	1.5	45	3.3	100	1
Total	138.8	58	101.9	42	240.7	100	100

The table shows that there is substantially more Coniferous High Forest than Broadleaved, as might be expected as a result of the afforestation of upland sites, and that the other forest types form a minor part of the total area. In addition, Table 2 on page 13 indicates that 83 per cent of all Broadleaved High Forest is in "Other" private ownership. This does not imply lack of management, but rather that some owners have either never joined or have withdrawn from the formal Dedication or Approved Woodland schemes although continuing to manage their woodlands on sound principles.

The classification of crops has varied from survey to survey depending upon the aims and objectives of the assessment. In 1947 the objective was to ascertain the position after wartime fellings and the classification included such forest types as Devastated (crops from which most merchantable trees had been removed), and areas felled before or after September 1939. In 1965 the need to recognise these special categories had disappeared but, as the effects of exploitation were still evident in many of the stands it was necessary to introduce new categories such as Utilisable Scrub and Worked and Unworked Coppice to accommodate woods in a transition stage. A further period of fifteen years has resulted in many crops developing either naturally, or as a result of man's intervention, from a less productive to a more productive category. However it can be difficult, particularly in the case of some broadleaved crops, to place them neatly and permanently within any consistent system of classification. For example, standards can be allowed to grow on and close canopy to the exclusion of coppice, so leading to a reclassification from Coppice with Standards to High Forest. Heavy selective felling in High Forest may lead to reclassification as Scrub, and also, over time, Scrub stands may improve enough in quality to be considered as High Forest. Therefore, comparison of results for the distribution of forest types, particularly of broadleaved crops, is seldom straightforward and it is sometimes necessary to combine categories in order to show trends.

Distribution of Forest Types by Percentage of Woodland Area

Forest Type	Percentage of Woodland Area		
	1947	1965	1980
Coniferous High Forest	33	65	70
Broadleaved High Forest	26	13	25
Total High Forest	59	78	95
Coppice with Standards	1	<1	<1
Coppice	5	<1	1
Scrub	17	19	3
Cleared	18	3	1
Total	100	100	100

NOTE:

Scrub includes Devastated in 1947 and both Utilisable and Unutilisable Scrub in 1965.

The table above illustrates the proportions of forest types found at each assessment but does not take into account the effects of the various minimum areas.

The geographical location of the two High Forest types is indicated in the following table which analyses the proportions of the Welsh totals of High Forest types and land area administered by each Conservancy.

Conservancy	Percentage of Welsh Total			
	Coniferous High Forest	Broadleaved High Forest	Total High Forest	Total Land Area
North Wales	52	47	51	53
South Wales	48	53	49	47
Total	100	100	100	100

Thus Broadleaved High Forest is rather better represented in South than North Wales.

Mainly Coniferous High Forest

There has been an increase in the area of Coniferous High Forest from 33 per cent of the woodland area in 1947 to 70 per cent in 1980. The increase was most rapid between 1947 and 1965, when the area under conifers almost trebled, and although the rate of increase has been slow since that time, the actual area has risen by some 37 thousand hectares to the current value of 167 960 ha.

The distribution of planting years and ownership set out in Table 3 shows that 87 per cent of the conifer woodland has been planted in the forty year period 1941-1980, and whilst this is a direct result of the presence of the Forestry Commission, the private owners' share of conifer planting has steadily increased from 10 per cent in the P41-50 age class to 35 per cent in the P71-80 age class.

The three major conifer species are Sitka spruce, larch and Norway spruce, a selection influenced by the soil types, sites and conditions that obtain in upland areas of high rainfall. All classes of ownership have favoured the spruce and larch, although the third choice on Dedicated and Approved estates has been Douglas fir. The relative importance of the major coniferous species at the time of the three Surveys is shown below.

Year	1st	2nd	3rd	4th
1947	Sitka spruce	Norway spruce	Jap./Hybrid larch	European larch
1965	Sitka spruce	Jap./Hybrid larch	Norway spruce	Douglas fir
1980	Sitka spruce	Jap./Hybrid larch	Norway spruce	Douglas fir

Mainly Broadleaved High Forest

It is estimated that there are 59 327 ha of Broadleaved High Forest in Wales, of which 49 177 ha is in "Other" private ownership. The major species is oak, which accounts for more than 40 per cent of Broadleaved High Forest, and is also second to Sitka spruce in terms of area in all species. The next most widespread species among the broadleaves are ash, beech and birch. The age class distribution as shown by planting years in Table 5 indicates that 36 per cent of oak is more than eighty years of age and that 38 per cent originated in the years 1901-40. Since that time 5 374 ha are shown in the P. year class P41-50 (20 per cent of the oak found) derived partly from planting and more probably from crops that were previously classified as Coppice or Scrub. Ash and birch both show a peak of incidence during the period 1941-60, with 33 per cent of ash and 44 per cent of birch in the one decade P41-50.

Broadleaved High Forest has, at 25 per cent, approximately the same proportion of woodland area in 1980 as it did in 1947. However, the percentage figure masks an actual increase for the forest type, as the total woodland area has risen markedly over the years. After combining the High Forest element of the small woods with the 1947 estimate it would appear that the area of Broadleaved High Forest has risen by some 17 thousand hectares. Conversely, both the proportion and area of this forest type were lower in 1965 than in either of the other surveys. So the trend has been for Broadleaved High Forest to be classified as Scrub, restocked with conifers and disafforested during the period to the mid-sixties, and then for new woodland to be planted or colonised and for scrub to develop and improve either naturally, or with management, into High Forest to produce the present estimate.

There were 358 ha of elm present at the time of assessment, however, a further reduction in the overall total can be expected to take place, as more stands become infected with Dutch elm disease.

The relative importance of the major broadleaved species in High Forest at the time of each Survey is shown below.

Year	1st	2nd	3rd	4th
1947	Oak	Ash	Birch	Beech
1965	Oak	Beech	Ash	Sycamore
1980	Oak	Ash	Beech	Birch

## **Coppice and Coppice with Standards**

There are 1 929 ha still classed as Coppice or Coppice with Standards. This is predictably a significant reduction on the area found in 1947. Most of the change had occurred by 1965.

Stands previously worked as Coppice or Coppice with Standards, have been cleared and restocked, or have been allowed to develop naturally, some into Scrub, others into Broadleaved High Forest.

## **Scrub**

The area of Scrub has fallen during the last thirty years from 17 per cent of the total woodland area to the current figure of 3 per cent. There was a rise in 1965 largely because of the classifications adopted. As might be expected, Scrub is but a minor feature of Forestry Commission and Dedicated and Approved estates, and indeed, more than 80 per cent of Scrub is in "Other" private ownership. The reduction in overall area has been caused partly by clearance, partly by replanting and partly by natural development into Broadleaved High Forest.

The major components of Scrub were Other broadleaves, including such species as hawthorn, willow and rhododendron, and then alder and oak. All these stands will have been classified as Scrub by being of poor form (less than half the stems producing 3m timber lengths) or of unmarketable species.

## **Overall Broadleaved Position**

As noted above, it is difficult to make direct comparisons with past results, but it is possible to draw some conclusions, especially for figures at a country level. As broadleaves form a substantial proportion of the total area it is worth considering their overall position, thus overcoming some of the problems that may arise through changes in classification. If the broadleaved areas of High Forest, Coppice and Scrub are combined, and allowance made for the effects of small woodland blocks, it would appear that the total area is no less than it was 30 years ago. The fact that species such as sycamore, ash and birch have shown an increase in area is probably the result of colonisation. On the other hand, oak is now less prevalent than it was in 1947, there being approximately 7 thousand hectares less than there were at that time.

## **Standing Volume**

It is estimated that there are approximately 26 million cubic metres overbark in the Welsh woodlands, with almost 16 million cubic metres of coniferous timber and 10 million of broadleaved timber.

The volume distribution by planting year and size class confirm the pattern set by the species/area distribution, so that Sitka spruce, oak, larch, Norway spruce and ash are the species with the most volume. The spruce volume, like that of most conifers, is concentrated in the younger P. year classes and the two smallest size classes; oak is more evenly spread through the age classes, with the exception of the P1861-1900 period, and occurs mainly in the two largest size classes. Ash has a peak of volume in the P41-50 age class and in the 21-30 cm dbh size class.

Volume estimates were produced for both the 1947 and 1965 Surveys, and whilst the standards of measurement were similar to those of 1980 the overall estimates are affected by the minimum area and classification differences.

The total standing volume in 1947 after allowance for volume in woods of 0.25-2.0 ha has risen from 8 million cubic metres overbark to 10 million in 1965, and to 26 million cubic metres in 1980. The figures reflect the volume increases which have taken place as a result of the substantial areas planted in the post-war years now producing measurable timber. The rate of volume increase which was relatively small between 1947 and 1965, but has increased markedly since then, can be expected to continue to rise rapidly as the large areas planted in the nineteen sixties and seventies move into the measurable size category. Most of this volume increase will be of coniferous timber.

The volume distribution by ownership and by species in the productive forest types is shown in the tables below.

**Volume by Ownership Classes as a Percentage of Total Standing Volume**

		1947	1965	1980
Forestry Commission	Coniferous	18	43	48
	Broadleaved	3	4	2
	Total	21	47	50
Private	Coniferous	19	15	12
	Broadleaved	60	38	38
	Total	79	53	50
All	Coniferous	37	58	60
	Broadleaved	63	42	40
	Total	100	100	100

**Volume by Major Species Groups in High Forest as a Percentage of Total Standing Volume**

Species Group	1947	1965	1980
Pines	4	5	5
Spruces	13	29	34
Larches	10	15	13
Oak	31	21	18
Beech	9	4	4
Sycamore, ash and birch	14	10	11

The tables show that the coniferous share of the volume rose substantially between 1947 and 1965 and this is also reflected in the rise in the percentage of spruce. The rise between 1965 and 1980 has been relatively small in percentage terms, but must be seen in the light of a coniferous volume that has increased from 6 million to 16 million cubic metres over the period. On the other hand, although the proportion of volume in broadleaved species has declined the actual volume has increased to more than twice its 1965 estimate.

In estimating the standing volumes no allowance has been made for location or for any planning, conservation or amenity restrictions, so that it must not be assumed that all the volume in the tables is available for harvesting.

Diagram 1

Woodland Area by Ownership

Wales

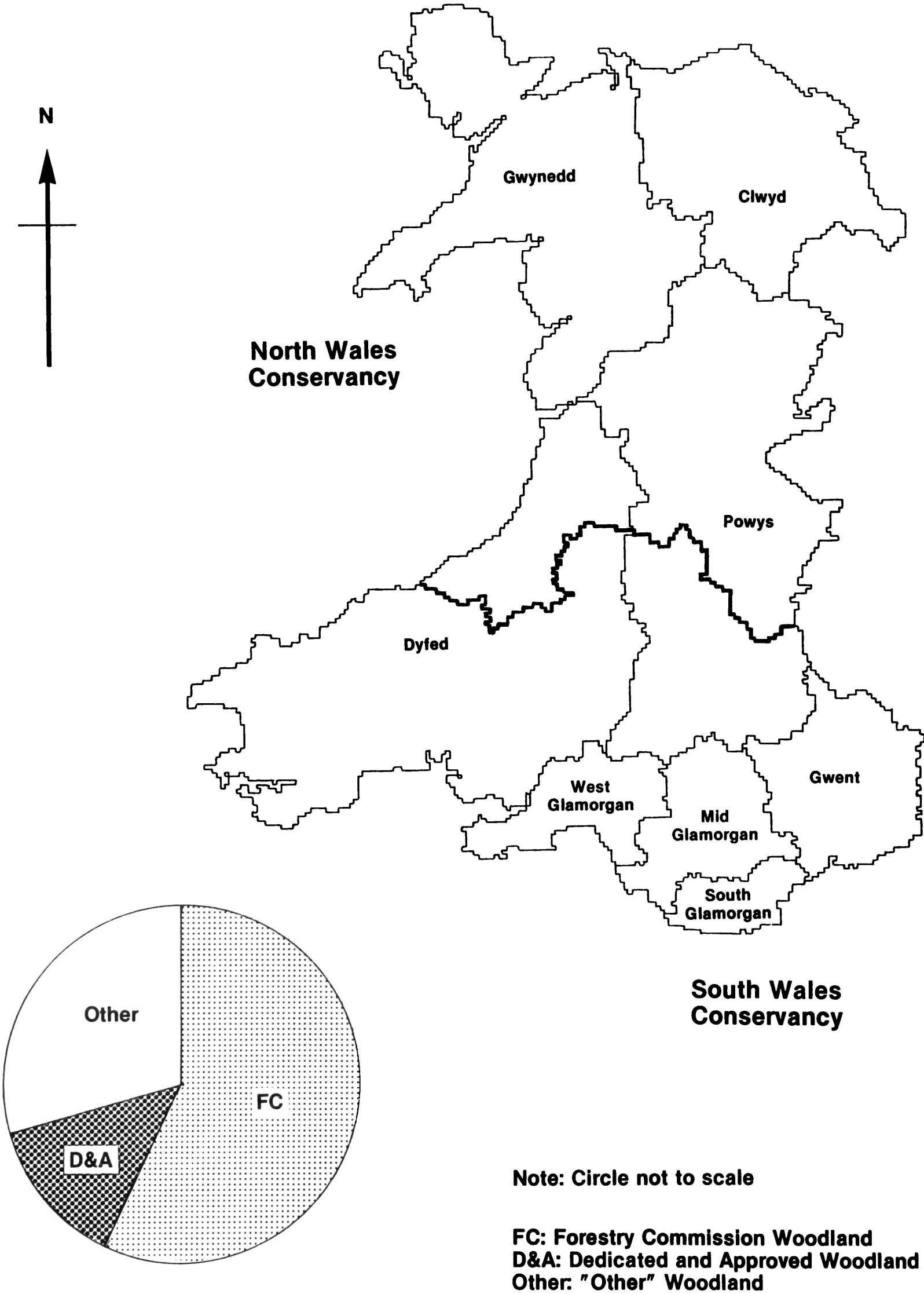




TABLE 1

SUMMARY OF AREAS BY OWNERSHIP

Area of Wales (including inland water):

2 076 402 hectares.

	Hectares	% Woodland Area
Area of Forestry Commission Woodland	138 854	57
Area of Dedicated and Approved Woodland	32 994	14
Area of "Other" Woodland	68 936	29
Total Area of Woodland over 0.25 ha	240 784	100

NOTES:

The areas of Forestry Commission and Dedicated and Approved Woodlands were taken from the forest records; these are assumed to be accurate. Any uncertainty, therefore, arises in the estimate of "Other" Woodlands.

The O.S. 1:50 000 First Series maps used in the survey were compiled photographically from the O.S. Seventh Series one inch to one mile maps which were last revised for major change between 1964 and 1972.

The estimated total woodland area is 240 784 ha ( $\pm$  803 ha or 0.3 per cent). This represents 11.6 per cent of the land and inland water area of Wales. In addition, an estimated area of 11 900 ha not represented on the maps but found during the ground sample, has not been included in the above total because of the limited information about the composition of this extra woodland and the substantial standard error attached to the estimate.

Some of the land shown on the maps as woodland has been reclassified by the Census either because the land use has changed or because it did not fall within the definition of woodland used in the survey. It is estimated that there were approximately 7 910 ha in this category.

Small Woods

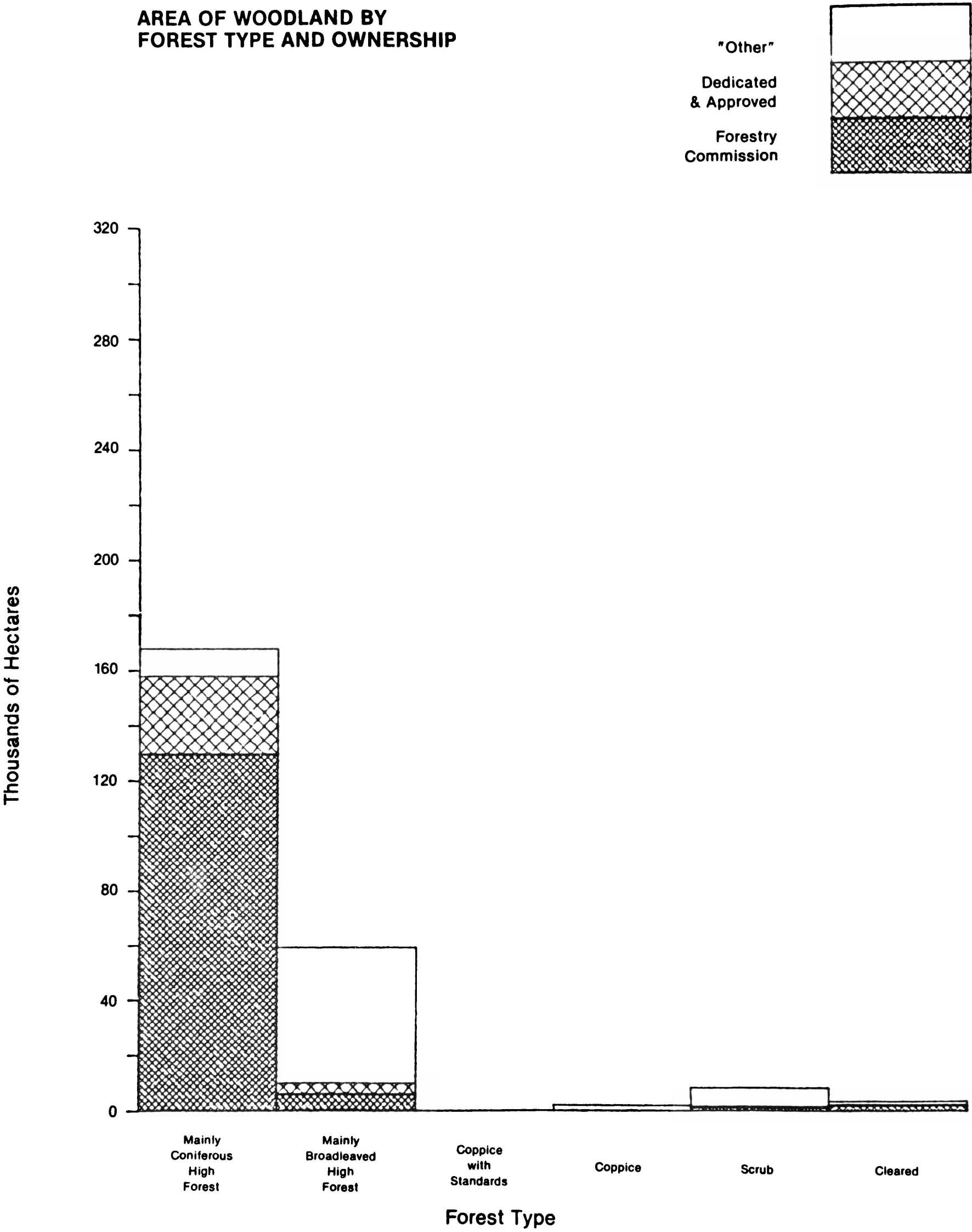
Details of Forestry Commission and Dedicated and Approved Woodlands are not available as the data for these ownerships are not recorded by individual woodland blocks.

"Other" Woodlands Only

	Woods 0.25-1.99 ha	Woods 2.0-9.99ha
Total Number of Woods	15 000	7 180
Total Area of Woods	14 115 ha	28 460 ha
Mean Area of Woods	0.94 ha	3.96 ha

DIAGRAM 2

AREA OF WOODLAND BY  
FOREST TYPE AND OWNERSHIP



**TABLE 2     AREA OF WOODLAND BY FOREST TYPE AND OWNERSHIP**

**Hectares**

Forest Type	Forestry Commission		Dedicated and Approved		"Other"		Total	
	area	% of total	area	% of total	area	% of total	area	% of total
Mainly Coniferous High Forest	129 930	94	28 077	86	9 953	14	167 960†	70
Mainly Broadleaved High Forest	6 123	4	3 886	12	49 312*	72	59 321†	25
Total High Forest	136 053	98	31 963	98	59 265	86	227 281†	95
Coppice with Standards	—	—	53	<1	27	<1	80†	<1
Coppice	1	<1	140	<1	1 708	2	1 849†	1
Scrub	1 017	1	447	1	6 758	10	8 222†	3
Cleared	1 783	1	391	1	1 178	2	3 352†	1
Total	138 854	100	32 994	100	68 936	100	240 784	100

**NOTES:**

\* This figure for Mainly Broadleaved High Forest contains 33.0 per cent of Coppice origin.

† Standard errors on the area estimates of forest types are as follows:

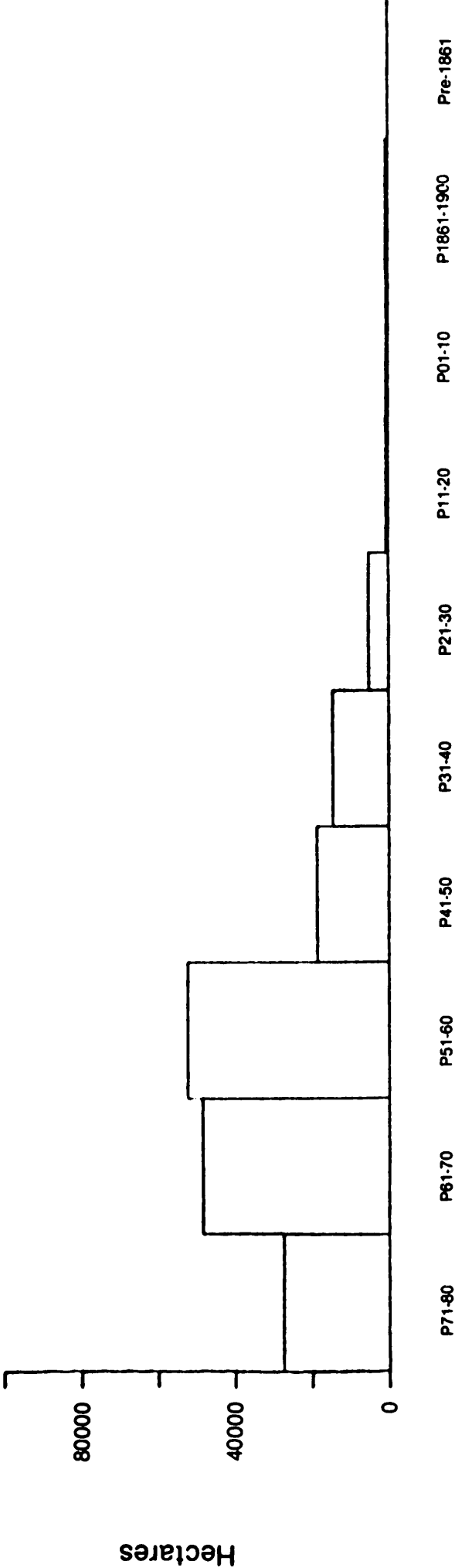
Mainly Coniferous High Forest	± 0.5 per cent
Mainly Broadleaved High Forest	± 2.2 per cent
Total High Forest	± 0.5 per cent
Coppice with Standards	± 29.2 per cent
Coppice	± 26.3 per cent
Scrub	± 10.3 per cent
Cleared	± 8.1 per cent

In this table, areas of the two categories of High Forest have been derived by allocating the area of each individual High Forest stand to either Mainly Broadleaved High Forest if 50 per cent or more of the area comprised broadleaved species, or to Mainly Coniferous High Forest if more than 50 per cent of the area comprised coniferous species.

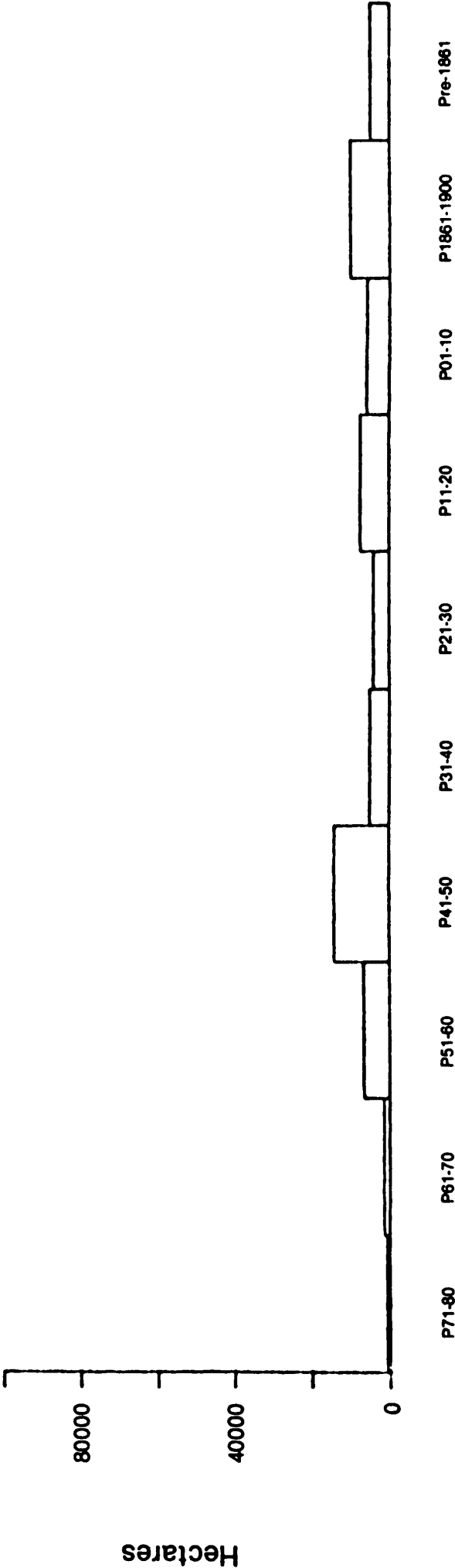
**DIAGRAM 3**  
**AREA OF HIGH FOREST TYPES BY PLANTING YEAR CLASSES**

**ALL WOODLAND OWNERSHIPS**

**MAINLY CONIFEROUS**



**MAINLY BROADLEAVED**



**Planting Year Classes**



AREA OF HIGH FOREST BY PLANTING YEAR CLASSES AND OWNERSHIPS

DIAGRAM 3a  
Forestry Commission Woodland

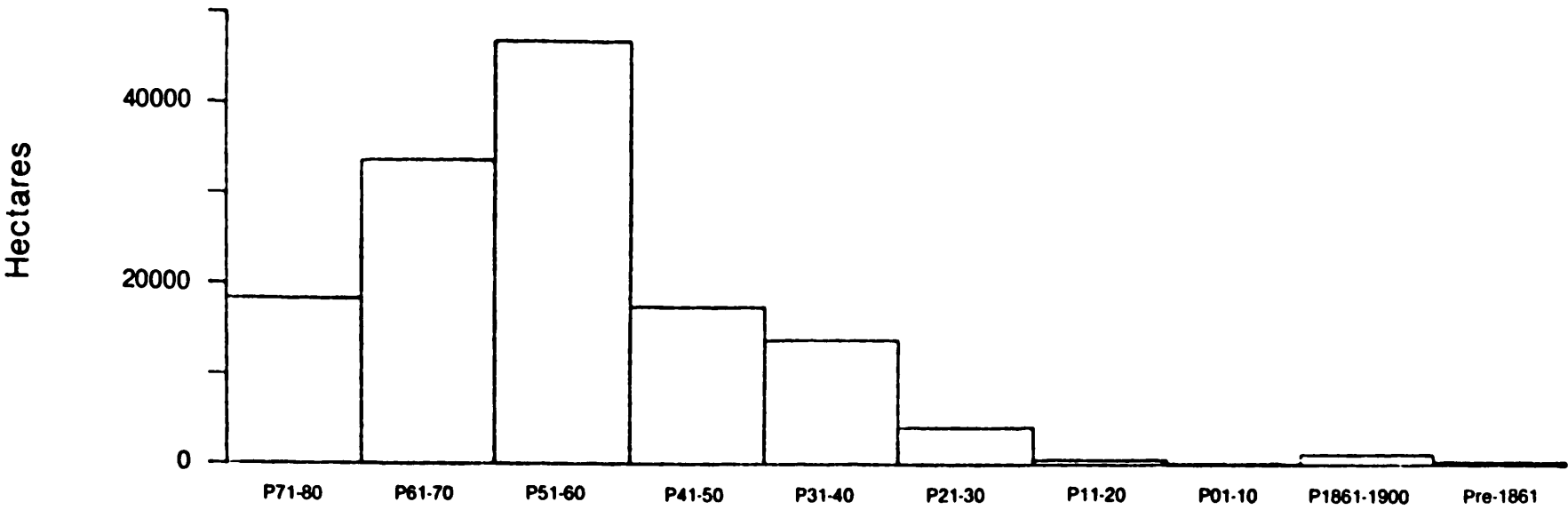


DIAGRAM 3b  
Dedicated and Approved Woodland

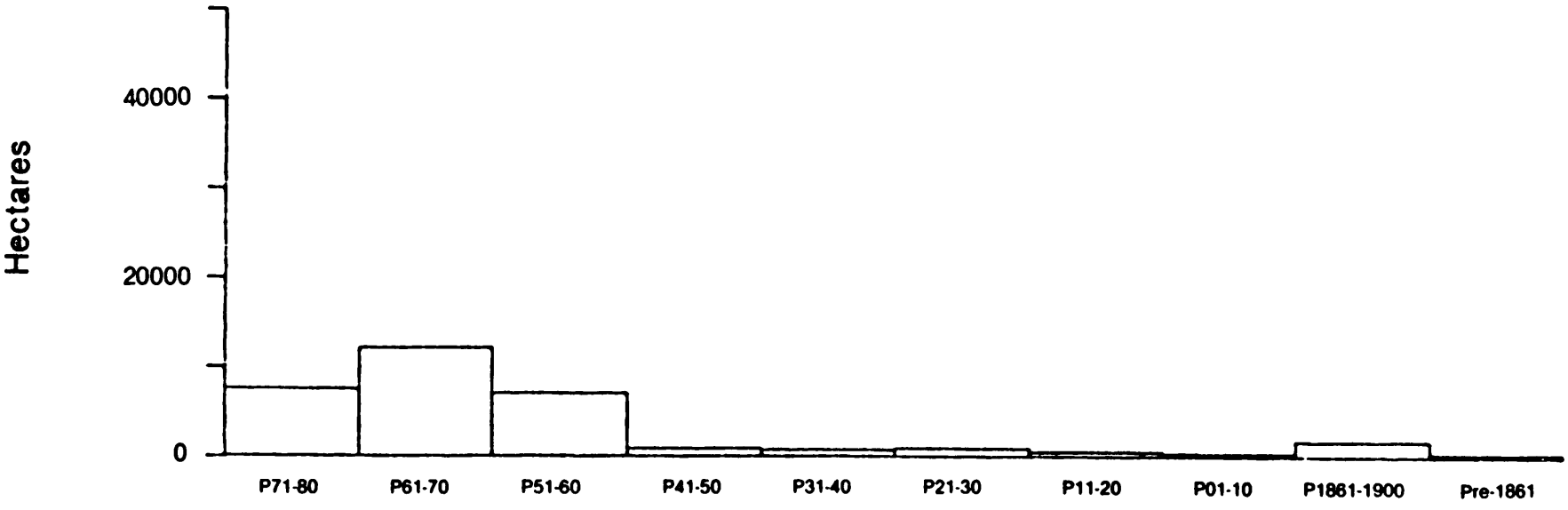
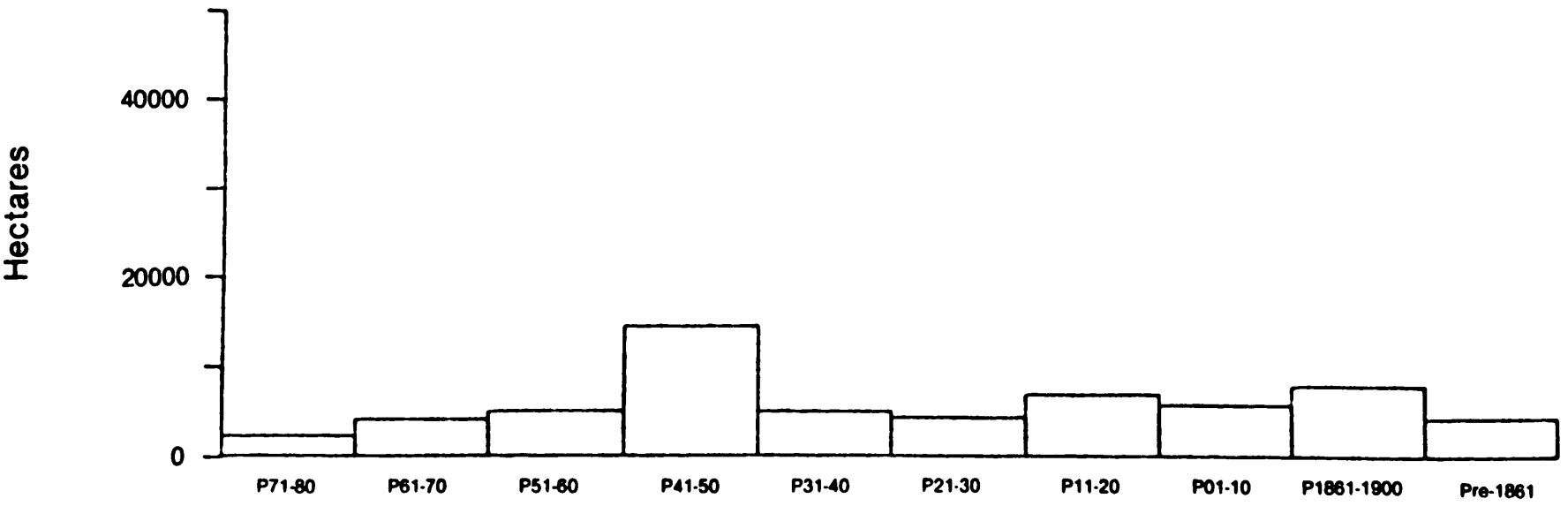


DIAGRAM 3c  
"Other" Woodland



Planting Year Classes

AREA OF HIGH FOREST TYPES BY PLANTING YEAR CLASSES  
AND OWNERSHIPS

TABLE 3aForestry Commission WoodlandHectares

High Forest	Planting Year Classes										Total
	P71-80	P61-70	P51-60	P41-50	P31-40	P21-30	P11-20	P01-10	P1861-1900	Pre-1861	
Mainly Coniferous	18 239	33 215	44 351	16 835	13 266	3 791	94	39	95	5	129 930
Mainly Broadleaved	125	385	2 380	650	532	305	383	73	1 004	286	6 123
Total	18 364	33 600	46 731	17 485	13 798	4 096	477	112	1 099	291	136 053

TABLE 3bDedicated and Approved WoodlandHectares

High Forest	Planting Year Classes										Total
	P71-80	P61-70	P51-60	P41-50	P31-40	P21-30	P11-20	P01-10	P1861-1900	Pre-1861	
Mainly Coniferous	7 386	11 810	6 660	731	467	619	200	64	134	6	28 077
Mainly Broadleaved	162	312	400	153	278	209	295	236	1 581	260	3 886
Total	7 548	12 122	7 060	884	745	828	495	300	1 715	266	31 963

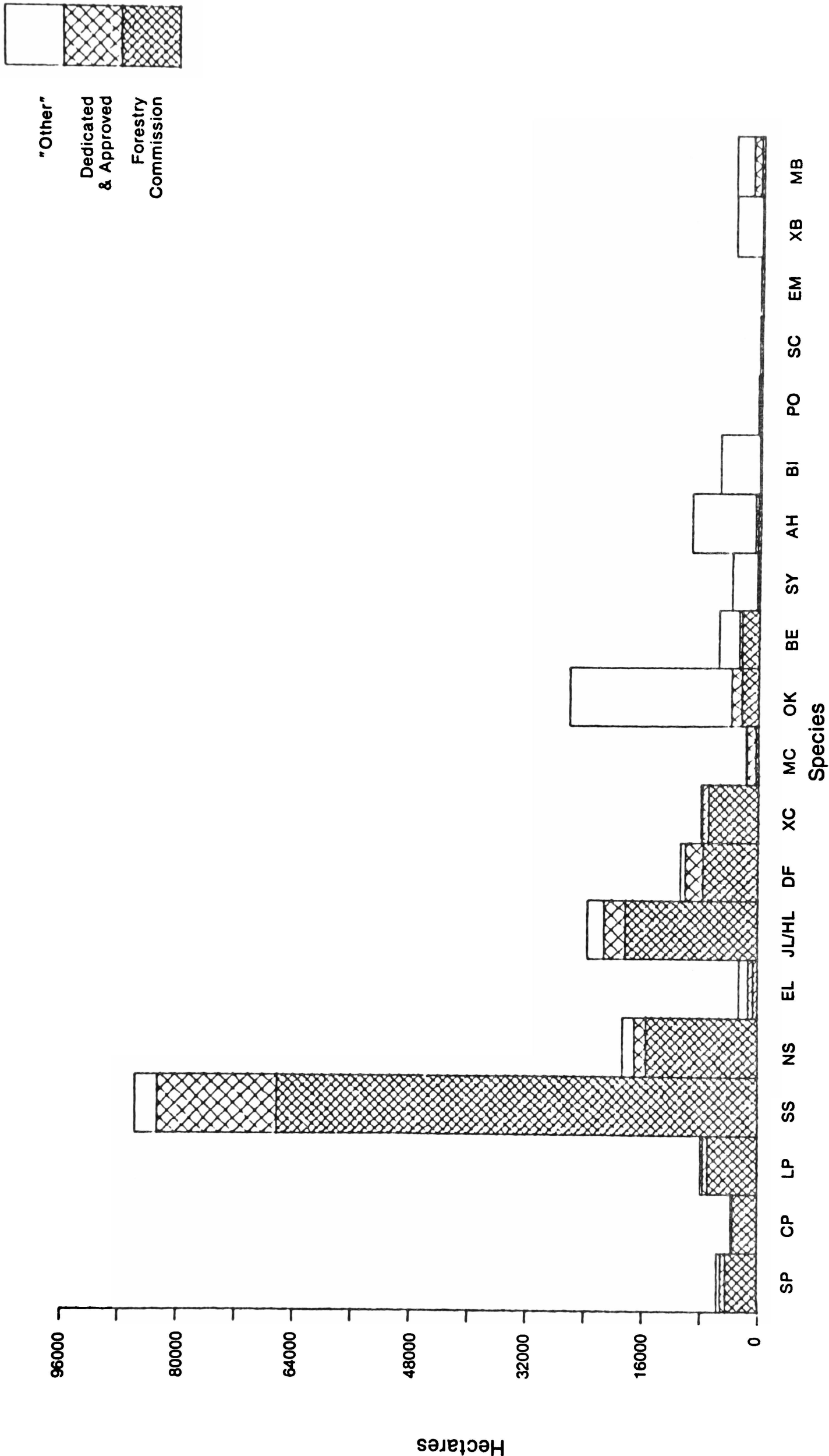
TABLE 3c"Other" WoodlandHectares

High Forest	Planting Year Classes										Total (S.E.)
	P71-80	P61-70	P51-60	P41-50	P31-40	P21-30	P11-20	P01-10	P1861-1900	Pre-1861	
Mainly Coniferous	1 760	3 425	1 304	1 039	854	731	163	333	315	29	9 953 (± 8%)
Mainly Broadleaved	418	621	3 671	13 309	4 067	3 498	6 633	5 321	7 540	4 234	49 312 (± 3%)
Total	2 178	4 046	4 975	14 348	4 921	4 229	6 796	5 654	7 855	4 263	59 265 (± 2%)

NOTE:  
• This total contains 33.0 per cent of Coppice origin.

DIAGRAM 4

AREA OF HIGH FOREST BY PRINCIPAL SPECIES AND OWNERSHIP



Note: For an explanation of the abbreviations used, see Appendix 2.



TABLE 4

AREA OF HIGH FOREST BY PRINCIPAL SPECIES AND OWNERSHIP

Hectares

Species	Forestry Commission			Dedicated and Approved			"Other"			Total Area of all Woodland
	Area	Percentage		Area	Percentage		Area	Percentage		
		Of Category	Of all Species		Of Category	Of all Species		Of Category	Of all Species	
Scots pine	4 371	3	3	695	2	2	526	5	1	5 592
Corsican pine	3 407	3	3	138	<1	<1	148	1	<1	3 693
Lodgepole pine	6 855	5	5	706	3	2	334	3	1	7 895
Sitka spruce	66 216	52	49	16 434	59	52	3 051	31	5	85 701
Norway spruce	15 384	12	11	1 667	6	5	1 590	16	3	18 641
European larch	634	<1	<1	716	3	2	1 245	12	2	2 595
Jap./Hybrid larch	18 234	14	13	3 023	11	9	2 204	22	4	23 461
Douglas fir	7 549	6	6	2 501	9	8	658	7	1	10 708
Other conifers	6 829	5	5	879	3	3	198	2	<1	7 906
Mixed conifers	408	<1	<1	1 201	4	4	135	1	<1	1 744
Total conifers	129 887	100	95	27 960	100	87	10 089	100	17	167 936†
Oak	2 329	37	2	1 458	36	5	22 300	45	37	26 087
Beech	2 404	39	3	413	10	1	2 795	6	5	5 612
Sycamore	129	2	<1	300	8	1	3 404	7	6	3 833
Ash	369	6	<1	397	10	1	8 621	17	14	9 387
Birch	174	3	<1	73	2	<1	5 336	11	9	5 583
Poplar	176	3	<1	210	5	1	118	<1	<1	504
Sweet chestnut	43	1	<1	24	1	<1	345	1	1	412
Elm	3	<1	<1	15	<1	<1	340	1	1	358
Other broadleaves	179	3	<1	26	1	<1	3 513	7	6	3 718
Mixed broadleaves	360	6	<1	1 087	27	4	2 404	5	4	3 851
Total broadleaves	6 166	100	5	4 003	100	13	49 176*	100.	83	59 345†
Total	136 053	100	100	31 963	100	100	59 265	100	100	227 281

NOTES:

\* Contains 33.0 per cent of Coppice origin.

† The standard errors of the area estimates of High Forest are as follows:  

Total conifers ± <1 per cent

Total broadleaves ± 2 per cent

The total area of conifer and of broadleaved species in this and subsequent High Forest tables differs from the total area classified as Mainly Conifer and Mainly Broadleaved in Tables 2 and 3. The reason for this is that here the actual percentages of species in each stand have been totalled.

TABLE 5  
AREA OF HIGH FOREST BY PRINCIPAL SPECIES AND PLANTING YEAR CLASSES

All Woodland Ownerships

Hectares

Species	P71- 80	P61- 70	P51- 60	P41- 50	P31- 40	P21- 30	P11- 20	P01- 10	P1861- 1900	Pre- 1861	Totals
Scots pine	78	548	1 990	1 174	876	517	65	97	164	83	5 592
Corsican pine	239	587	1 476	594	531	166	32	4	59	5	3 693
Lodgepole pine	1 225	3 480	2 846	102	208	34	—	—	—	—	7 895
Sitka spruce	19 097	28 134	22 726	8 776	5 587	1 309	60	9	3	—	85 701
Norway spruce	1 046	4 371	5 051	3 254	3 704	1 119	43	15	34	4	18 641
European larch	32	221	354	475	556	417	141	259	76	64	2 595
Jap./Hybrid larch	3 342	4 107	10 465	3 102	1 847	566	28	1	3	—	23 461
Douglas fir	1 306	3 282	3 690	577	911	839	46	26	29	2	10 708
Other conifers	900	3 386	2 956	285	247	47	7	—	44	34	7 906
Mixed conifers	148	356	740	143	109	88	33	36	79	12	1 744
Total conifers	27 413	48 472	52 294	18 482	14 576	5 102	455	447	491	204	167 936
Oak	101	181	1 130	5 373	1 430	1 293	3 899	3 246	6 292	3 142	26 087
Beech	127	281	1 427	225	364	114	443	618	1 221	792	5 612
Sycamore	38	153	241	1 132	338	176	551	440	527	237	3 833
Ash	18	101	688	3 060	1 163	1 261	1 197	698	980	221	9 387
Birch	198	121	1 210	2 446	857	333	342	55	20	1	5 583
Poplar	21	133	288	34	23	1	—	—	—	4	504
Sweet chestnut	2	10	17	64	63	32	138	16	53	17	412
Elm	—	2	18	98	1	75	33	12	71	48	358
Other broadleaves	60	154	913	1 211	409	344	475	96	55	1	3 718
Mixed broadleaves	115	161	545	595	234	429	234	435	955	148	3 851
Total broadleaves	680	1 297	6 477	14 238	4 882	4 058	7 312	5 616	10 174	4 611	59 345
Total	28 093	49 769	58 771	32 720	19 458	9 160	7 767	6 063	10 665	4 815	227 281

NOTE:  
The standard errors of the estimates of totals in this Table are the same as those given for Table 4.

**TABLE 6            PRINCIPAL SPECIES IN HIGH FOREST BY PLANTING YEAR CLASSES**

All Woodland Ownerships

Planting Year Classes	Principal Species by Percentage of Area				
	First	%	Second	%	Third
P71-80	Sitka spruce	68	Jap./Hybrid larch	12	Douglas fir
P61-70	Sitka spruce	57	Norway spruce	9	Jap./Hybrid larch
P51-60	Sitka spruce	39	Jap./Hybrid larch	18	Norway spruce
P41-50	Sitka spruce	27	Oak	16	Norway spruce
P31-40	Sitka spruce	29	Norway spruce	19	Jap./Hybrid larch
P21-30	Sitka spruce	14	Oak	14	Ash
P11-20	Oak	50	Ash	15	Other broadleaves
P01-10	Oak	54	Ash	12	Beech
P1861-1900	Oak	59	Beech	11	Ash
Pre 1861	Oak	65	Beech	16	Sycamore

TABLE 7

AREA OF COPPICE BY PRINCIPAL SPECIES

All Woodland Ownerships
Hectares

Sub Type		Principal Species of Coppice					Total	
		Sycamore	Ash	Sweet chestnut	Hornbeam	Hazel		Other species
With Standards	ha	—	—	—	—	—	80	80
	%	—	—	—	—	—	100	100
Coppice Only	ha	83	370	—	—	53	1 343	1 849
	%	4	20	—	—	3	73	100
Total	ha	83	370	—	—	53	1 423	1 929
% of Coppice Total		4	19	—	—	3	74	100

NOTE:

"Other species" includes mixtures of the above five named species as well as other minor species of coppice eg. oak.

TABLE 8

AREA OF COPPICE WITH STANDARDS BY PRINCIPAL SPECIES OF BOTH COPPICE AND STANDARDS

All Woodland Ownerships
Hectares

Principal Species of Standard	Principal Species of Coppice						Total
	Sycamore	Ash	Sweet chestnut	Hornbeam	Hazel	Other species	
Conifers	—	—	—	—	—	—	—
Oak	—	—	—	—	—	53	53
Ash	—	—	—	—	—	27	27
Sweet chestnut	—	—	—	—	—	—	—
Other broadleaves	—	—	—	—	—	—	—
Total	—	—	—	—	—	80	80
% of Total	—	—	—	—	—	100	100



DIAGRAM 5

STANDING VOLUME OF TIMBER BY CATEGORY AND OWNERSHIP

All Woodlands

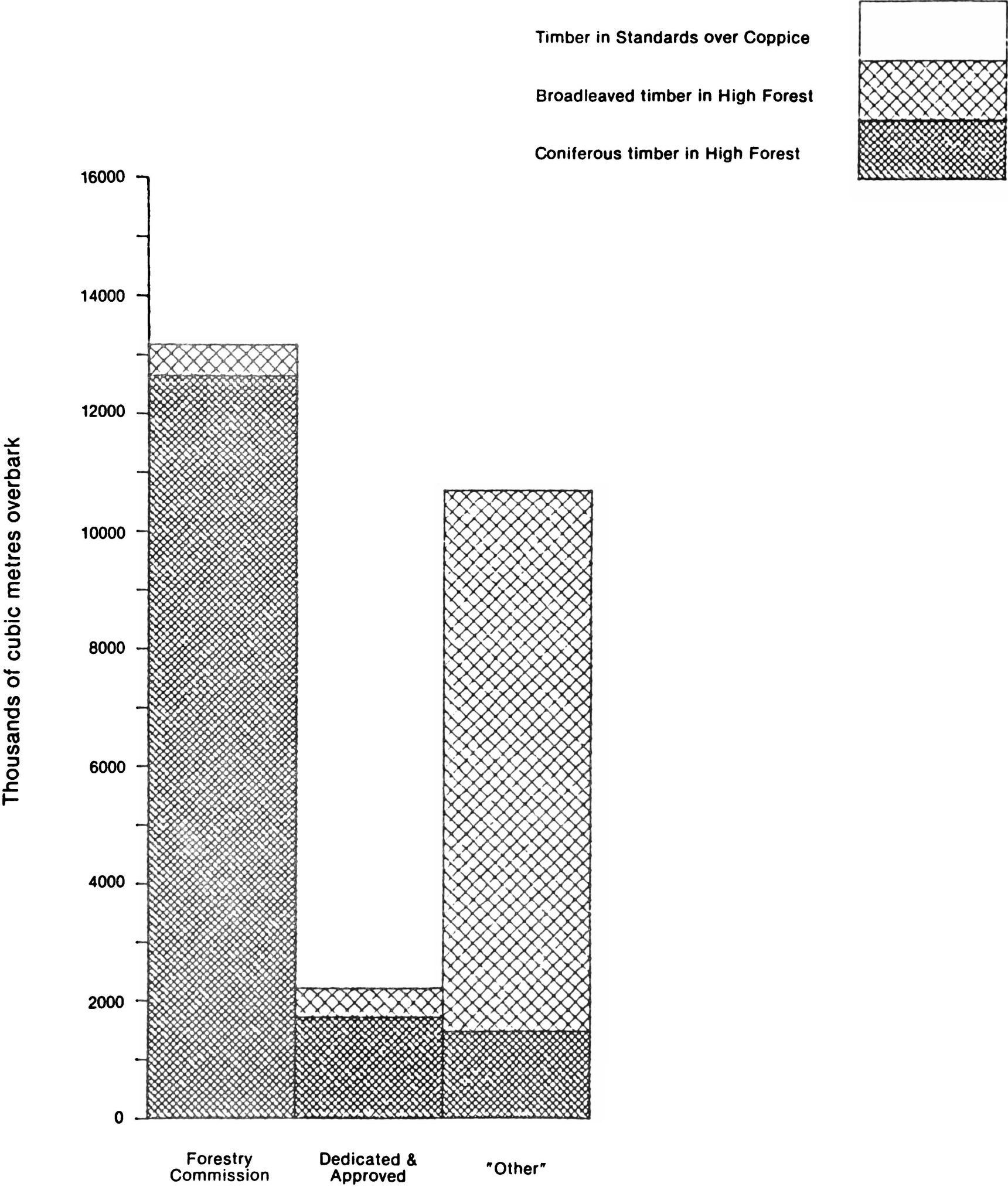


TABLE 11

STANDING VOLUME OF TIMBER BY CATEGORY AND OWNERSHIP

All Woodlands

Thousands of cubic metres overbark

Volume Category	Forestry Commission	Dedicated and Approved	"Other"	Total (S.E.)
In High Forest				
Coniferous Timber	12 643.3	1 711.3	1 466.3	15 820.9 (± 1%)
Broadleaved Timber	533.6	495.1	9 241.9	10 270.6 (± 4%)
Total High Forest	13 176.9	2 206.4	10 708.2	26 091.5 (± 2%)
Timber in Standards over Coppice	—	5.0	3.8	8.8 (± 36%)
Total*	13 176.9	2 211.4	10 712.0	26 100.3 (± 2%)

NOTE:

\* No volume estimate is made for Scrub or Coppice.

DIAGRAM 6

STANDING VOLUME OF TIMBER IN HIGH FOREST AND STANDARDS OVER COPPICE BY  
PRINCIPAL SPECIES AND PLANTING YEAR CLASSES

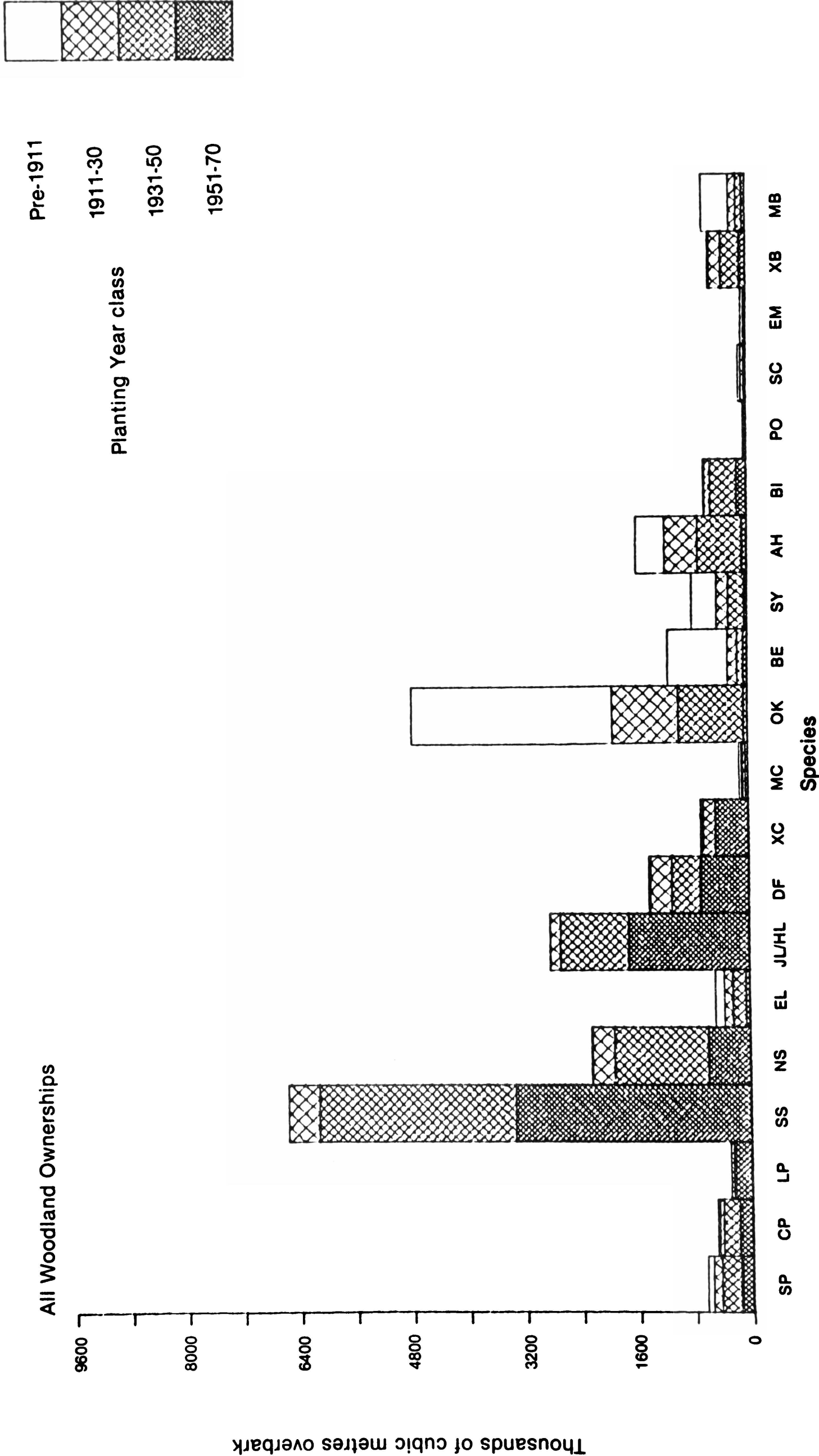




TABLE 12  
STANDING VOLUME OF TIMBER IN HIGH FOREST AND STANDARDS OVER  
COPPICE BY PRINCIPAL SPECIES AND PLANTING YEAR CLASSES

All Woodland Ownerships  
Thousands of cubic metres overbark

Species	P61- 70	P51- 60	P41- 50	P31- 40	P21- 30	P11- 20	P01- 10	P1861- 1900	Pre- 1861	Total
Scots pine	15.2	149.6	126.9	147.6	109.3	15.4	19.6	36.5	23.1	643.2
Corsican pine	25.9	153.9	107.1	125.1	49.9	7.1	1.5	21.0	2.8	494.3
Lodgepole pine	73.1	180.4	10.3	32.6	5.0	—	—	—	—	301.4
Sitka spruce	978.8	2 357.3	1 457.4	1 337.8	410.2	20.7	3.2	1.3	—	6 566.7
Norway spruce	111.4	487.0	561.6	769.5	296.1	12.7	6.9	11.5	0.5	2 257.2
European larch	13.6	38.2	83.9	108.8	86.1	34.8	88.0	19.3	17.8	490.5
Jap./Hybrid larch	294.4	1 420.4	569.1	401.7	136.3	9.8	0.2	0.9	—	2 832.8
Douglas fir	207.7	475.9	127.3	277.5	288.7	18.5	9.7	13.6	1.9	1 420.8
Other conifers	113.4	357.2	65.8	103.0	18.2	1.1	—	10.4	15.4	684.5
Mixed conifers	1.9	35.7	14.7	17.9	14.3	6.7	11.5	24.8	2.3	129.8
Total conifers	1 835.4	5 655.6	3 124.1	3 321.5	1 414.1	126.8	140.6	139.3	63.8	15 821.2
Oak	4.1	52.8	697.7	225.1	203.5	741.5	707.8	1 399.3	751.2	4 783.0
Beech	0.5	53.3	14.9	70.9	23.1	116.4	214.4	373.3	262.7	1 129.5
Sycamore	8.5	21.9	148.9	90.7	39.3	124.5	90.9	168.8	91.7	785.2
Ash	2.4	66.8	446.7	185.3	252.3	219.8	158.3	194.5	48.0	1 574.1
Birch	9.4	127.8	306.0	78.3	27.5	47.8	11.4	2.8	0.2	611.2
Poplar	6.0	21.3	4.2	8.9	0.4	—	—	0.1	1.5	42.4
Sweet chestnut	—	0.7	12.2	13.2	6.8	41.6	4.1	21.6	12.9	113.1
Elm	—	1.5	4.5	0.2	15.3	8.8	2.6	29.8	10.4	73.1
Other broadleaves	13.0	79.9	176.4	87.8	90.3	73.0	19.1	2.4	0.3	542.2
Mixed broadleaves	3.2	41.7	57.0	26.5	73.0	36.3	114.7	197.4	75.5	625.3
Total broadleaves	47.1	467.7	1 868.5	786.9	731.5	1 409.7	1 323.3	2 390.0	1 254.4	10 279.1
Total	1 882.5	6 123.3	4 992.6	4 108.4	2 145.6	1 536.5	1 463.9	2 529.3	1 318.2	26 100.3

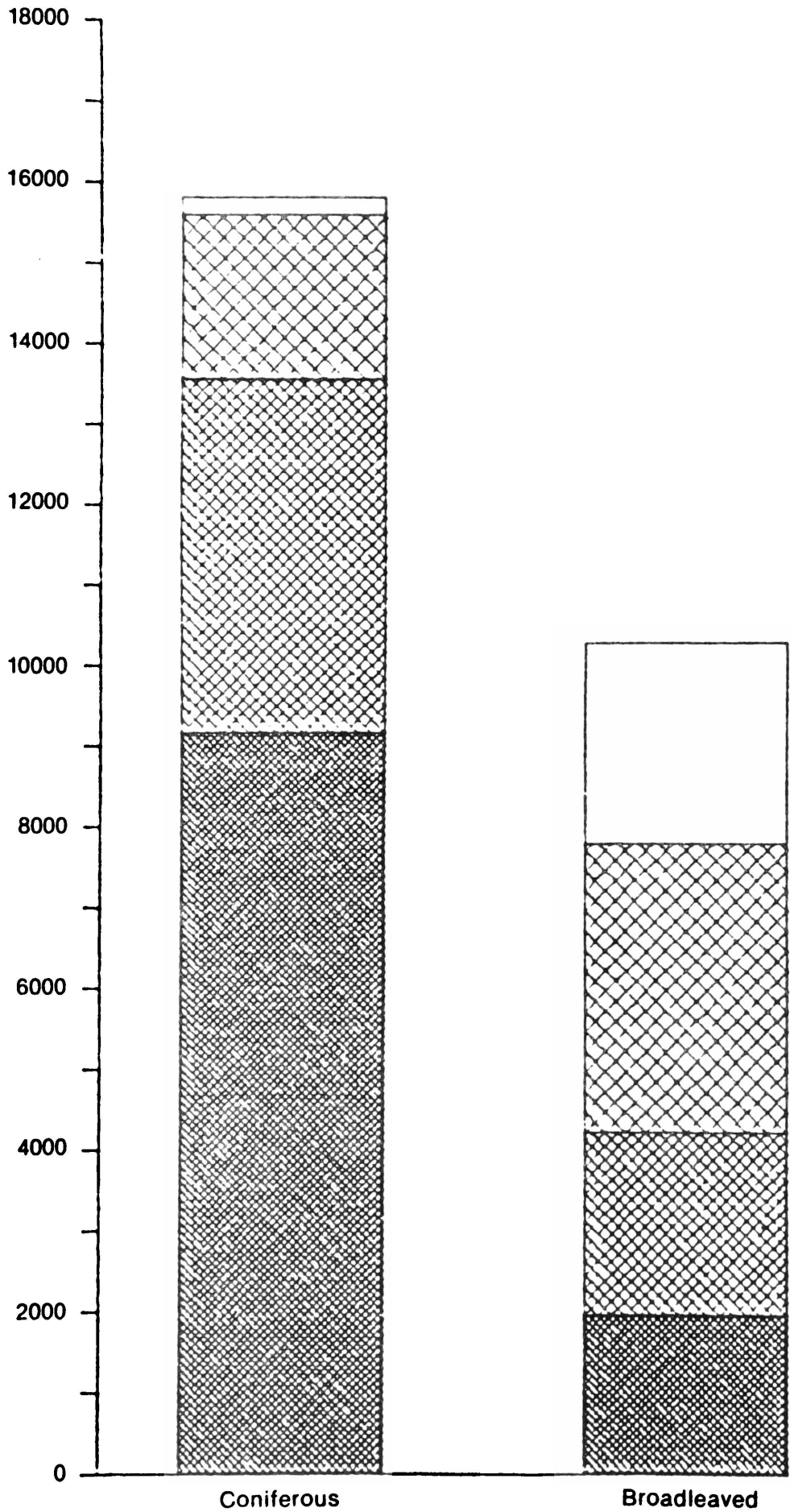
NOTE:  
The standard errors of the estimates of totals in this Table are the same as those given for Table 13.

DIAGRAM 7

STANDING VOLUME OF TIMBER IN HIGH  
FOREST AND STANDARDS OVER COPPICE  
BY SPECIES GROUPS AND SIZE CLASSES

All Woodland Ownerships

Thousands of cubic metres overbark



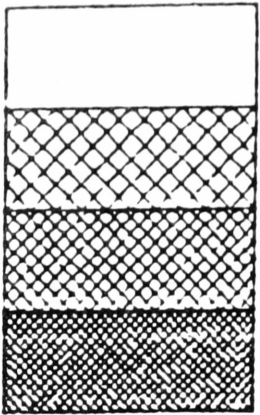
Size Classes  
(dbh)

> 50 cm

31-50 cm

21-30 cm

7-20 cm



**TABLE 13**
**STANDING VOLUME OF TIMBER IN HIGH FOREST AND STANDARDS  
OVER COPPICE BY PRINCIPAL SPECIES AND SIZE CLASSES**

All Woodland Ownerships
Thousands of cubic metres overbark

Species	Size Class (dbh)				Total
	7-20 cm	21-30 cm	31-50 cm	>50 cm	
Scots pine	349.0	160.8	120.4	13.0	643.2
Corsican pine	275.1	141.5	61.2	16.5	494.3
Lodgepole pine	285.2	15.5	0.7	—	301.4
Sitka spruce	4 530.9	1 579.8	443.1	12.9	6 566.7
Norway spruce	1 358.0	700.1	191.7	7.4	2 257.2
European larch	69.8	188.9	206.3	25.5	490.5
Jap./Hybrid larch	1 105.6	1 210.6	510.3	6.3	2 832.8
Douglas fir	639.1	270.4	405.5	105.8	1 420.8
Other conifers	478.6	106.5	72.7	26.7	684.5
Mixed conifers	74.7	27.6	19.3	8.2	129.8
Total conifers	9 166.0	4 401.7	2 031.2 (± 3.1%)	222.3 (± 10.9%)	15 821.2 (± 0.9%)
Oak	810.5	953.9	1 802.1	1 216.5	4 783.0
Beech	125.9	88.5	335.6	579.5	1 129.5
Sycamore	131.1	161.4	351.2	141.5	785.2
Ash	334.2	453.1	555.4	231.4	1 574.1
Birch	281.6	197.8	122.7	9.1	611.2
Poplar	3.8	13.0	19.7	5.9	42.4
Sweet chestnut	7.9	9.6	60.3	35.3	113.1
Elm	8.0	10.5	19.2	35.4	73.1
Other broadleaves	146.4	204.0	169.9	21.9	542.2
Mixed broadleaves	95.0	167.9	153.3	209.1	625.3
Total broadleaves	1 944.4	2 259.7	3 589.4 (± 5.3%)	2 485.6 (± 8.6%)	10 279.1 (± 4.0%)
Total	11 110.4	6 661.4	5 620.6 (± 3.5%)	2 707.9 (± 7.9%)	26 100.3 (± 1.6%)

NOTE:  
The figures in brackets are standard errors.



## **Part Two**

### **Non-Woodland Trees**



COMMENTARY ON THE RESULTS FOR NON-WOODLAND TREES  
IN WALES

PREVIOUS FORESTRY COMMISSION SURVEYS

The 1950-51 Census of Hedgerow Trees and Small Woods provided estimates of the volume of hedgerow and park trees by Country and Conservancy but Wales was totally excluded from the sampling survey of hedgerows carried out in conjunction with the 1965 Census.

SAMPLE STRATA USED IN THE 1980 CENSUS

Soil groups were used as the basis for selection of sampling strata. Seventeen soil groups were recognised for the whole of England and Wales of which ten occurred in Wales. The names and descriptions of the various soil groups are shown in Appendix 3.

The sample size was chosen with the objective of estimating firstly the total number of isolated trees in a county with a precision of  $\pm 25$  per cent, or better, and secondly the species, health, size classes and timber volumes of all non-woodland trees. As the figures in the tables of this Report are a summation of all the Welsh county tables, the precision of the estimates is normally higher than those of the individual counties and in Wales the precision of the estimate of isolated trees is 7.6 per cent.

RESULTS

General

Although non-woodland trees do occur on Forestry Commission land it can be assumed that virtually the whole of this category is privately owned.

The total number of live trees in Wales with a diameter at breast height of 7 cm or more is 12.6 million ( $\pm 9$  per cent) distributed as shown below.

Millions of trees				
	Conifers	Broadleaves	Total	Per cent of total
Isolated Trees	0.2	1.9	2.1	16
Clumps	0.6	3.3	3.9	31
Linear Features	0.7	5.9	6.6	53
Total	1.5	11.1	12.6	100

Coniferous species account for 11 per cent of the total number of measurable trees with spruces the most widely represented species group accounting for over 30 per cent of the conifer total. Pines are next with 23 per cent and then larches with 17 per cent.

The predominant broadleaved species is oak with 20 per cent followed by alder and ash, both with 17 per cent, and sycamore and birch both with 12 per cent.

The distribution of trees by Conservancies is shown below in terms of total tree numbers and tree densities.

The ranges quoted refer to the lowest and highest county or part county values within each Conservancy.

Conservancy	Total number of trees of 7 cm dbh and greater (millions)	Per cent of total	Tree density per square kilometre	
			Average	Range
North Wales	6.3	50	575	483-709
South Wales	6.3	50	641	514-889
Wales	12.6	100	606	483-889

From the previous table it will be seen that the average tree density is slightly higher in South Wales Conservancy than it is in North Wales.

### **Isolated Trees**

There are 2.1 million isolated trees divided into two sub-categories; 1.4 million trees growing on major land use boundaries such as hedges, walls and fences and 0.7 million growing in open positions. Boundaries in urban areas were often difficult to assess and consequently all trees in urban situations were classed as being in open positions irrespective of actual location.

It should be noted that owing to problems of access to many gardens and enclosures, it was necessary on occasions to estimate the dimensions of trees visible from a public right of way.

Conifers, with about two thirds of their number occurring in open positions, account for 8 per cent of the isolated tree population and this percentage is the same for both Conservancies. Cypresses account for over 30 per cent of the coniferous total and represent the substantial population of this genus which now exists in urban gardens. Other conifers are next in importance with 22 per cent and this species group contains a wide range of species, many of which are primarily ornamental. Spruces account for 19 per cent, with pines and larches having 15 and 14 per cent respectively.

Among broadleaved trees about 71 per cent are classed as being on boundaries and 29 per cent open grown. This contrasts markedly with the situation in England which has 45 per cent and 55 per cent respectively.

Oak is the most frequently represented species with 29 per cent and is followed fairly closely by ash with 24 per cent. There is then a substantial gap until the next species group, Other broadleaves, which has 12 per cent; sycamore is fourth with 9 per cent.

Cypresses are the most numerous coniferous trees in both North and South Wales Conservancies but among broadleaves ash followed by oak is the position in North Wales, with the species order reversed in South Wales.

### **Clumps**

There are approximately 650 thousand clumps in Wales covering an area of nearly 12 thousand hectares and including about 3.9 million trees. The average number of trees per clump for Wales is nearly 6 with the figure for South Wales Conservancy just over 6.

Conifers account for 15 per cent of the total and are thus more important in this category than they are as isolated trees or in linear features. Larches are the most important species group with over a third of the total followed by spruces and pines. Ash is the most frequently represented broadleaved species with 19 per cent of the total followed closely by alder. Other broadleaves, oak, sycamore and birch are also well represented. The species distribution pattern differs between North and South Wales Conservancies in that in the former spruces and pines are the commonest conifers while in the South larches and pines predominate. In the case of broadleaved species the order of prevalence in the North is Other broadleaves, ash and sycamore while in the South it is oak, ash and alder.

### **Linear Features**

Linear features include trees in close canopy in well grown avenues and along boundaries, as well as in shelterbelts; this category contains an estimated 6.6 million trees. Coniferous species account for 11 per cent of the total, a percentage greater than that of isolated trees but lower than that for clumps. Spruces have the largest number of trees in the category (39 per cent) followed by pines and Other conifers. Oak is the most frequently occurring broadleaved species with 22 per cent of the total followed by alder with 21 per cent and ash and birch with 14 and 13 per cent respectively. Among the coniferous species groups spruces are the most prevalent in the north of the Country whereas pines occur most frequently in the south; in broadleaves ash is the most common species in the north and oak in the south.



**Size Class Distribution**

In addition to the trees with a minimum dbh of 7 cm there are 2.9 million well-grown trees recorded as being below this limit. To be included in this group in the Survey all such trees had to have single stems, be in good health, and show every likelihood of being able to grow on. They did not include the many coppice shoots of species such as ash and sycamore that may declare themselves in due course. It is therefore probable that the estimate is conservative.

Table 17 shows that when the under 7 cm dbh size class is included the total number of trees in Wales increases from 12.6 million to 15.5 million, a rise of nearly a quarter. The percentage number of trees in each of the diameter classes is as follows.

Diameter Class	Conifers	Broadleaves	Total
Under 7 cm	10	9	19
7-20 cm	6	40	46
21-30 cm	1	14	15
31-50 cm	2	12	14
Over 50 cm	<1	6	6
Total	19	81	100

The inclusion of the under 7 cm dbh size class results in the number of coniferous trees more than doubling. Spruces show the greatest increase, nearly fourfold and mostly in shelterbelts in North Wales, while cypresses nearly double their numbers. In comparison with trees of 7 cm dbh and over the overall species order of spruces first, pines second, is unaltered but the substantial number of small cypresses result in this species group taking over from the larches in third place.

The addition of the small trees to the broadleaved total increases that total to 12.5 million, or a rise of about 13 per cent. The young trees are mostly Other broadleaves, ash and oak but there are also substantial numbers of birch, sycamore and alder. The inclusion of the small tree category does not materially alter the overall species ranking in broadleaves; oak is still first but ash takes second place from alder which occupies third place. Birch and sycamore still account for the fourth and fifth positions. Young broadleaved trees are fairly equally distributed between the two Conservancies.

In the conifer size class distribution the less than 7 cm dbh class holds 51 per cent of the total numbers and the 7-20 cm class 31 per cent. Thus no less than 82 per cent of the non-woodland conifers are under 20 cm dbh. The two middle range categories, 21-30 and 31-50 cm dbh size classes each account for roughly 8 per cent and the largest size class for only 2 per cent. In broadleaves the pattern is somewhat different in that the smallest size category includes only 11 per cent of the total while the 7-20 cm dbh size class accounts for 50 per cent. The two middle range categories hold 17 and 15 per cent respectively and the largest size class holds 7 per cent. Oak and ash are well represented in all size classes but especially so in the 7-20 cm dbh size class, while sycamore, alder and birch tend to have their tree numbers concentrated in the smaller classes. Elm ranks ninth in species order in the Country and its numbers can be expected to decline as a result of the continued spread of Dutch elm disease.

The overall distribution of trees for the future looks reasonably good with sufficient numbers available in the smaller size classes to permit recruitment to the larger diameters. This confirms and indeed improves on the position found in 1951 when 56 per cent of trees were under 20 cm dbh compared with the present 65 per cent.

**Health**

All live non-woodland trees were assessed for health and, in addition, a count was made of dead trees; this latter category covered trees of all species which were already dead and in the case of elm, also those affected by Dutch elm disease and in a dying condition.

Table 18a shows the overall position with 85 per cent in good health, 11 per cent in moderate health, 2 per cent in poor health and 2 per cent dead or dying. Leaving aside the special features of elm declining health is generally correlated with advancing age.

Elm with nearly 180 thousand dead and dying trees accounts, as might be expected, for over 60 per cent of this category; indeed the number of live elm in Wales at the date of survey only exceeded the dead and dying elm by a relatively small margin. Four other species or species groups account for the bulk of the remaining dead and dying trees - spruces, Other conifers, ash and Other broadleaves - but the numbers in all cases are small in relation to the total populations of these species.

**Standing Volume**

It is estimated that there is a standing volume of 3.8 million cubic metres ( $\pm$  9.0 per cent) in non-woodland trees in Wales. Of this total 0.4 million cubic metres are coniferous and 3.4 million broadleaved. Table 19 analyses volume by species and size classes and shows that the distribution of volume differs from that of numbers of trees. Thirty seven per cent of the coniferous volume occurs in pines and 26 per cent in Other conifers. In both species groups the volume is concentrated in the two largest size classes and, in the case of Other conifers, mainly in the largest one. North Wales Conservancy contains rather more than half the total conifer volume and more than 60 per cent of the volume in the over 50 cm dbh size class.

In broadleaved species oak accounts for over 40 per cent of the overall volume, ash is next with 17 per cent and sycamore with 11 per cent. There are also substantial quantities of beech and alder. Over half the broadleaved volume occurs in the largest size class and the two largest size classes together account for 82 per cent of the total. Species such as poplar, Sweet chestnut, Horse chestnut, lime and elm all have the major part of their volume in trees over 50 cm dbh and indeed over 70 per cent of the volume of oak is in this class. Beech volume is spread more evenly over the size classes but still has over half in the largest. The volume of species such as birch, alder and willow tends naturally to be concentrated in the smaller and middle ranges of the distribution.

The relative proportions of the major broadleaved species in terms of tree numbers and volumes are shown below.

Percentage	Oak	Beech	Sycamore	Ash	Birch	Poplar	Sweet chestnut	Horse chestnut	Alder	Lime	Elm	Willow	Other b/leaves
of numbers	20	6	12	17	12	1	—	<1	17	<1	2	3	10
of volume	41	10	11	17	3	3	—	1	8	1	2	2	1

North Wales Conservancy contains a slightly higher proportion of the broadleaved volume than South Wales but the latter accounts for rather more of the oak volume and a high proportion of the alder. On the other hand the volume of sycamore is much more significant in North Wales Conservancy than it is in the South.

Although all trees of 7 cm dbh and greater were eligible for volume assessment, it was often found that broadleaved trees had no measurable volume because of damage or poor form in the first 2 m butt length.

Not all the volume quoted in the tables is available for harvesting as assessments were made without reference to the location of trees or to any other constraints.

**Comparison with Previous Surveys**

When making comparisons with estimates from each of the previous surveys the following points must be considered.

1. In 1951 the minimum area for woodland was 0.4 ha while in 1980 it was 0.25 ha.
2. The sampling intensity used in the 1980 survey was much higher than in the previous Survey. In 1951 the ground area sampled was approximately 1 ha in every 8 000 ha of land area whereas in 1980 the sample was 1 ha in every 900 ha thus producing more precise figures.
3. Dutch elm disease has had an effect on the elm population in a number of counties.
4. The minimum size of tree considered for volume was 20 cm dbh in 1951 compared with 7 cm dbh in 1980.

All these factors combine to make it difficult to make detailed comparisons of the results of one survey with another, but it is possible to draw some general conclusions.

Comparisons of Tree Numbers

In 1951 the total number of trees of 7 cm dbh and over recorded for Wales was 10.8 million whereas the figure for the 1980 Survey is 12.6 million. The figure of 10.8 million in 1951 needs, however, to be reduced to allow for the influence of trees in woods of 0.25-0.4 ha to make it comparable with the 1980 total. The adjusted 1951 total is estimated to be about 10.3 million. During the last thirty years, therefore, the total number of non-woodland trees has apparently risen by about 2.3 million or about 22 per cent on the adjusted total. This, however, is the overall change and there have been increases in tree numbers in certain diameter classes and decreases in others. The extent of the change, however, is difficult to quantify partly because of the change from quarter girth to the metric system which results in the class limits not being exactly comparable, and partly because in the 1951 Survey Report there is no summarised information on the diameter distribution of 'firewood' trees ie crooked, shortboled or defective trees, or 'short' trees, those with stem lengths of between 6 and 10 feet (2-3 m). The absence of this information means that an overall tree distribution by size classes cannot be derived. It appears likely, however, that there has been some increase in the 7-20 cm dbh size class, which does correspond reasonably closely with the 3-6 inches breast height quarter girth size class used in 1951, and shows a rise from 6.0 million trees to 7.1 million trees in 1980. The substantial total in the current 7-20 cm dbh size class, combined with the 2.9 million trees which are of below measurable size should ensure that in Wales there are sufficient small trees to maintain the present diameter distribution. The position is similar in both North and South Wales Conservancies.

Volume Comparison

The results of the 1951 and 1980 Surveys are shown in the following table after adjustments to the 1951 figures to exclude the volume occurring in woods of 0.25-0.4 ha and to allow for the fact that volume measurements in the 1951 Survey were confined to trees of over 20 cm in diameter. In Wales the two values are similar so that the 1951 results are essentially unchanged.

Millions of cubic metres		
	1951	1980
Coniferous volume	0.4	0.4
Broadleaved volume	2.7	3.4
Total	3.1	3.8

These figures indicate that there has been a rise in non-woodland volume between 1951 and 1980 and that the whole of the increase has been in broadleaved species. The factors influencing the changes are complex as certain species show substantial gains in volume and others losses. The overall position is set out in the table below.

Millions of cubic metres					
1951			1980		
Species	Volume	Per cent	Species Group	Volume	Per cent
Scots pine	0.05	2	Pines	0.17	4
Norway spruce	0.05	2	Spruces	0.06	2
European larch	0.12	4	Larches	0.09	2
Other conifers	0.17	5	Other conifers	0.13	3
Total conifers	0.39	13	Total conifers	0.45	11
Oak	0.97	31	Oak	1.40	36
Beech	0.14	4	Beech	0.33	9
Sycamore	0.46	15	Sycamore	0.39	10
Ash	0.36	11	Ash	0.57	15
Birch	0.03	1	Birch	0.10	3
Sweet chestnut	—	—	Sweet chestnut	—	—
Elm	0.41	13	Elm	0.07	2
Other broadleaves	0.35	12	Other broadleaves	0.54	14
Total broadleaves	2.72	87	Total broadleaves	3.40	89
Total	3.11	100	Total	3.85	100

The coniferous species groups recognised at each survey do not correspond exactly but it would appear that pines are rather more important in volume terms than they were 30 years ago and that larches and Other conifers have shown a reduction.

Rather more dramatic changes have taken place in the broadleaved species in that elm, which in 1951 accounted for 13 per cent of the overall volume, now accounts for only 2 per cent. Also, sycamore seems to have suffered a slight reduction in volume although it is still as important in percentage terms as it was. The major increases have occurred in the volumes of oak, beech, ash and Other broadleaves with oak showing the highest absolute increase and beech the highest percentage rise.

Oak with over 70 per cent of its volume in the largest size class and apparently adequate recruitment potential from the smaller size classes is the most important non-woodland species in Wales and seems likely to remain so for the foreseeable future.

**TABLE 14      SUMMARY OF NUMBERS OF LIVE ISOLATED  
TREES AND CLUMPS AND LENGTH OF LINEAR FEATURES**  
Thousands of trees and clumps

Total Number of Isolated Trees	2 080 (± 7.6%)
Total Number of Clumps	666 (± 11.1%)
Total Length of Linear Features	17 010 km (± 13.0%)

NOTES:  
The figures in brackets are standard errors.  
Densities per square kilometre are as follows:

- Number of Isolated trees           — 100
- Number of Clumps                   — 32
- Length of Linear Features       — 0.82 km

**TABLE 15      AREA OF CLUMPS BY SPECIES GROUPS**  
Hectares

Species Group	Clumps
Mainly Coniferous	1 331
Mainly Broadleaved	10 461
Total	11 792

**DIAGRAM 8**  
**NUMBER OF LIVE TREES OF 7 CM DBH**  
**OR GREATER BY CATEGORY AND**  
**SPECIES GROUPS**

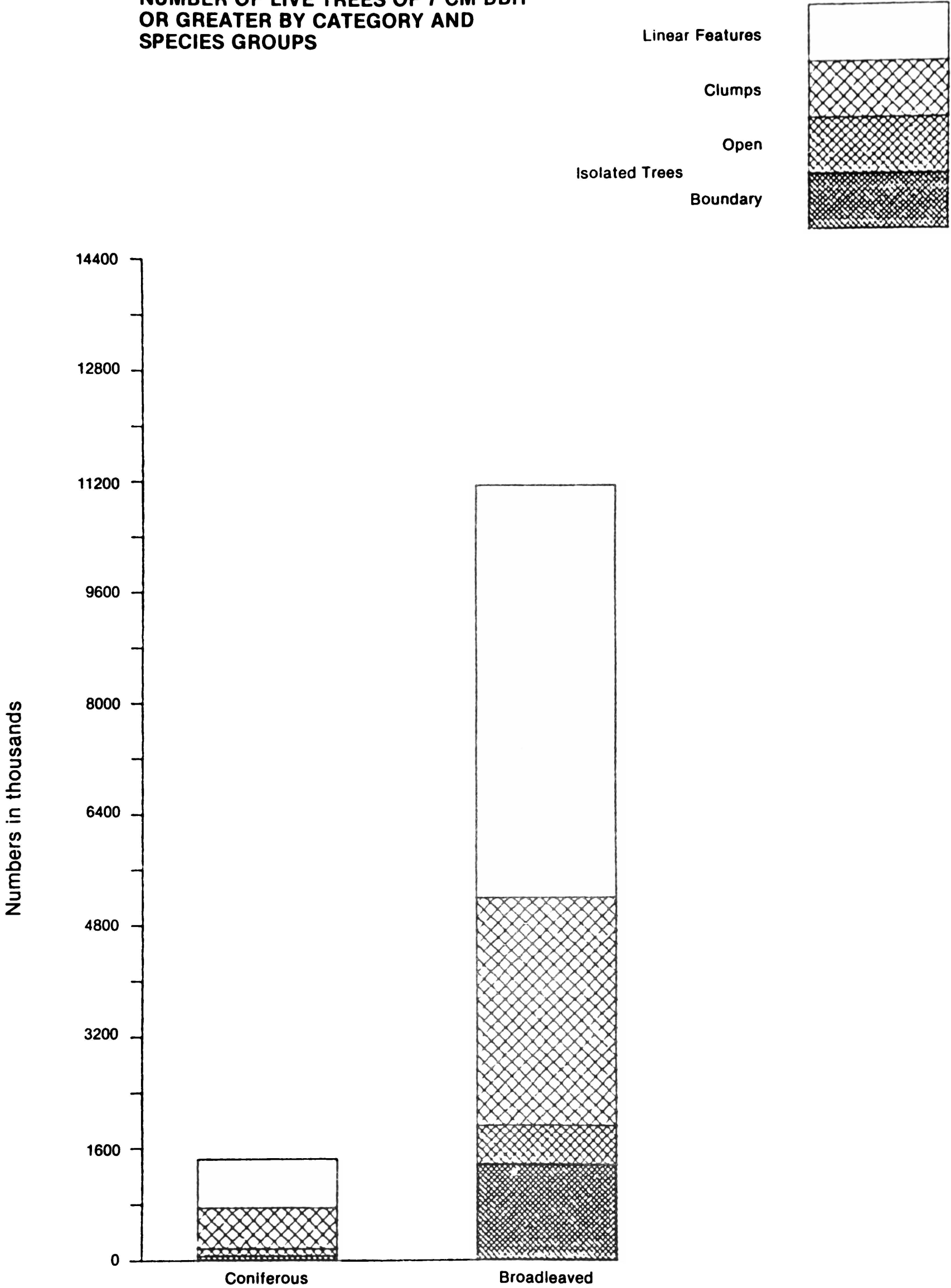


TABLE 16

NUMBER OF LIVE TREES OF 7 CM DBH OR GREATER  
BY CATEGORY AND PRINCIPAL SPECIES

Thousands of trees

Species	Isolated Trees		Clumps	Linear Features	Total (S.E.)
	Boundary	Open			
Pines	11	14	118	194	337
Spruces	25	7	139	276	447
Larches	19	4	205	13	241
Cypresses	1	51	60	88	200
Other conifers	7	30	57	128	222
Total conifers	63	106	579	699	1 447 (± 23%)
Oak	403	142	432	1 302	2 279
Beech	78	19	130	443	670
Sycamore	108	54	425	712	1 299
Ash	380	79	622	818	1 899
Birch	78	49	399	786	1 312
Poplar	49	22	35	5	111
Sweet chestnut	2	—	5	—	7
Horse chestnut	1	9	2	7	19
Alder	70	38	552	1 249	1 909
Lime	14	4	20	14	52
Elm	20	5	86	88	199
Willow	40	20	119	196	375
Other broadleaves	117	110	449	328	1 004
Total broadleaves	1 360	551	3 276	5 948	11 135 (± 10%)
Total	1 423	657	3 855	6 647	12 582 (± 9%)

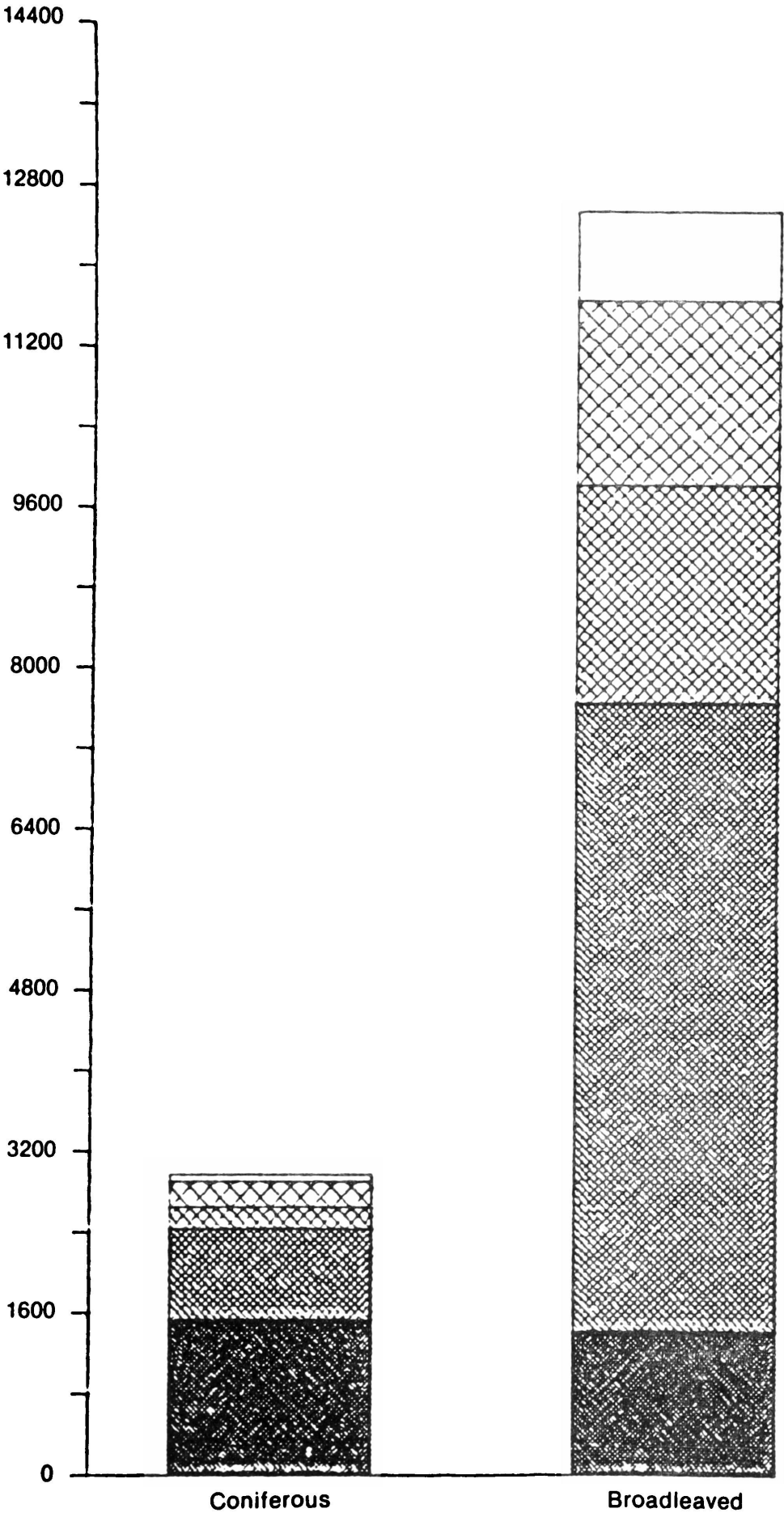
NOTE:

In addition, within Wales the following trees are present:

Species	Isolated Trees	Clumps	Linear Features	Total (S.E.)
Trees < 7cm dbh All species	735	1 671	538	2 944 (± 31%)
Dead and Dying All species	59	174	54	287 (± 20%)

**DIAGRAM 9**  
**NUMBER OF ALL LIVE TREES BY**  
**SPECIES GROUPS AND SIZE CLASSES**

Numbers in thousands



Size Classes  
(dbh)

> 50 cm

31-50 cm

21-30 cm

7-20 cm

< 7 cm

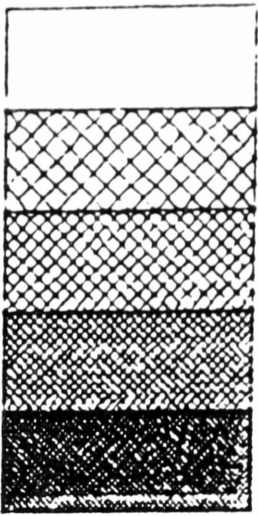




TABLE 17

NUMBER OF ALL LIVE TREES BY PRINCIPAL SPECIES  
AND SIZE CLASSES

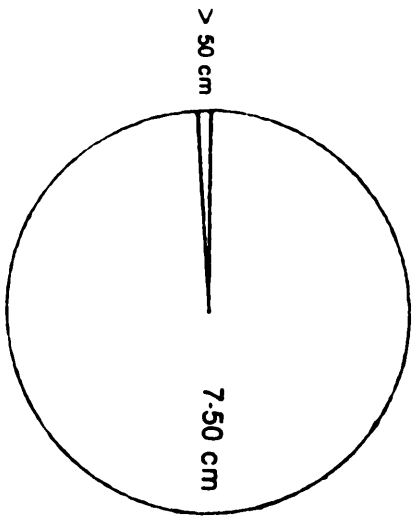
Thousands of trees

Species	Size Class (dbh)					Total
	< 7 cm	7-20 cm	21-30 cm	31-50 cm	> 50 cm	
Pines	106	164	50	97	26	443
Spruces	1 111	370	42	33	2	1 558
Larches	6	124	28	82	7	247
Cypresses	198	170	25	3	2	398
Other conifers	105	77	72	46	27	327
Total conifers	1 526	905	217	261	64	2 973
Oak	251	758	373	713	435	2 530
Beech	8	255	189	145	81	678
Sycamore	138	699	269	218	113	1 437
Ash	274	1 037	397	334	131	2 173
Birch	165	938	271	94	9	1 477
Poplar	14	40	37	20	14	125
Sweet chestnut	3	—	—	4	3	10
Horse chestnut	2	5	1	2	11	21
Alder	133	1 266	400	213	30	2 042
Lime	—	13	16	9	14	52
Elm	37	120	36	15	28	236
Willow	106	281	58	30	6	481
Other broadleaves	287	824	123	46	11	1 291
Total broadleaves	1 418	6 236	2 170	1 843	886	12 553
Total	2 944	7 141	2 387	2 104	950	15 526

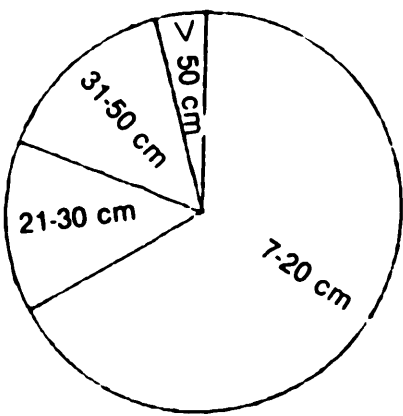
NOTE:  
The average number of all live trees per square kilometre is 748.

DIAGRAM 10

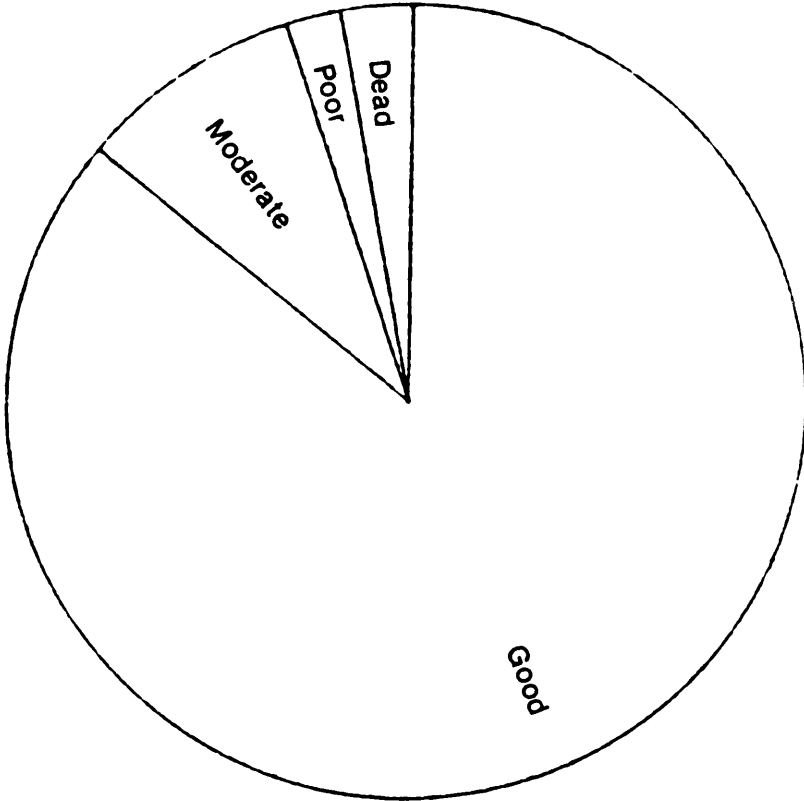
HEALTH OF ALL CONIFEROUS TREES OF 7 CM DBH OR GREATER BY SIZE CLASSES



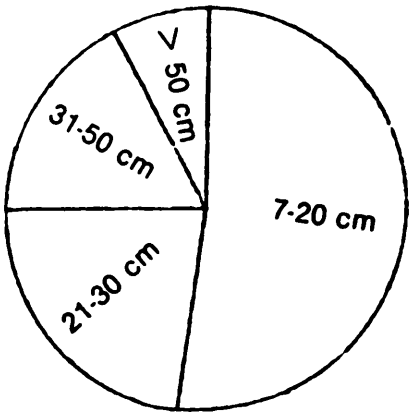
Dead



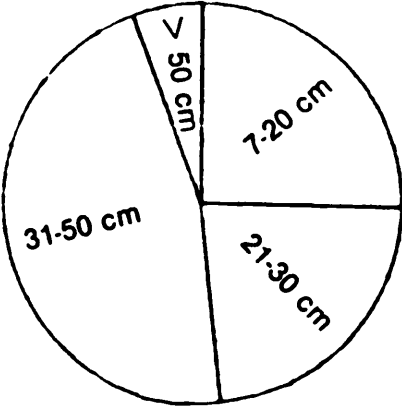
Good



Health expressed as a proportion of the total population



Poor



Moderate

Note: The sizes of the circles are not to scale

HEALTH OF ALL TREES OF 7 CM DBH OR GREATER BY PRINCIPAL SPECIES  
AND SIZE CLASSES

TABLE 18aALL SPECIESThousands of trees

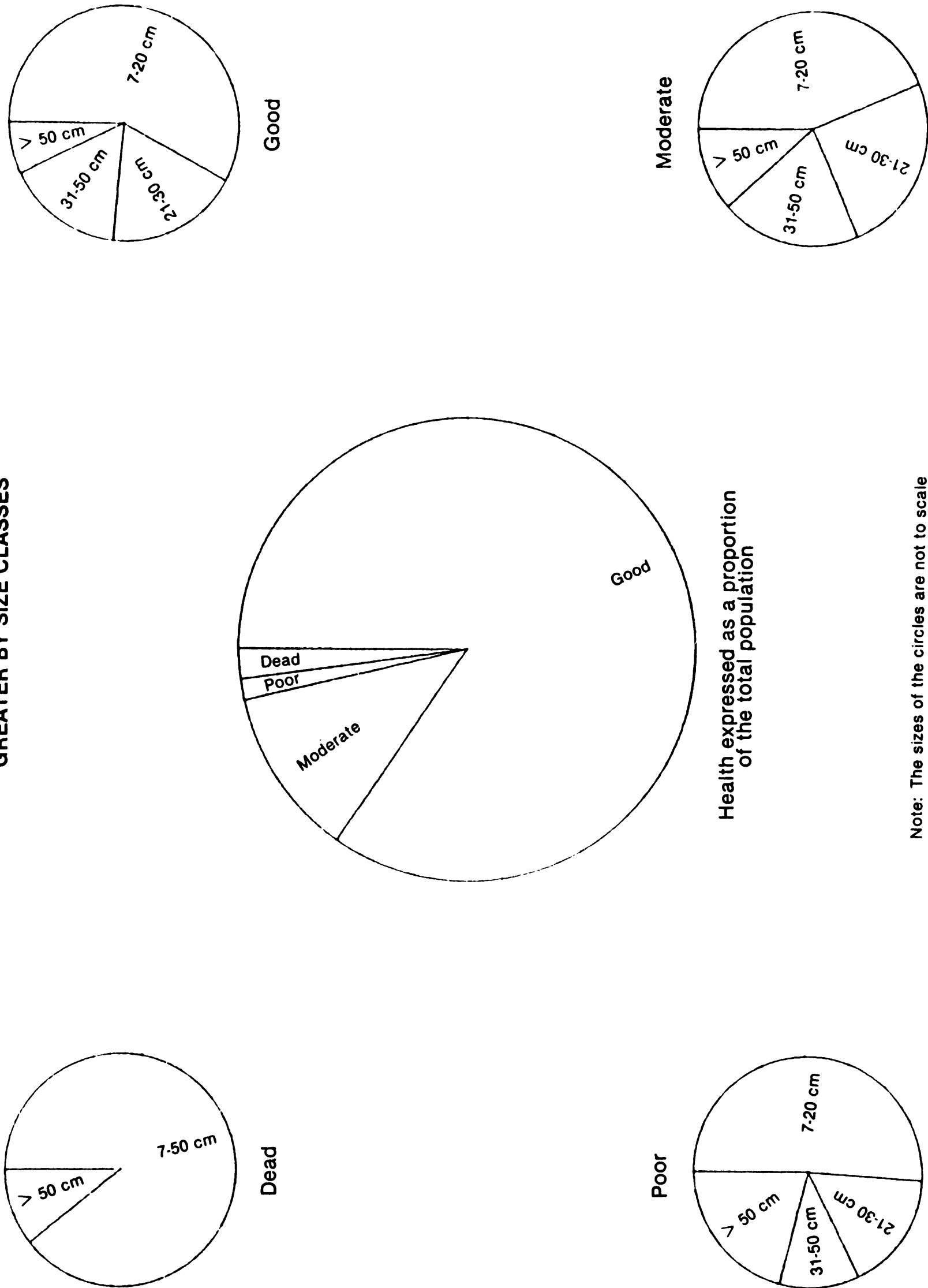
Species	dbh class cm	Health Class			Dead and Dying
		Good	Moderate	Poor	
Total conifers	7-20	854	34	17	)
	21-30	179	31	7	) 43
	31-50	193	62	6	)
	> 50	54	7	3	) —
	Total	1 280	134	33	43
Total broadleaves	7-20	5 568	585	83	)
	21-30	1 807	335	28	) 218
	31-50	1 560	266	17	)
	> 50	697	155	34	) 26
	Total	9 632	1 341	162	244
Total	7-20	6 422	619	100	)
	21-30	1 986	366	35	) 261
	31-50	1 753	328	23	)
	> 50	751	162	37	) 26
	Total	10 912	1 475	195	287

TABLE 18bCONIFERSThousands of trees

Species	dbh class cm	Health Class			Dead and Dying
		Good	Moderate	Poor	
Pines	7-20	143	21	—	)
	21-30	22	25	3	) 3
	31-50	79	15	3	)
	> 50	18	6	2	) —
	Total	262	67	8	3
Spruces	7-20	357	5	8	)
	21-30	38	4	—	) 19
	31-50	26	4	3	)
	> 50	1	—	1	) —
	Total	422	13	12	19
Larches	7-20	113	3	8	)
	21-30	23	2	3	) —
	31-50	41	41	—	)
	> 50	7	—	—	) —
	Total	184	46	11	—
Cypresses	7-20	168	2	—	)
	21-30	25	—	—	) 3
	31-50	3	—	—	)
	> 50	2	—	—	) —
	Total	198	2	—	3
Other conifers	7-20	73	3	1	)
	21-30	71	—	1	) 18
	31-50	44	2	—	)
	> 50	26	1	—	) —
	Total	214	6	2	18
Total conifers	7-20	854	34	17	)
	21-30	179	31	7	) 43
	31-50	193	62	6	)
	> 50	54	7	3	) —
	Total	1 280	134	33	43

DIAGRAM 11

HEALTH OF ALL BROADLEAVED TREES OF 7 CM DBH OR GREATER BY SIZE CLASSES



Note: The sizes of the circles are not to scale

HEALTH OF ALL TREES OF 7 CM DBH OR GREATER BY PRINCIPAL SPECIES AND SIZE CLASSES

TABLE 18c

BROADLEAVES

Thousands of trees

Species	dbh class cm	Health Class			Dead and Dying
		Good	Moderate	Poor	
Oak	7-20	711	40	7	)
	21-30	350	21	2	)
	31-50	628	82	3	)
	> 50	358	65	12	1
	Total	2 047	208	24	2
Beech	7-20	226	28	1	)
	21-30	164	25	—	)
	31-50	120	24	1	)
	> 50	66	15	—	2
	Total	576	92	2	2
Sycamore	7-20	608	75	16	)
	21-30	222	45	2	)
	31-50	181	35	2	)
	> 50	99	12	2	2
	Total	1 110	167	22	6
Ash	7-20	968	60	9	)
	21-30	334	57	6	)
	31-50	273	59	2	)
	> 50	91	37	3	1
	Total	1 666	213	20	18
Birch	7-20	840	91	7	)
	21-30	212	56	3	)
	31-50	78	15	1	)
	> 50	8	1	—	—
	Total	1 138	163	11	1
Poplar	7-20	36	4	—	)
	21-30	30	4	3	)
	31-50	19	—	1	)
	> 50	9	5	—	4
	Total	94	13	4	5
Sweet chestnut	7-20	—	—	—	)
	21-30	—	—	—	)
	31-50	3	1	—	)
	> 50	—	1	2	—
	Total	3	2	2	—

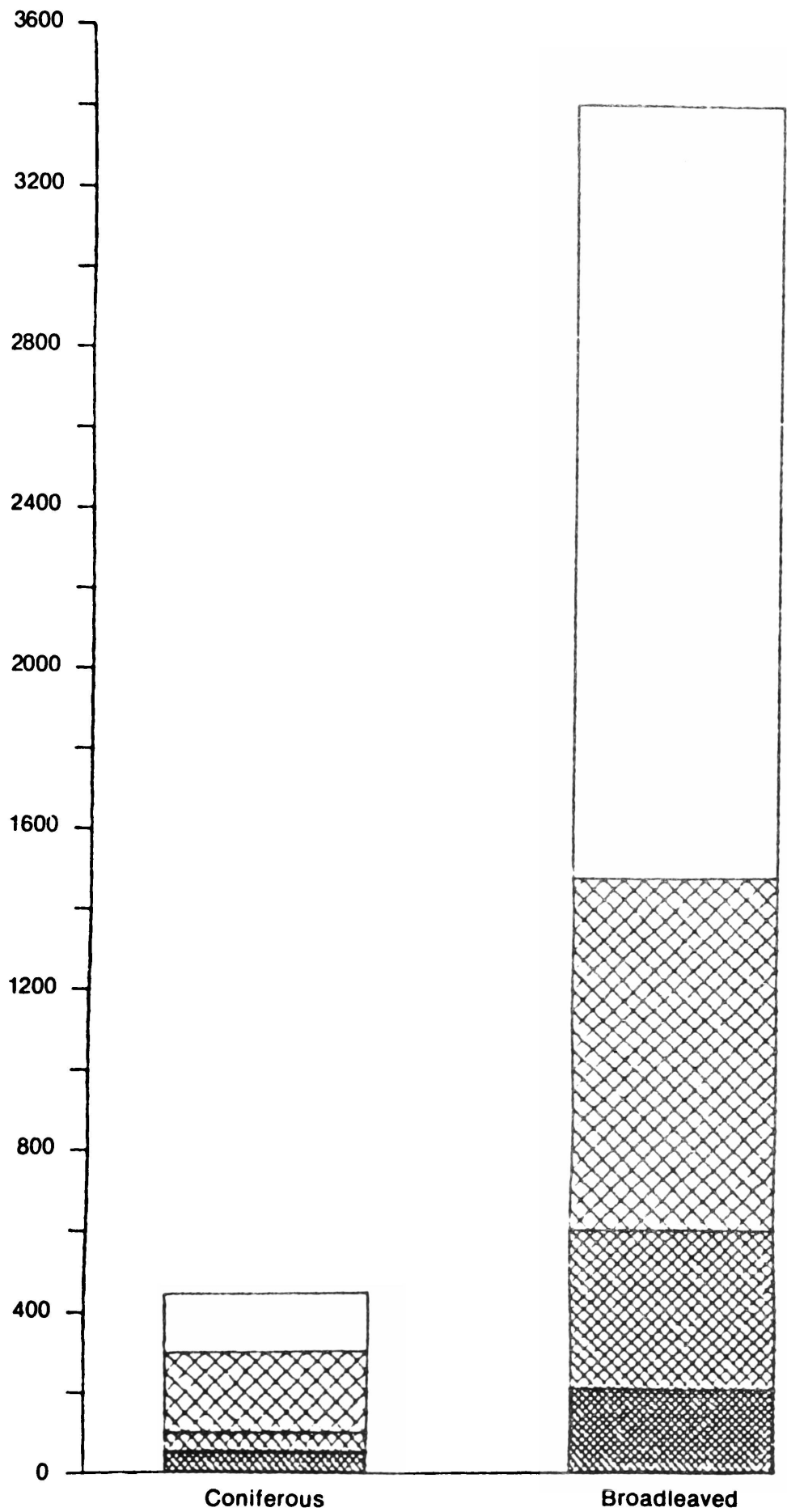
Thousands of trees

Species	dbh class cm	Health Class			Dead and Dying
		Good	Moderate	Poor	
Horse chestnut	7-20	5	—	—	)
	21-30	1	—	—	)
	31-50	1	1	—	)
	> 50	8	2	1	—
	Total	15	3	1	—
Alder	7-20	1 162	96	8	)
	21-30	317	79	4	)
	31-50	186	25	2	)
	> 50	24	4	2	5
	Total	1 689	204	16	16
Lime	7-20	13	—	—	)
	21-30	16	—	—	)
	31-50	9	—	—	)
	> 50	13	—	1	—
	Total	51	—	1	—
Elm	7-20	70	35	15	)
	21-30	15	16	5	)
	31-50	4	7	4	)
	> 50	10	7	11	11
	Total	99	65	35	178
Willow	7-20	197	73	11	)
	21-30	37	21	—	)
	31-50	20	10	—	)
	> 50	3	3	—	—
	Total	257	107	11	—
Other broadleaves	7-20	732	83	9	)
	21-30	109	11	3	)
	31-50	38	7	1	)
	> 50	8	3	—	—
	Total	887	104	13	16
Total broadleaves	7-20	5 568	585	83	)
	21-30	1 807	335	28	)
	31-50	1 560	266	17	)
	> 50	697	155	34	26
	Total	9 632	1 341	162	244

DIAGRAM 12

STANDING VOLUME OF TIMBER FOR LIVE  
TREES OF 7 CM DBH OR GREATER BY  
SPECIES GROUPS AND SIZE CLASSES

Thousands of cubic metres overbark



Size Classes  
(dbh)

> 50 cm

31-50 cm

21-30 cm

7-20 cm

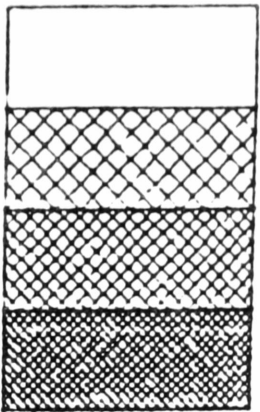


TABLE 19

STANDING VOLUME OF TIMBER FOR LIVE TREES OF 7 CM DBH OR GREATER BY PRINCIPAL SPECIES AND SIZE CLASSES

Thousands of cubic metres overbark

Species	Size Class (dbh)				Total
	7-20 cm	21-30 cm	31-50 cm	>50 cm	
Pines	4.7	11.1	84.9	64.3	165.0
Spruces	24.7	10.0	22.4	4.1	61.2
Larches	9.9	4.0	67.2	10.3	91.4
Cypresses	6.8	2.4	1.4	1.8	12.4
Other conifers	5.3	19.2	23.8	67.2	115.5
Total conifers	51.4	46.7	199.7 (± 31%)	147.7 (± 28%)	445.5 (± 20.7%)
Oak	36.8	56.3	306.1	1 005.1	1 404.3
Beech	22.9	46.3	76.5	186.7	332.4
Sycamore	19.1	52.0	116.4	201.7	389.2
Ash	36.7	93.0	195.6	248.2	573.5
Birch	27.3	41.2	24.9	7.9	101.3
Poplar	2.4	7.4	9.8	74.9	94.5
Sweet chestnut	0.1	0.1	0.6	10.5	11.3
Horse chestnut	0.6	0.1	1.1	22.8	24.6
Alder	36.9	80.1	113.6	54.9	285.5
Lime	0.5	1.9	4.3	30.3	37.0
Elm	1.4	3.3	6.2	56.5	67.4
Willow	16.3	13.3	20.7	8.1	58.4
Other broadleaves	3.2	3.4	3.5	14.5	24.6
Total broadleaves	204.2	398.4	879.3 (± 13%)	1 922.1 (± 13%)	3 404.0 (± 9.3%)
Total	255.6	445.1	1 079.0 (± 12%)	2 069.8 (± 12%)	3 849.5 (± 9.0%)

NOTE:

The figures in brackets are standard errors.

**Approved Woodland**

Privately owned woodland included in a Forestry Commission scheme where the owners could not, or did not wish to, enter into the long-term, legally-binding arrangement of Dedication.

**Broadleaved High Forest of Coppice Origin**

Crops of Coppice origin which have a mean breast height diameter of more than 15 cm and are assessed by the same criteria as Broadleaved High Forest.

**Cleared**

Woodland areas which are marked green on the O.S. 1:50 000 map, but at the time of the Survey were found to be cleared of trees and had not been converted to another land use.

**Clump**

A small woodland or group of trees of less than 0.25 ha.

**Coppice**

Crops of marketable broadleaved species that have at least two stems per stool and are either being worked or capable of being worked on rotation. With the exception of hazel coppice, more than half the stems should be capable of producing 3 m timber lengths of good form. Coppice crops with a mean breast height diameter greater than 15 cm are assessed as B.H.F. of Coppice origin.

**Coppice with Standards (C.W.S.)**

Two-storey stands where the overstorey consists of at least 25 stems per ha that are older than the understorey of worked Coppice by at least one Coppice rotation.

**Dedicated Woodland**

Privately owned woodland within the Forestry Commission Dedication Scheme. In return for financial assistance, an owner accepts a continuing obligation by Deed or Agreement of Covenant to manage these woodlands in accordance with a Plan of Operations which is designed to secure sound forestry practice.

**Diameter Breast Height (dbh)**

Diameter of a tree rounded down to the nearest centimetre at a point on the tree 1.3 m above ground level.

**Disforested**

Woodland areas which are marked green on the O.S. 1:50 000 map, but at the time of survey were found to be under another land use, eg agriculture, buildings.

**Extra Woodland**

Areas of woodland over 0.25 ha in extent found during the Survey but not marked green on the O.S. 1:50 000 map.

**Forestry Commission Woodland (FC)**

Woodland owned by, on lease to or managed by the Forestry Commission.

**High Forest (H.F.)**

Stands of trees having a canopy density of 20 per cent or more, or, in the case of young stands which have not closed canopy, occupying 20 per cent or more of the ground at normal spacing. More than half of the crop should be capable of producing 3 m timber lengths of good form and be of merchantable species.



## **Linear Feature**

Strips of woody vegetation less than 20 m mean width, crown edge to crown edge, and more than 25 m long.

## **Mainly Broadleaved High Forest**

High Forest (q.v.) containing 50 per cent or more by area of broadleaved species.

## **Mainly Coniferous High Forest**

High Forest (q.v.) containing more than 50 per cent by area of coniferous species.

## **"Other" Woodland**

Woodland which is neither in Forestry Commission ownership or management nor included in a Dedication or Approved Woodland Scheme.

## **Planting Year (P. Year)**

The year in which the trees were planted or regenerated naturally. With older crops it was often necessary to estimate the P. Year.

## **Planting Year Class**

A group of planting years.

## **Scrub**

All inferior crops where more than half the trees are of poor form, poor timber potential or composed of unmarketable species, and so do not qualify as either High Forest or Coppice.

## **Shrub Layer**

A layer of woody plants below the tree canopy.

## **Woodland**

Area of woody growth greater than 0.25 ha in area and at least 20 m wide. Where the stocking density was less than 20 per cent or there was evidence of recent woody growth, the area was described as cleared, otherwise it was allocated to a forest type.

APPENDIX 2

LIST OF SPECIES RECORDED AND REPORTED UPON — WOODLAND

English Name	Standard Abbreviation	Botanical Name
Scots pine	SP	<i>Pinus sylvestris</i> L.
Corsican pine	CP	<i>Pinus nigra</i> var. <i>maritima</i> (Ait.) Melville
Lodgepole pine	LP	<i>Pinus contorta</i> Douglas ex Loud.
Sitka spruce	SS	<i>Picea sitchensis</i> (Bong.) Carr.
Norway spruce	NS	<i>Picea abies</i> (L.) Karst.
European larch	EL	<i>Larix decidua</i> Miller
Japanese/Hybrid larch	JL	<i>Larix kaempferi</i> (Lamb.) Carr.
	HL	<i>Larix x eurolepis</i> Henry
Douglas fir	DF	<i>Pseudotsuga menziesii</i> (Mirb.) Franco
Other conifers*	XC	
Mixed conifers	MC	
Oak	OK	<i>Quercus robur</i> L.
		<i>Quercus petraea</i> (Matt.) Lieblein.
Beech	BE	<i>Fagus sylvatica</i> L.
Sycamore	SY	<i>Acer pseudoplatanus</i> L.
Ash	AH	<i>Fraxinus excelsior</i> L.
Birch	BI	<i>Betulus</i> spp.
Poplar	PO	<i>Populus</i> spp.
Sweet chestnut	SC	<i>Castanea sativa</i> Mill.
Alder	AR	<i>Alnus</i> spp.
Elm	EM	<i>Ulmus</i> spp.
Hornbeam	HBM	<i>Carpinus betulus</i> L.
Hazel	HAZ	<i>Corylus avellana</i> L.
Willow		<i>Salix</i> spp.
Other broadleaves*	XB	
Mixed broadleaves	MB	

\* Included within Other conifers and Other broadleaves are some species which were recognised in the Survey but are of such limited occurrence as to preclude their individual inclusion in the Report.

LIST OF SPECIES RECORDED BUT NOT REPORTED UPON INDIVIDUALLY — WOODLAND

English Name	Standard Abbreviation	Botanical Name
Other pine	XP	<i>Pinus</i> spp.
Other spruce	XS	<i>Picea</i> spp.
Western hemlock	WH	<i>Tsuga heterophylla</i> (Raf.) Sarg.
Western red cedar	RC	<i>Thuja plicata</i> D.Don.
Cypresses		<i>Cupressus</i> spp. <i>Chamaecyparis</i> spp. <i>x Cupressocyparis leylandii</i> (Jacks. Dallim.) Dallim.
Grand fir	GF	<i>Abies grandis</i> Lindl.
Noble fir	NF	<i>Abies procera</i> Rehd.
Other fir	XF	<i>Abies</i> spp.
Redwoods		<i>Sequoia sempervirens</i> (D.Don) End. <i>Sequoiadendron giganteum</i> (Lindl.) Buchholz
Yew		<i>Taxus baccata</i> L.
Other conifers	XC	
Other oak		<i>Quercus</i> spp.
Norway maple	NOM	<i>Acer platanoides</i> L.
Horse chestnut	HCH	<i>Aesculus hippocastanum</i> L.
Lime	LI	<i>Tilia</i> spp.
English elm**	EEM	<i>Ulmus procera</i> Salis.
Wych elm**	WEM	<i>Ulmus glabra</i> Huds.
Nothofagus	N	<i>Nothofagus</i> spp.
Prunus (Cherries)		<i>Prunus</i> spp.
Ornamentals		
Other broadleaves	XB	

\*\* For the purposes of the Report, English elm and Wych elm were included as elm.

NOTE:  
In certain circumstances the following were also recorded as Woodland species:

Rowan	<i>Sorbus aucuparia</i> L.
Holly	<i>Ilex aquifolium</i> L.
Field maple	<i>Acer campestre</i> L.
Whitebeam	<i>Sorbus aria</i> agg.

APPENDIX 2 (contd)

LIST OF SPECIES RECORDED AND REPORTED UPON — NON-WOODLAND TREES

English Name	Standard Abbreviation	Botanical Name
Pines		<i>Pinus</i> spp.
Spruces		<i>Picea</i> spp.
Larches		<i>Larix</i> spp.
Cypresses		<i>Cupressus</i> spp.
		<i>Chamaecyparis</i> spp.
		<i>x Cupressocyparis leylandii</i> (Jacks. Dallim.) Dallim.
Other conifers	XC	
Oak	OK	<i>Quercus robur</i> L.
		<i>Quercus petraea</i> (Matt.) Lieblein.
Beech	BE	<i>Fagus sylvatica</i> L.
Sycamore	SY	<i>Acer pseudoplatanus</i> L.
Ash	AH	<i>Fraxinus excelsior</i> L.
Birch	BI	<i>Betula</i> spp.
Poplar	PO	<i>Populus</i> spp.
Sweet chestnut	SC	<i>Castanea sativa</i> Mill.
Horse chestnut	HCH	<i>Aesculus hippocastanum</i> L.
Alder	AR	<i>Alnus</i> spp.
Lime	LI	<i>Tilia</i> spp.
Elm	EM	<i>Ulmus</i> spp.
Willow		<i>Salix</i> spp.
Other broadleaves	XB	

NOTE:

Although the above species are given in the Report the total list of species recorded was the same as for Woodland.

LIST OF SHRUB LAYER SPECIES RECORDED

English Name	Botanical Name
Rowan*	<i>Sorbus aucuparia</i> L.
Field maple*	<i>Acer campestre</i> L.
Blackthorn	<i>Prunus spinosa</i> L.
Hawthorn	<i>Crataegus monogyna</i> Jacq.
Rhododendron	<i>Rhododendron</i> spp.
Holly*	<i>Ilex aquifolium</i> L.
Elder	<i>Sambucus</i> spp.
Broom	<i>Sarothamnus scoparius</i> (L.) Wimmer ex Koch.
Gorse	<i>Ulex</i> spp.
Privet	<i>Ligustrum vulgare</i> L.
Dogwood	<i>Cornus sanguinea</i> L.
Sallow	<i>Salix caprea</i> L.
Box	<i>Buxus sempervirens</i> L.
Whitebeam*	<i>Sorbus aria</i> agg.
Spindle	<i>Euonymus europaeus</i> L.
Yew*	<i>Taxus baccata</i> L.
Hornbeam*	<i>Carpinus betulus</i> L.
Hazel	<i>Corylus avellana</i> L.
Willow*	<i>Salix</i> spp.
Other shrubs	
Mixed shrubs	

\*These species have on occasion been recognised as tree species.

**DESCRIPTION OF SOIL STRATA****Reassessment of Soil Survey of England and Wales 1:1 million Soil Map for Woodland Surveys**

The Forestry Commission Census Section sought advice from the Soil Survey of England and Wales and the Forestry Commission's own Site Studies Branch on soils to be recognised for Census purposes. The object was to produce a map showing broad site types relevant to tree growth potential. As a result, the 71 soil units shown on the 1:1 million soil map were combined to produce 16 soil groups.

A further variable was recognised which overrode the new soil strata units: potential soil moisture deficit (PSMD). Deficits more or less than 150 millimetres (mm) were distinguished at county level; counties with >150 mm PSMD were considered dry (namely, those east of and including Nottinghamshire, Lincolnshire, Leicestershire, Northamptonshire, Oxfordshire, Berkshire and Hampshire), and counties in the 100-150 mm zone were intermediate. Wet uplands (<100 mm PSMD) were already separated (units 12 to 16 in the list below).

**Soil Groups**

1. Sandy; well drained.
2. Alluvial and "valley" soils; with groundwater.
3. Lowland peaty and humose soils; with groundwater.
4. Rendzinas over chalk and limestone; well drained.
5. Brown calcareous soils; well drained.
6. Lowland brown earths; mainly well drained.
7. Deeply leached brown earths; mainly over chalk.
8. Podzols; well drained.
9. Sandy soils, some podzolisation, with groundwater.
10. Surface-water gleys and other clayey soils.
11. Surface-water gleys over compacted silty or loamy beds. (High Weald.)
12. Brown earths; uplands.
13. Stagno-podzols; humose or peaty; often with iron-pan and rock.
14. Surface-water gleys in moist climates.
15. Peaty or humose surface-water gleys.
16. Hill peat.
17. Urban; areas not given a soil group by the Soil Survey of England and Wales.

## CRITERIA FOR THE ASSESSMENT OF THE HEALTH OF NON-WOODLAND TREES

For all living trees, health was estimated in three categories; good, moderate and poor.

Symptoms of poor health were:

a. Crown deterioration, indicated by:

abnormally small, sparse or unhealthily discoloured foliage;  
premature discolouration of foliage or defoliation;  
extensive dieback, breakage or shedding of limbs in the upper crown (disregarding 10 per cent of dieback in oak).

b. Bole deterioration, indicated by:

diseased, dead or missing areas of bark including decayed wood;  
death of large limbs;  
advanced and hazardous decay following lopping;  
suspected internal decay of swollen boles.

c. Instability, indicated by:

wind - rock symptoms of displaced soil at the base of the bole;  
exposure of root system through erosion.

From an assessment of the presence or otherwise of any of the above symptoms the condition of each tree was classified as good, moderate or poor. All assessments were external from ground level.

If none of the above symptoms were present, the health of the tree was assessed as "good".

If one symptom only was present, the health was assessed as "moderate".

If more than one symptom was present, tree health was assessed as "poor".

There were occasions, particularly in summer, when the general appearance of a tree was unsatisfactory, and then the surveyor, if in doubt, recorded tree health as "moderate".

### NOTES:

1. Dead branches or areas of dead bark in beech automatically classified the tree health as "poor".

2. Elm was treated on its own, as the symptoms of Dutch elm disease can occur very quickly during the latter part of the summer. For prognosis, the general health of the tree was compared with those around it. Checks were made for dead leaves, twigs, branches and 'shepherds crooks' as well as for beetle emergence holes in the bark. Areas of dead or peeling bark indicated serious loss of health.

APPENDIX 5a

LIFE EXPECTANCY BY SPECIES GROUPS, SIZE AND HEALTH OF CONIFEROUS SPECIES  
REPORTED UPON IN THE NON-WOODLAND TREE TABLES

Species Groups	Pines Larches			Spruces Douglas fir Other firs			Other conifers		
	Health								
	Good	Mod.	Poor	Good	Mod.	Poor	Good	Mod.	Poor
Size Class (dbh)									
7 - 20 cm	180	90	40	150	70	30	100	60	30
21 - 50 cm	100	60	20	90	50	20	80	50	20
51 - 80 cm	80	50	10	70	40	10	60	40	10
> 80 cm	50	20	—	40	20	—	40	20	—

NOTES:

The object of this table is to give a broad assessment of life expectancy of non-woodland trees, thus allowing forecasts to be made of the likely changes in the tree population in the landscape.

The years of life expectancy are broad national figures, assuming normal conditions over the period. Allowance must be made for local climatic and soil conditions.

Redwoods and yew in good health must be considered separately from all other conifers as both species may live a very considerable time.



APPENDIX 5b

LIFE EXPECTANCY BY SPECIES GROUPS, SIZE AND HEALTH OF BROADLEAVED SPECIES  
REPORTED UPON IN THE NON-WOODLAND TREE TABLES

Years

Species Groups	Oak Sweet chestnut			Sycamore Lime			Beech† Elm†			Ash			Horse chestnut Willow Alder Poplar			Birch		
	Good	Mod.	Poor	Good	Mod.	Poor	Good	Mod.	Poor	Good	Mod.	Poor	Good	Mod.	Poor	Good	Mod.	Poor
Health																		
Size Class (dbh)																		
7 - 20 cm	> 300	> 250	100	> 200	> 150	60	> 150	80	—	100	70	30	80	50	20	50	20	—
21 - 50 cm	> 250	> 200	90	> 200	> 100	50	> 100	60	—	80	50	20	50	30	10	30	10	—
51 - 80 cm	> 200	> 150	70	> 150	> 100	40	90	40	—	60	40	10	30	10	—	20	—	—
> 80 cm	> 150	> 100	50	> 100	> 80	20	60	30	—	40	30	—	10	—	—	10	—	—

NOTES:

The object of this table is to give a broad assessment of life expectancy of non-woodland trees thus allowing forecasts to be made of the likely changes in the tree population in the landscape.

The years of life expectancy are broad national figures, assuming normal conditions over the period. Allowance must be made for local climatic and soil conditions.

The species in this table are only those found in Table 18c. The species in the "Other broadleaves" category, namely those recognised in the Non-Woodland Tree Survey, but not reported upon individually in Table 18c, cover such a wide range of life expectancies that it is not feasible to classify them in any meaningful way.

† In the case of elms, consideration must be given to the local incidence of Dutch elm disease. The life expectancy stated above assumes that the trees will be free of this particular threat. No life expectancy is given for beech or elm in poor health because of the likelihood of Beech bark disease and Dutch elm disease; such trees may live for some time or be dead next year.