FORESTRY COMMISSION

Census of Woodlands and Trees

1979—1982

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 Ministry of Agriculture, Fisheries and Food, 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 ± 25 per cent. A standard error limit of ± 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 ± 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 ENGLAND

General

The tables and report for England 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. It 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 woodland 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 area at that date 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 and 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	13 034 614	754 758	2.0	805 000	6.2
1965	13 035 839	886 020	0.4	892 000	6.8
1980	13 043 927	947 688	0.25	948 000	7.3

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 for woodland blocks of 0.25 ha and greater for 1947 has been calculated using the survey figure for woods of 0.4-2.0 ha obtained in 1951 together with a further allowance for woods of 0.25-0.4 ha. This earlier survey estimated the area of woods between 0.4 and 2.0 ha to be 45 850 ha (113 000 acres) compared with the current figure of 74 200 ha. The difference in area is substantial and the major reasons 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 1 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 undoubtably 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 114 thousand hectares between 1947 and 1980. If, however, the 1951 estimate of small woods is used the increase over the same period is 143 thousand hectares. Nevertheless, the greater part of the increase seems to have taken place before, rather than after, 1965.

The details of Forestry Commission and Dedicated and Approved Woodlands were obtained from records while the area in "Other" private ownership 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 37 thousand hectares of woodland shown on the maps no longer existed at the time of survey, whereas there were approximately 52 thousand hectares of 'extra' woodland. Therefore it is probable that, allowing for both gains and losses, the maps underestimated the area of woodlands by 15 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.

The distribution of woodland by Forestry Commission conservancy is shown in the table below.

Conservancy	Woodland area in thousands of ha	Per cent of total	Woodland density per cent of land area
North West England	169	18	5.6
North East England	177	19	7.6
East England	180	19	5.3
South East England	229	24	14.5
South West England	193	20	7.1
England	948	100	7.3

The very high woodland density in South East England Conservancy is noteworthy as it is almost twice the average for England.

Woodland Ownership

Of the total area of 948 thousand hectares in 1980, 255 thousand hectares were in Forestry Commission ownership and 693 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	15	85
1965	26	74
1980	27	73

A substantial increase in the area of Forestry Commission woodland occurred between 1947 and 1965, since when the rate of expansion has been much slower. Part of the increase is accounted for by afforestation, and part by the restocking of felled or derelict land acquired from private ownership after the Second World War. At present, North East England Conservancy has the highest proportion of its woodland area in Forestry Commission ownership with 46 per cent, followed by North West (27 per cent), East (24 per cent), South West (21 per cent) and South East (18 per cent).

In the case of private woodlands it seems likely that although the percentage in this ownership dropped substantially between 1947 and 1965 there was little change in actual area. Since 1965 the increase in private area has been at much the same percentage rate as the Forestry Commission.

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	204.4	53	178.1	47	382.5	100	41
Mainly Broadleaved High Forest	44.0	10	385.2	90	429.2	100	45
Total High Forest	248.4	31	563.3	69	811.7	100	86
Coppice with Standards	—	—	11.5	100	11.5	100	1
Coppice	1.0	4	24.7	96	25.7	100	3
Scrub	2.0	3	77.5	97	79.5	100	8
Cleared	3.6	19	15.7	81	19.3	100	2
Total	255.0	27	692.7	73	947.7	100	100

The table shows that there is more Broadleaved High Forest than Coniferous High Forest and that Coppice and Coppice with Standards form a minor part of the total area. In addition, a substantial proportion (75 per cent) of the Broadleaved High Forest is in the hands of "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 accomodate 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 a classification of 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	21	38	41
Broadleaved High Forest	34	32	45
Total High Forest	55	70	86
Coppice with Standards	12	1	1
Coppice	6	2	3
Scrub	16	25	8
Cleared	11	2	2
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 English totals of High Forest types and land area administered by each English Conservancy.

Percentage of English Total

Conservancy	Coniferous High Forest	Broadleaved High Forest	Total High Forest	Total Land Area
North West England	20	18	19	23
North East England	30	12	20	18
East England	16	23	20	26
South East England	19	21	20	21
South West England	15	26	21	12
Total	100	100	100	100

This table shows that High Forest is relatively well represented in South West England Conservancy and poorly represented in East England in relation to their share of total land area. So far as the composition of High Forest is concerned North East England has a particularly high representation of Coniferous High Forest and South West England of Broadleaved High Forest.

Mainly Coniferous High Forest

There has been an increase in the area of Coniferous High Forest from 21 per cent of the woodland area in 1947 to 41 per cent in 1980. The increase was most rapid between 1947 and 1965, when the area under conifers almost doubled, and although the percentage increase has been slow since that time, the actual area has risen by some 50 thousand hectares to the current value of 387 407 ha.

The distribution of planting years and ownership shown in Table 3 indicates that almost 65 per cent of the conifer area was planted during the thirty year period 1941-70. For the first two decades the Forestry Commission planted 60 per cent of the area, whereas in 1961-70, private owners planted more than half the total. Since that time both private and state forestry have made equal contributions.

Species distribution has been affected by the location of each batch of new plantings as well as by owners' preference based upon site conditions, marketing forces and other requirements. Although pines and spruces are the most frequently planted species, the Forestry Commission's order of importance is Sitka spruce, Scots pine and Corsican pine, whilst among private owners, those with formal management schemes have planted more Scots pine, larches and Sitka spruce, and "Other" woodland owners have tended towards Scots pine, Norway spruce and the larches. The relative importance of the major coniferous species at the time of the three surveys is shown below.

Year	1st	2nd	3rd	4th
1947	Scots pine	European larch	Sitka spruce	Norway spruce
1965	Scots pine	European larch	Norway spruce	Sitka spruce
1980	Scots pine	Sitka spruce	Norway spruce	Corsican pine

Mainly Broadleaved High Forest

The area of Broadleaved High Forest is now estimated to be 424 338 ha. The type has increased since 1947 from a 34 per cent share of the total woodland area to the current estimate of 45 per cent. The increase has not been steady, as in 1965 the total area classified as Broadleaved High Forest accounted for 32 per cent of all woodland, implying an effective reduction from the previous estimate. However this drop may be more apparent than real because of changes in the areas ascribed to particular forest types as a result of reclassification. In 1965 Broadleaved High Forest was known to have gained substantial areas from crops previously classified as Coppice with Standards or as Coppice and also to have lost some of the poorer broadleaved areas to the Utilisable Scrub category which did not exist at the previous survey.

The change since 1965 is easier to interpret because there has been a significant natural development of Scrub into Broadleaved High Forest throughout the country, as well as the normal processes of planting, restocking and also of the colonisation of bare land.

The age class distribution is different from that of conifers. Approximately 32 per cent of all broadleaves are more than eighty years of age, whilst almost 25 per cent originate in the twenty year period 1941-60. Most of the oldest age class is accounted for by oak and beech, with some contribution from other long lived species, whilst much of the twenty to forty year old woodland is composed of the colonising species sycamore, ash and birch. Although the figures show a steady reduction in the area of hardwoods planted in the years since 1960 this does not mean that this age class will always show the current area as it will increase as conifer nurses are removed from what are now stands of Mixed High Forest. It is noticeable that more oak has been planted in the last decade, than any other single species.

There were 5 545 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	Beech	Ash	Birch
1965	Oak	Beech	Ash	Sycamore
1980	Oak	Beech	Ash	Birch

Coppice and Coppice with Standards

There is still some interest in coppice systems as a form of management, although the total area has fallen considerably since 1947, with most of the change occurring by 1965. South East England Conservancy accounts for 80 per cent of the total 37 184 ha of Coppice and Coppice with Standards in the country, although there has been a renewal of some stands previously managed in this way in other southern counties such as Essex. Other 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 123 600 ha classed as Scrub or Devastated in the 1947 Report to the current figure of 79 498 ha. 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, almost 90 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 are Other broadleaves, including such species as hawthorn, sallow and rhododendron, and then birch 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 previously, it is difficult to draw direct comparisons with past results, but it is possible to draw some conclusions, especially for figures at a country level. As broadleaves still 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 little different from what it was 30 years ago. The fact that species such as sycamore, ash and birch have shown a major 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 between 50 and 60 thousand hectares less than there were at that time.

Standing Volume

It is estimated that there are approximately 111 million cubic metres overbark in the English woodlands, with almost 43 million cubic metres of coniferous timber and 68 million of broadleaved timber.

Analyses by forest types, ownerships, planting years and size classes are shown in Tables 11, 12 and 13. As might be expected, not only total area but also age structure determines which species carry most volume. Thus Sitka spruce, with an area equivalent to 83 per cent of the area of Scots pine, contains a total timber volume which is only half that of Scots pine. The older age classes of the pine far outweigh the high area and low volume of Sitka spruce in the younger age classes. Oak dominates, with more than twice as much volume as any other species, and more in the 1861-1900 age class than the total for most other species.

The three colonising species, sycamore, ash and birch also have differing volume distributions, with ash and sycamore having a regular proportion in all age classes, whilst birch predominates in the years 1941-60.

Volume estimates were produced for both the 1947 and 1965 Surveys, and although 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 about 62 million cubic metres overbark to some 75 million cubic metres in 1965, after adjustments to bring it into line with the minimum assessed area, and to 111 million cubic metres in 1980. These 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 can be expected 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

Ownership Class	Category	1947	1965	1980
Forestry Commission	Coniferous	9	16	20
	Broadleaved	6	5	3
	Total	15	21	23
Private	Coniferous	17	20	19
	Broadleaved	68	59	58
	Total	85	79	77
All	Coniferous	26	36	39
	Broadleaved	74	64	61
	Total	100	100	100

This Table shows that the Forestry Commission share in the percentage of total volume has risen steadily over the period from 15 per cent in 1947 to nearly 23 per cent in 1980; most of this increase has understandably been of coniferous timber. The coniferous percentage in private ownership has risen only slightly whilst that of broadleaved has dropped. These percentages do, however, mask the fact that both the coniferous and the broadleaved volumes have risen substantially with a sizeable proportion of both totals in the smallest size class.

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

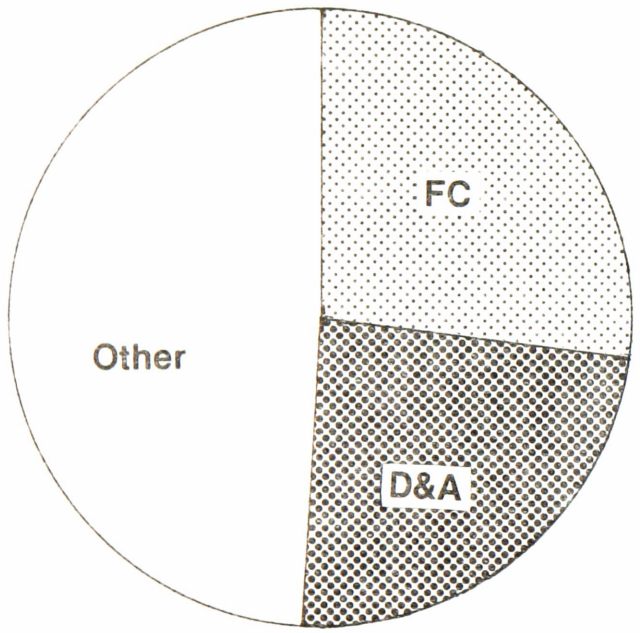
Species Group	1947	1965	1980
Pines	11	17	16
Spruces	4	7	10
Larches	6	8	7
Oak	37	28	22
Beech	15	12	10
Sycamore, ash and birch	13	14	16

This Table shows that while the percentage that larch forms of the whcle has remained relatively static, as has the proportion in pines after an increase between 1947 and 1965, the proportion of spruce has shown an increase at each of the three surveys and this trend is likely to continue. Among broadleaves oak and beech show reductions while sycamore, ash and birch combined show a substantial increase.

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



Note: Circle not to scale

FC: Forestry Commission Woodland
D&A: Dedicated and Approved Woodland
Other: "Other" Woodland

England

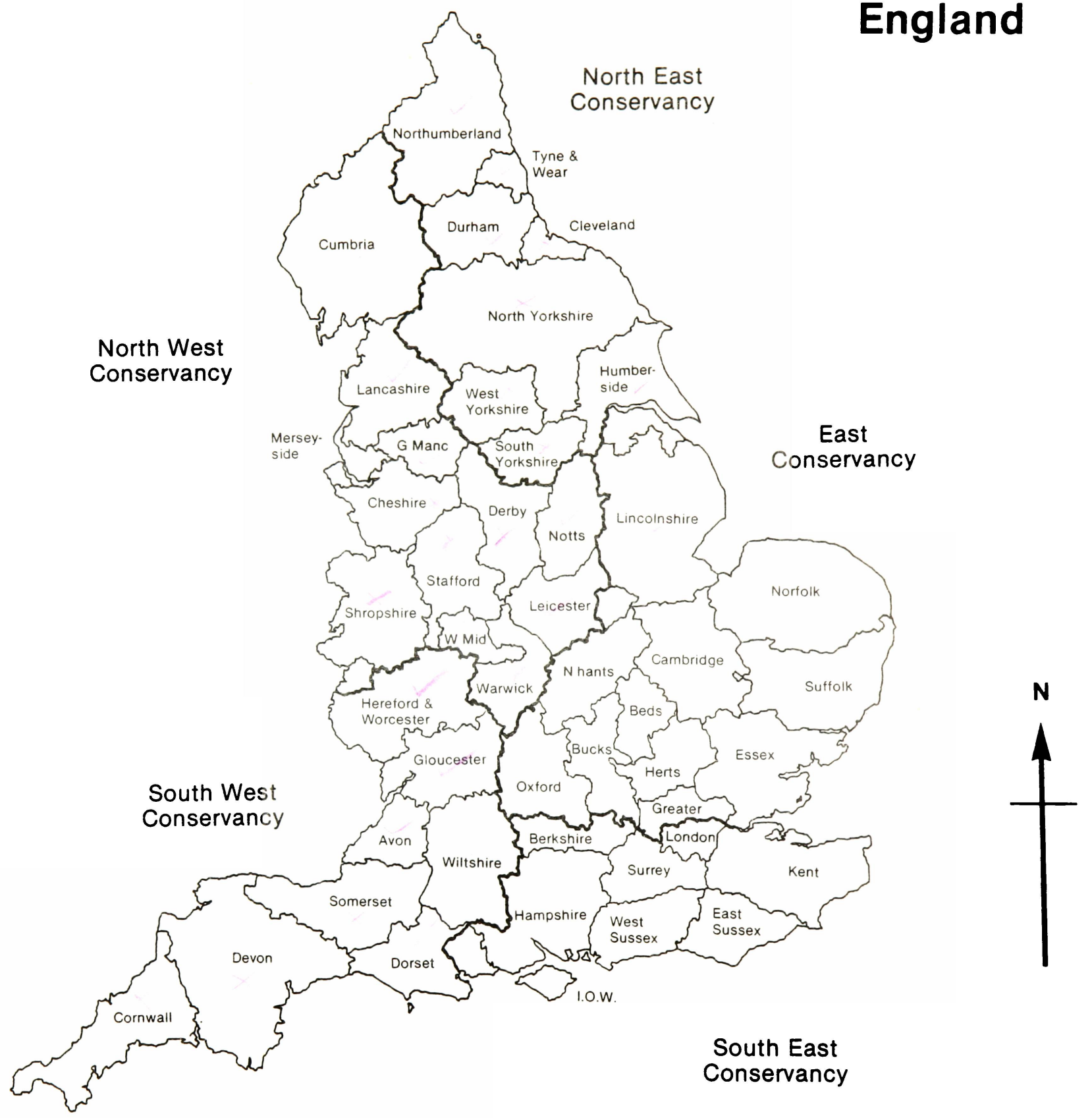


TABLE 1 **SUMMARY OF AREAS BY OWNERSHIP**

Area of England (including inland water): 13 043 927 hectares.

	Hectares	% Woodland Area
Area of Forestry Commission Woodland	254 968	27
Area of Dedicated and Approved Woodland	223 298	24
Area of "Other" Woodland	469 422	49
Total Area of Woodland over 0.25 ha	947 688	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 1959 and 1982.

The estimated total woodland area is 947 688 ha (± 3 133 ha or 0.3 per cent). This represents 7.3 per cent of the land and inland water area of England. In addition, an estimated area of 52 100 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 37 300 ha in this category.

Small Woods

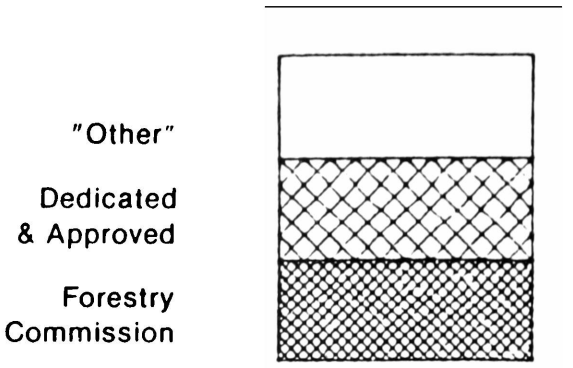
Details of Forestry Commission and Dedicated and Approved Woodlands are not available as the data for these ownerships are not recorded by individual woodland blocks.

"Other" Woodlands Only

	Woods 0.25-1.99 ha	Woods 2.0-9.99ha
Total Number of Woods	72 170	40 900
Total Area of Woods	74 170 ha	160 470 ha
Mean Area of Woods	1.03 ha	3.92 ha

DIAGRAM 2

AREA OF WOODLAND BY FOREST TYPE AND OWNERSHIP



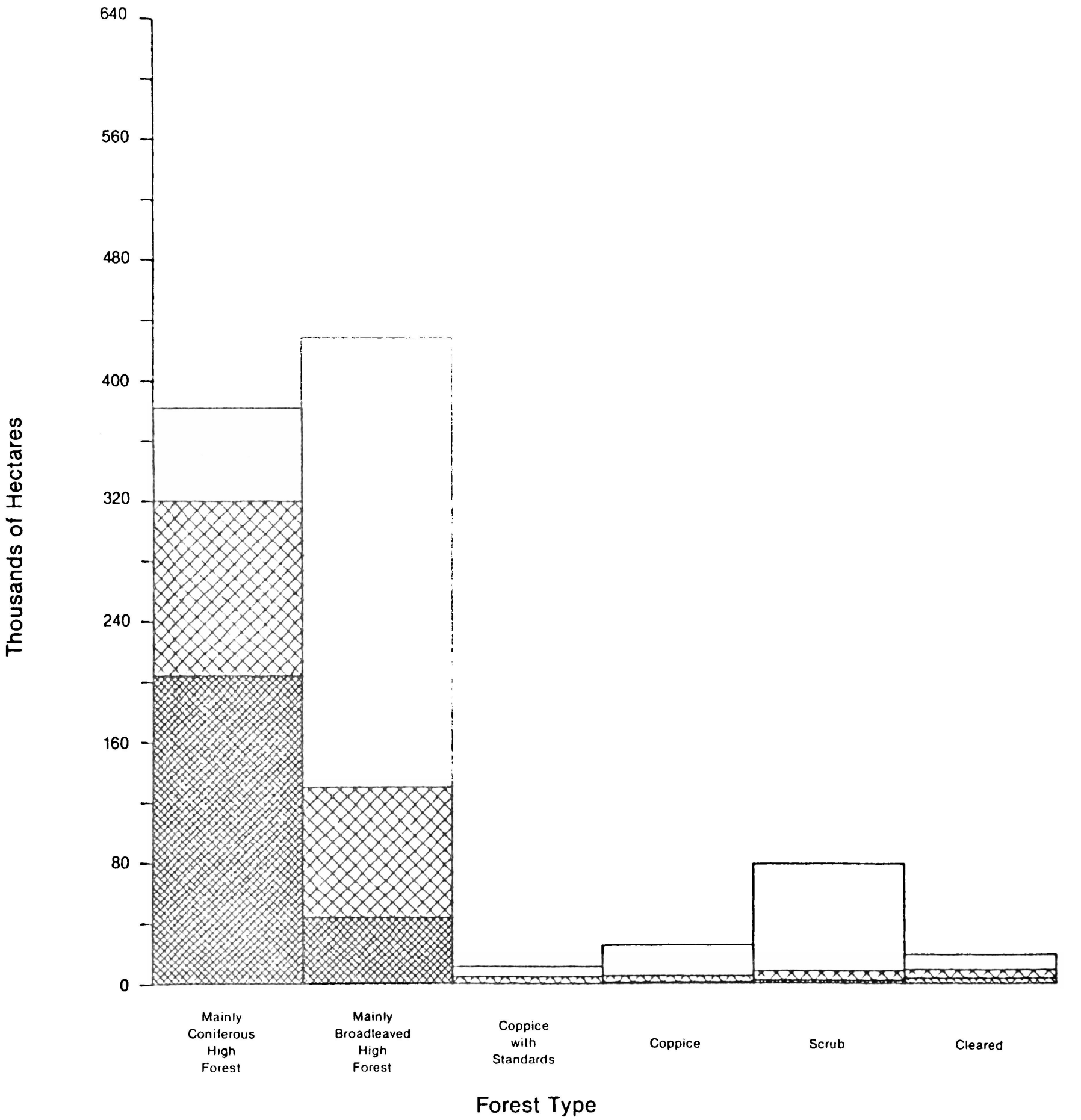


TABLE 2 AREA OF WOODLAND BY FOREST TYPE AND OWNERSHIP

Hectares

Forest Type	Forestry Commission area	Forestry Commission % of total	Dedicated and Approved area	Dedicated and Approved % of total	"Other" area	"Other" % of total	Total area	Total % of total
Mainly Coniferous High Forest	204 379	81	115 962	52	62 156	13	382 497†	41
Mainly Broadleaved High Forest	43 976	17	86 460	38	298 812*	65	429 248†	45
Total High Forest	248 355	98	202 422	90	360 968	78	811 745†	86
Coppice with Standards	32	<1	4 476	2	6 965	1	11 473†	1
Coppice	999	<1	4 360	2	20 352	4	25 711†	3
Scrub	2 010	1	6 349	3	71 139	15	79 498†	8
Cleared	3 572	1	5 691	3	9 998	2	19 261†	2
Total	254 968	100	223 298	100	469 422	100	947 688	100

NOTES:

* This figure for Mainly Broadleaved High Forest contains 13.2 per cent of Coppice origin.

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

Mainly Coniferous High Forest	± 0.9 per cent
Mainly Broadleaved High Forest	± 1.2 per cent
Total High Forest	± 0.6 per cent
Coppice with Standards	± 14.1 per cent
Coppice	± 8.9 per cent
Scrub	± 4.8 per cent
Cleared	± 4.8 per cent

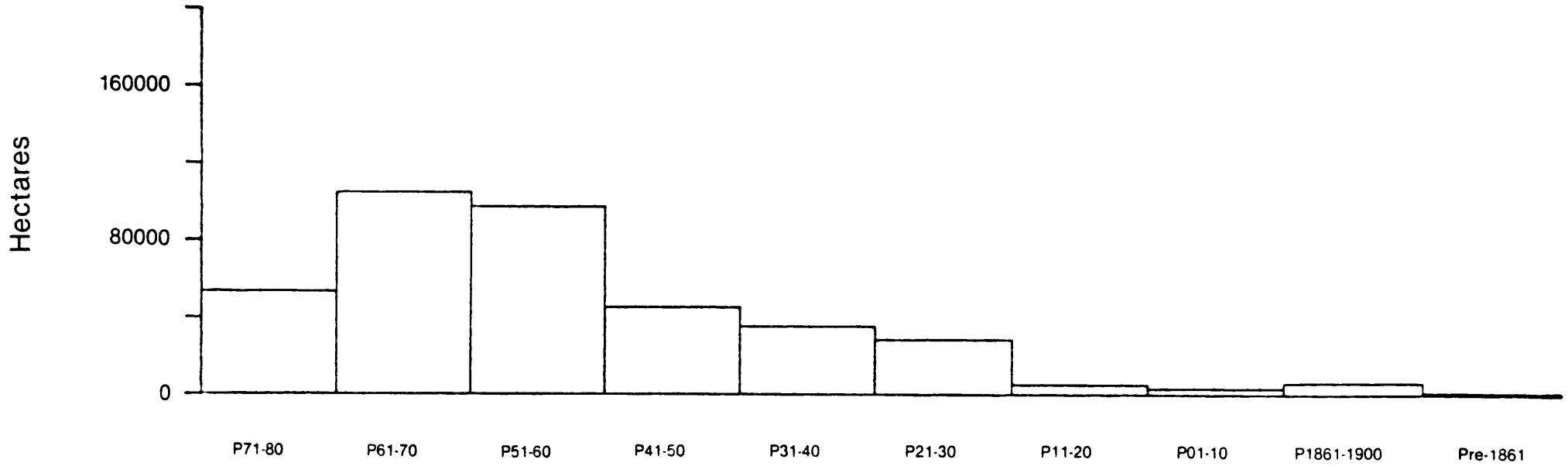
In this table, areas of the two categories of High Forest have been derived by allocating the area of each individual High Forest stand to either Mainly Broadleaved High Forest if 50 per cent or more of the area comprised broadleaved species, or to Mainly Coniferous High Forest if more than 50 per cent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

DIAGRAM 3

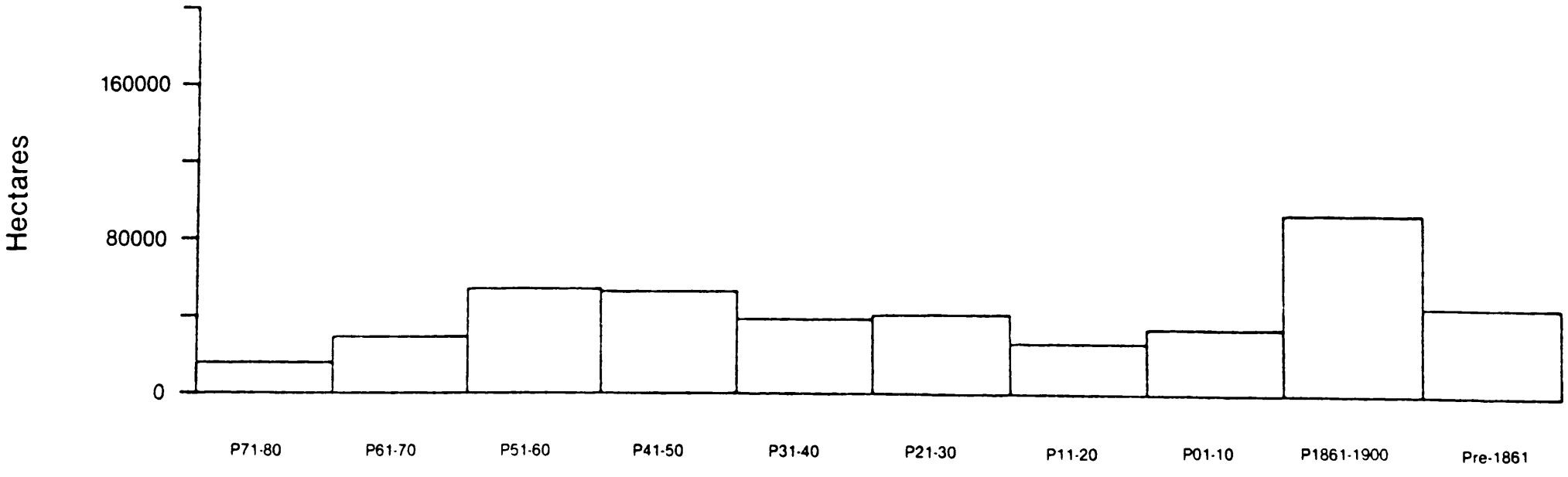
AREA OF HIGH FOREST TYPES BY PLANTING YEAR CLASSES

ALL WOODLAND OWNERSHIPS

MAINLY CONIFEROUS



MAINLY BROADLEAVED



Planting Year Classes

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

All Woodland Ownerships

Hectares

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	53 676	104 917	97 393	45 514	35 549	28 752	5 394	3 617	6 302	1 383	382 497
Mainly Broadleaved	15 745	28 953	54 030	52 562	38 500	40 840	26 244	33 716	93 254	45 404	429 248
Total	69 421	133 870	151 423	98 076	74 049	69 592	31 638	37 333	99 556	46 787	811 745

NOTE:

In Tables 3, 3a, 3b and 3c areas of the two categories of High Forest have been derived by allocating the total area of each individual High Forest stand to 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.

AREA OF HIGH FOREST BY PLANTING YEAR CLASSES AND OWNERSHIPS

DIAGRAM 3a

Forestry Commission Woodland

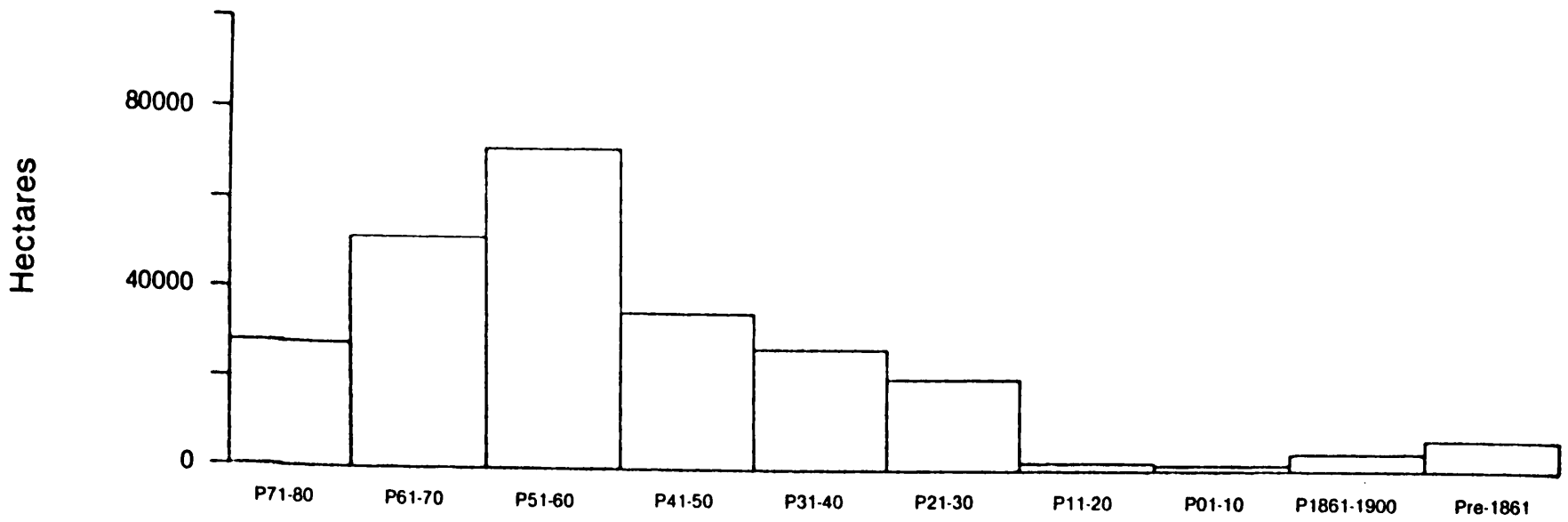


DIAGRAM 3b

Dedicated and Approved Woodland

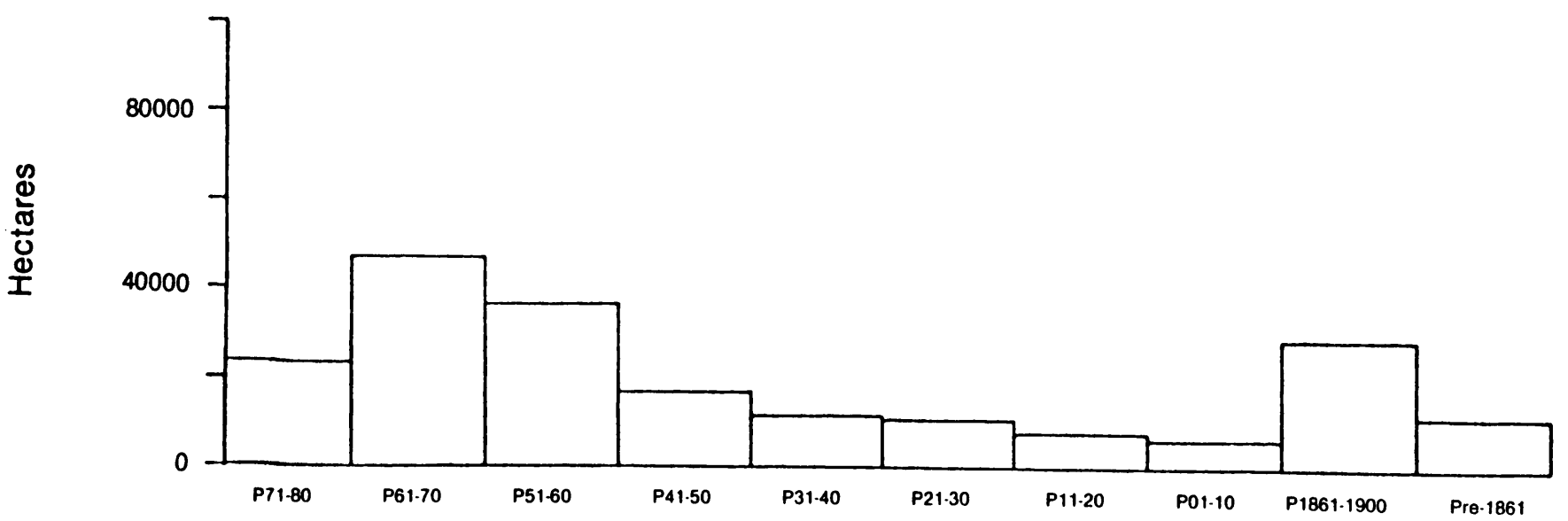
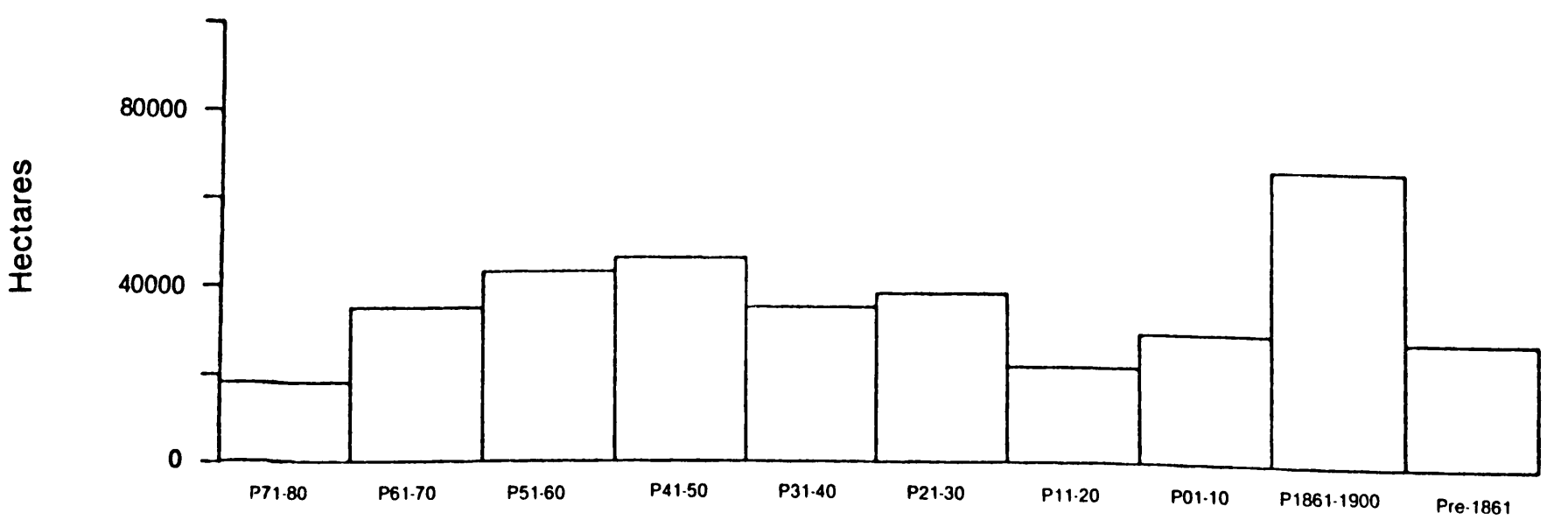


DIAGRAM 3c

"Other" Woodland



Planting Year Classes

AREA OF HIGH FOREST TYPES BY PLANTING YEAR CLASSES AND OWNERSHIPS

TABLE 3a **Forestry Commission Woodland** **Hectares**

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	26 819	48 471	60 248	28 061	21 319	17 473	727	498	605	158	204 379
Mainly Broadleaved	1 225	3 307	11 463	7 015	5 923	3 155	1 126	788	3 236	6 738	43 976
Total	28 044	51 778	71 711	35 076	27 242	20 628	1 853	1 286	3 841	6 896	248 355

TABLE 3b **Dedicated and Approved Woodland** **Hectares**

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	19 205	37 503	26 642	11 157	6 937	6 895	2 934	1 412	2 596	681	115 962
Mainly Broadleaved	4 256	9 804	10 167	5 852	4 894	3 991	5 028	5 106	26 276	11 086	86 460
Total	23 461	47 307	36 809	17 009	11 831	10 886	7 962	6 518	28 872	11 767	202 422

TABLE 3c **"Other" Woodland** **Hectares**

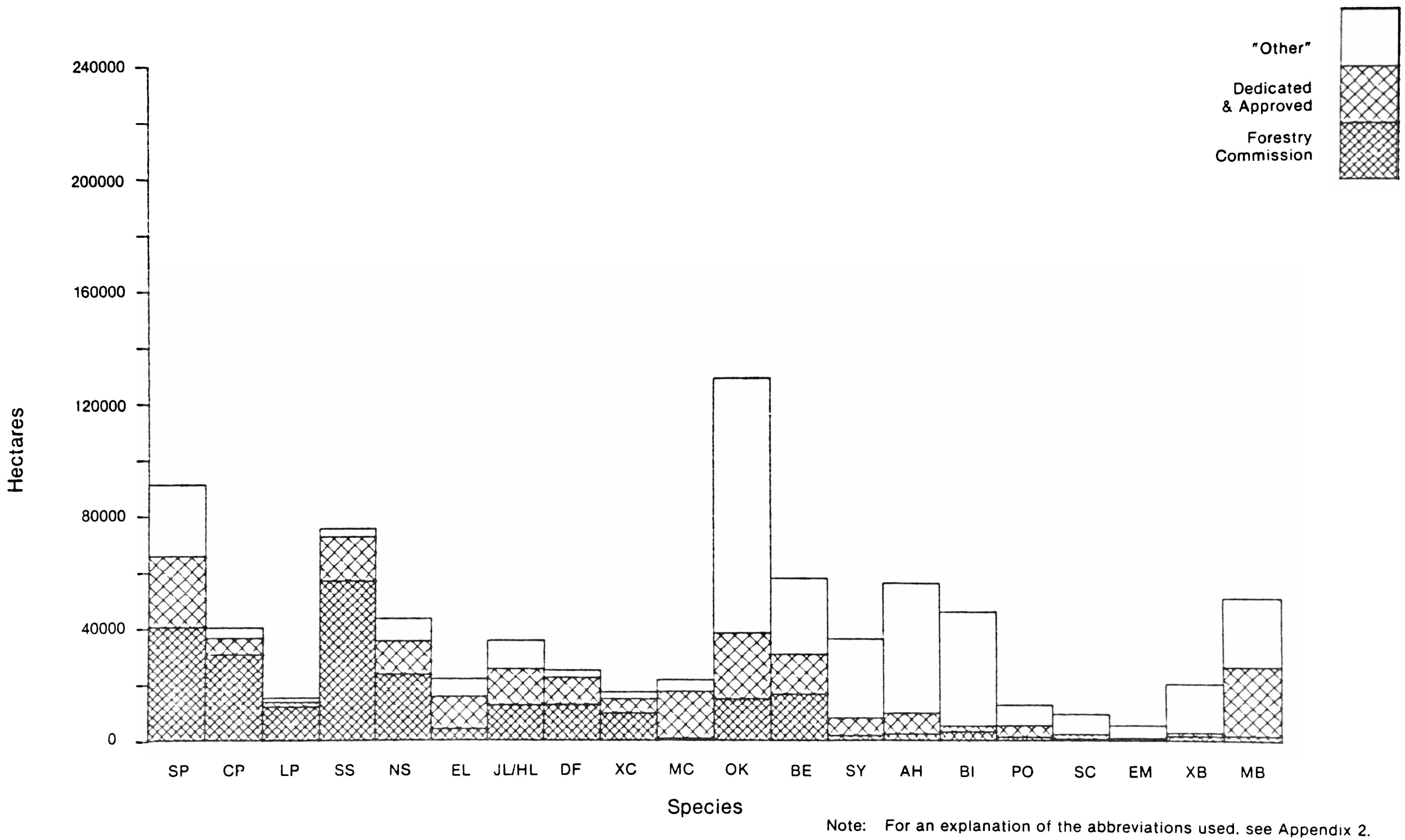
High Forest	Planting Year Classes										Total (S.E.)
	P71-80	P61-70	P51-60	P41-50	P31-40	P21-30	P11-20	P01-10	P1861-1900	Pre-1861	
Mainly Coniferous	7 652	18 943	10 503	6 296	7 293	4 384	1 733	1 707	3 101	544	62 156 (± 5%)
Mainly Broadleaved *	10 264	15 842	32 400	39 695	27 683	33 694	20 090	27 822	63 742	27 580	298 812 (± 2%)
Total	17 916	34 785	42 903	45 991	34 976	38 078	21 823	29 529	66 843	28 124	360 968 (± 1%)

NOTE:

* This total contains 13.2 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	40 189	20	16	25 536	22	13	25 349	38	7	91 074
Corsican pine	30 555	15	12	5 921	5	3	3 736	6	1	40 212
Lodgepole pine	12 039	6	5	1 771	2	1	1 439	2	<1	15 249
Sitka spruce	56 947	28	23	15 734	13	8	2 918	4	1	75 599
Norway spruce	23 469	12	10	12 108	10	6	7 922	12	2	43 499
European larch	4 245	2	2	11 467	10	6	6 150	9	2	21 862
Jap./Hybrid larch	12 704	6	5	12 842	11	6	10 196	15	3	35 742
Douglas fir	12 919	6	5	9 602	8	5	2 542	4	1	25 063
Other conifers	9 811	5	4	5 053	4	2	2 578	4	1	17 442
Mixed conifers	663	<1	<1	16 935	15	8	4 067	6	1	21 665
Total conifers	203 541	100	82	116 969	100	58	66 897	100	19	387 407†
Oak	14 910	34	6	23 470	27	11	90 972	31	25	129 352
Beech	16 586	37	7	14 190	17	7	27 052	9	7	57 828
Sycamore	1 835	4	1	6 280	7	3	28 089	10	8	36 204
Ash	2 415	5	1	7 356	9	4	46 321	16	13	56 092
Birch	3 175	7	1	2 145	3	1	40 581	14	11	45 901
Poplar	1 270	3	<1	4 148	5	2	7 339	2	2	12 757
Sweet chestnut	578	1	<1	1 673	2	1	7 200	2	2	9 451
Elm	211	<1	<1	670	1	<1	4 664	2	1	5 545
Other broadleaves	1 793	4	1	1 180	1	1	17 321	6	5	20 294
Mixed broadleaves	2 041	5	1	24 341	28	12	24 532	8	7	50 914
Total broadleaves	44 814	100	18	85 453	100	42	294 071*	100	81	424 338†
Total	248 355	100	100	202 422	100	100	360 968	100	100	811 745

NOTES:

* Contains 13.2 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	± 1 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	5 031	18 979	20 914	12 129	11 324	14 887	2 285	1 858	3 228	439	91 074
Corsican pine	8 030	12 108	8 332	3 158	4 480	3 065	447	253	279	60	40 212
Lodgepole pine	2 455	7 035	5 172	306	249	28	2	2	—	—	15 249
Sitka spruce	20 493	17 059	17 986	12 559	5 696	1 597	134	8	63	4	75 599
Norway spruce	4 040	14 243	11 649	5 728	4 944	1 873	413	158	397	54	43 499
European larch	1 531	3 599	3 780	2 993	3 765	2 796	1 108	923	1 239	128	21 862
Jap./Hybrid larch	4 844	9 340	12 815	4 216	2 441	1 589	263	125	96	13	35 742
Douglas fir	3 506	8 728	7 137	1 677	1 085	2 269	348	104	140	69	25 063
Other conifers	2 499	7 944	4 942	585	303	334	134	156	444	101	17 442
Mixed conifers	2 352	5 604	4 662	2 138	1 723	1 561	970	729	1 538	388	21 665
Total conifers	54 781	104 639	97 389	45 489	36 010	29 999	6 104	4 316	7 424	1 256	387 407
Oak	1 987	2 511	5 637	6 195	6 811	10 479	8 253	14 564	48 289	24 626	129 352
Beech	1 971	5 434	9 168	4 096	3 348	2 071	2 177	4 191	13 819	11 553	57 828
Sycamore	1 635	2 971	5 124	6 762	5 371	3 842	2 871	2 304	4 281	1 043	36 204
Ash	1 549	1 978	6 568	10 222	8 485	8 955	4 562	5 560	6 679	1 534	56 092
Birch	1 881	7 261	13 737	12 312	5 283	3 094	1 167	398	615	153	45 901
Poplar	1 952	4 286	4 359	927	299	582	234	28	73	17	12 757
Sweet chestnut	352	356	1 125	1 082	1 099	943	630	957	1 426	1 481	9 451
Elm	151	137	320	800	841	752	565	276	1 404	299	5 545
Other broadleaves	970	1 240	2 871	4 690	1 929	3 684	1 221	916	2 115	658	20 294
Mixed broadleaves	2 186	3 075	5 159	5 513	4 578	5 185	3 838	3 805	13 417	4 158	50 914
Total broadleaves	14 634	29 249	54 068	52 599	38 044	39 587	25 518	32 999	92 118	45 522	424 338
Total	69 415	133 888	151 457	98 088	74 054	69 586	31 622	37 315	99 542	46 778	811 745

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	30	Corsican pine	12	Scots pine	7
P61-70	Scots pine	14	Sitka spruce	13	Norway spruce	11
P51-60	Scots pine	14	Sitka spruce	12	Birch	9
P41-50	Sitka spruce	13	Birch	13	Scots pine	12
P31-40	Scots pine	15	Ash	11	Oak	9
P21-30	Scots pine	21	Oak	15	Ash	13
P11-20	Oak	26	Ash	14	Mixed broadleaves	12
P01-10	Oak	39	Ash	15	Beech	11
P1861-1900	Oak	49	Beech	14	Mixed broadleaves	13
Pre 1861	Oak	53	Beech	25	Mixed broadleaves	9

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	115	193	5 275	1 697	1 465	2 728	11 473
	%	1	2	45	15	13	24	100
Coppice Only	ha	2 297	1 184	13 816	1 716	1 573	5 125	25 711
	%	9	5	53	7	6	20	100
Total	ha	2 412	1 377	19 091	3 413	3 038	7 853	37 184
% of Coppice Total		7	4	51	9	8	21	100

NOTE:
"Other species" includes mixtures of the above five named species as well as other minor species of coppice eg. birch and 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	—	—	16	4	—	—	20
Oak	97	173	4 897	1 594	1 444	2 728	10 933
Ash	8	20	—	88	21	—	137
Sweet chestnut	—	—	353	—	—	—	353
Other broadleaves	10	—	9	11	—	—	30
Total	115	193	5 275	1 697	1 465	2 728	11 473
% of Total	1	2	45	15	13	24	100

TABLE 9 AREA OF SCRUB BY PRINCIPAL SPECIES

All Woodland Ownerships — Hectares

Principal Species	Area	% of Total
Conifers	824	1
Oak	12 568	16
Beech	775	1
Sycamore	1 911	2
Ash	7 276	9
Birch	20 390	26
Sweet chestnut	256	<1
Alder	4 736	6
Hornbeam	400	1
Hazel	5 171	6
Willow	4 005	5
Other broadleaves	21 186	27
Total	79 498	100

NOTE:
"Other broadleaves" includes hawthorn and sallow.

TABLE 10 PRINCIPAL SPECIES OF THE SHRUB LAYER BY FOREST TYPES

"Other" Woodlands Only

Forest Type	Principal Species of Shrub Layer in Order of Total Area					
	First	Cover*	Second	Cover*	Third	Cover*
Coniferous High Forest	Elder	<1	Rhododendron	<1	Hazel	<1
Broadleaved High Forest	Hazel	7	Hawthorn	3	Elder	2
Coppice with Standards	Other shrubs	3	Hawthorn	1	Elder	<1
Coppice	Other shrubs	1	Hazel	<1	Hawthorn	<1
Scrub	Hazel	5	Sallow	3	Hawthorn	2
Cleared	Elder	<1	Hazel	<1	Hawthorn	<1

NOTE:
* "Cover" is the percentage of the ground area of each forest type covered by the named species. Figures relate only to "Other" Woodlands since Forestry Commission and Dedicated and Approved Woodland records do not contain data on this feature.

DIAGRAM 5

STANDING VOLUME OF TIMBER BY CATEGORY AND OWNERSHIP

All Woodlands

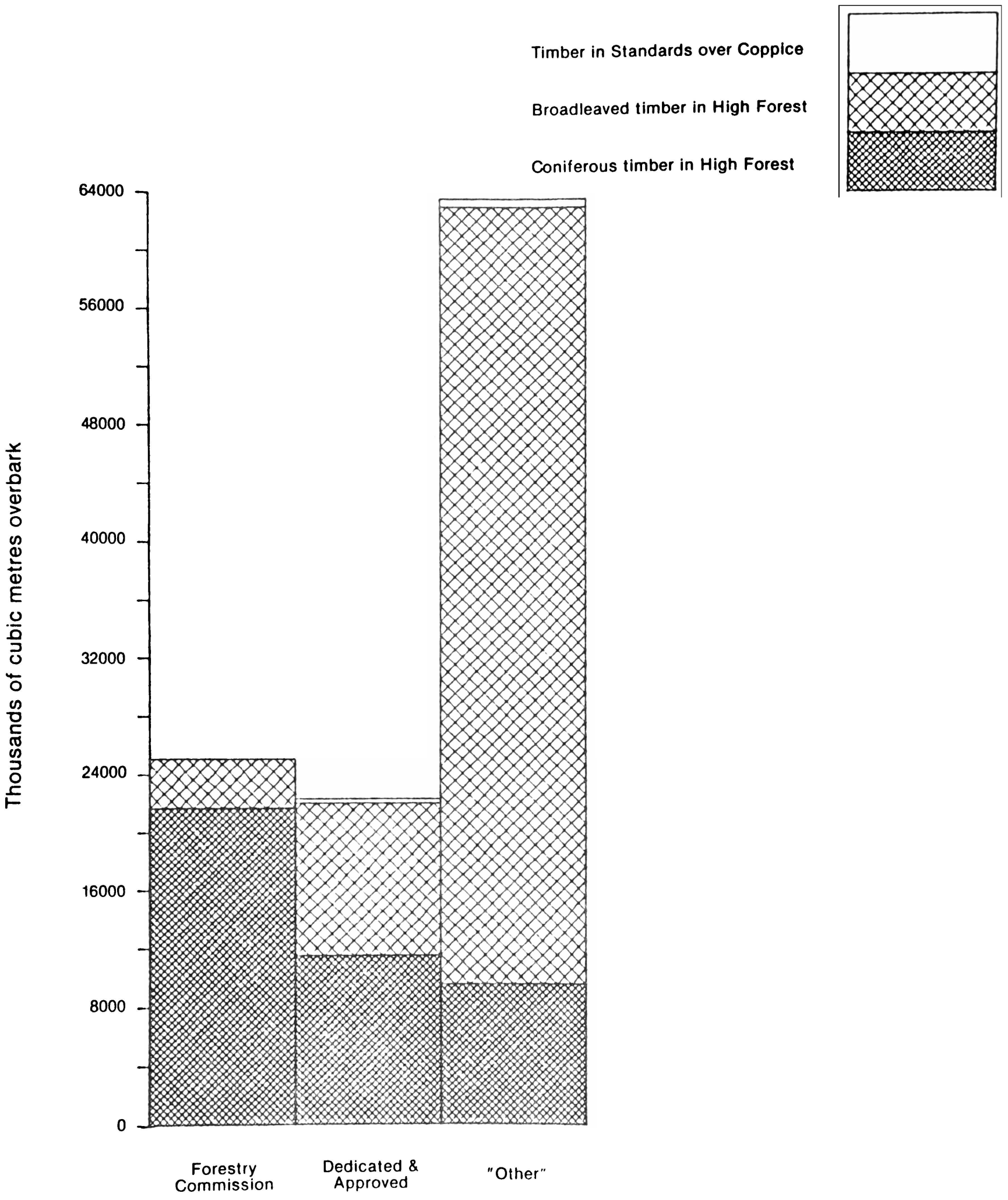


TABLE 11 STANDING VOLUME OF TIMBER BY CATEGORY AND OWNERSHIP

All Woodlands

Thousands of cubic metres overbark

Volume Category	Forestry Commission	Dedicated and Approved	"Other"	Total (S.E.)
In High Forest				
Coniferous Timber	21 681.2	11 528.8	9 559.2	42 769.2 (± 1%)
Broadleaved Timber	3 396.0	10 503.6	53 464.2	67 363.8 (± 2%)
Total High Forest	25 077.2	22 032.4	63 023.4	110 133.0 (± 1%)
Timber in Standards over Coppice	2.6	297.9	532.7	833.2 (± 13%)
Total*	25 079.8	22 330.3	63 556.1	110 966.2 (± 1%)

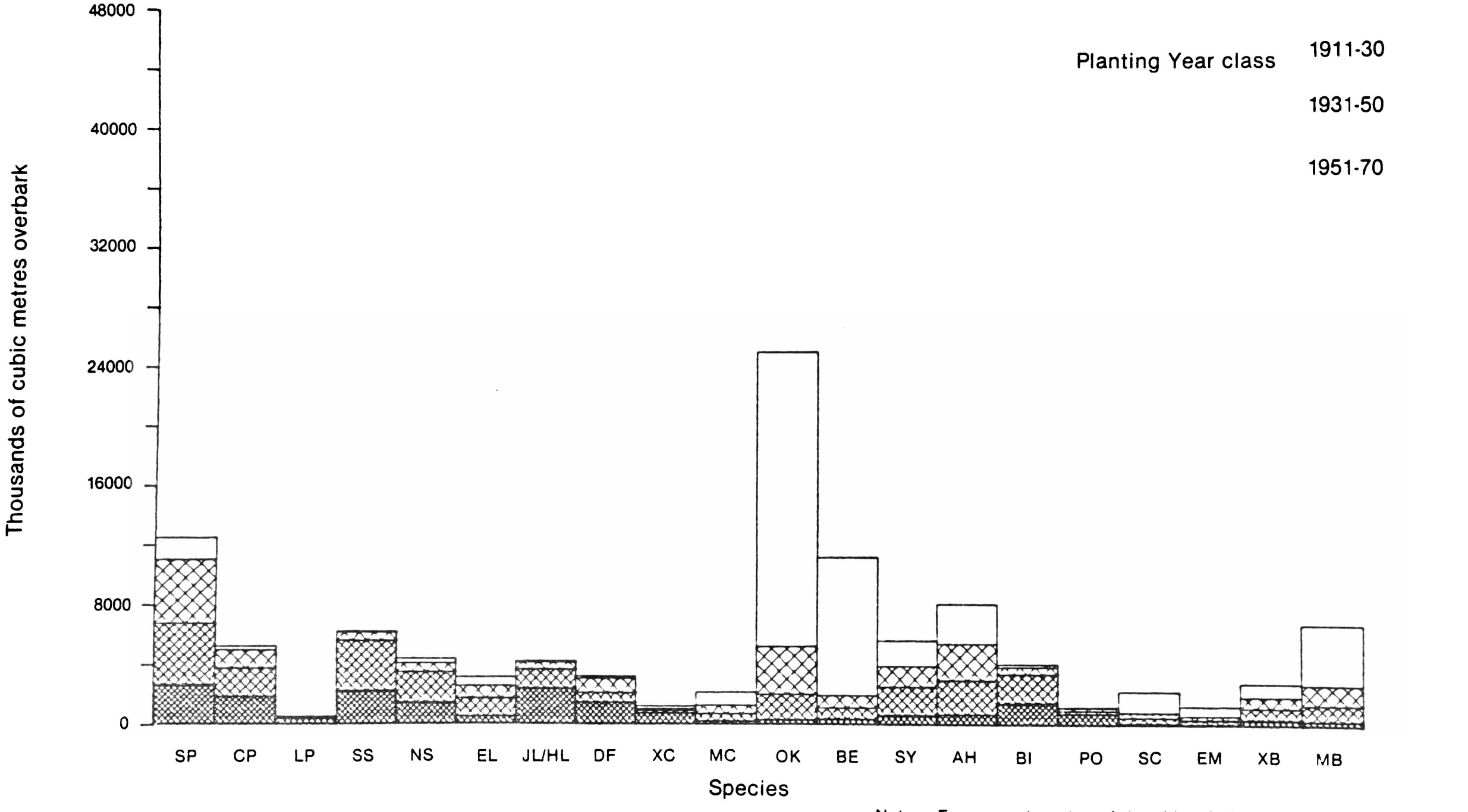
NOTE:

* 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

All Woodland Ownerships



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

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	756.9	1 875.1	1 773.1	2 317.6	3 632.5	639.2	385.0	939.8	146.9	12 466.1
Corsican pine	672.8	1 170.2	688.0	1 205.4	1 039.3	173.3	92.5	126.6	29.5	5 197.6
Lodgepole pine	167.7	268.6	47.7	40.1	4.6	0.5	0.7	—	—	529.9
Sitka spruce	441.7	1 806.7	2 026.2	1 329.6	495.4	50.2	4.3	16.9	2.2	6 173.2
Norway spruce	399.0	1 049.7	957.8	1 066.4	484.8	129.5	61.2	229.3	25.3	4 403.0
European larch	152.1	355.1	469.4	765.8	563.5	267.5	221.5	330.8	34.8	3 160.5
Jap./Hybrid larch	727.6	1 676.1	761.4	524.3	391.0	65.4	42.9	48.1	3.7	4 240.5
Douglas fir	538.8	919.7	359.1	306.4	810.5	138.3	46.7	61.1	33.1	3 213.7
Other conifers	256.0	497.4	107.7	67.1	69.0	38.0	44.1	132.9	33.2	1 245.4
Mixed conifers	29.5	169.9	203.5	290.8	346.7	233.8	195.8	558.3	112.3	2 140.6
Total conifers	4 142.1	9 788.5	7 393.9	7 913.5	7 837.3	1 735.7	1 094.7	2 443.8	421.0	42 770.5
Oak	23.3	276.5	679.4	1 065.0	1 749.4	1 437.3	2 728.2	11 514.5	5 556.2	25 029.8
Beech	28.5	333.1	328.0	421.9	392.6	456.9	1 132.1	4 439.3	3 651.2	11 183.6
Sycamore	132.1	487.3	988.7	933.6	743.6	606.6	463.4	1 015.3	263.1	5 633.7
Ash	70.7	616.1	1 145.9	1 150.5	1 559.5	875.9	950.7	1 263.5	435.8	8 068.6
Birch	355.8	1 103.4	1 329.6	588.9	360.1	127.6	55.5	99.1	22.2	4 042.2
Poplar	236.3	510.3	160.9	61.2	115.6	64.2	7.4	21.6	4.4	1 181.9
Sweet chestnut	7.3	96.7	211.8	181.2	210.4	125.6	279.9	457.4	672.2	2 242.5
Elm	2.2	31.8	125.6	194.3	180.8	109.7	66.1	455.6	101.3	1 267.4
Other broadleaves	49.0	336.3	499.2	276.7	545.3	206.8	189.1	571.6	139.2	2 813.2
Mixed broadleaves	48.7	266.0	502.1	557.2	752.5	608.1	722.9	2 433.9	841.4	6 732.8
Total broadleaves	953.9	4 057.5	5 971.2	5 430.5	6 609.8	4 618.7	6 595.3	22 271.8	11 687.0	68 195.7
Total	5 096.0	13 846.0	13 365.1	13 344.0	14 447.1	6 354.4	7 690.0	24 715.6	12 108.0	110 966.2

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

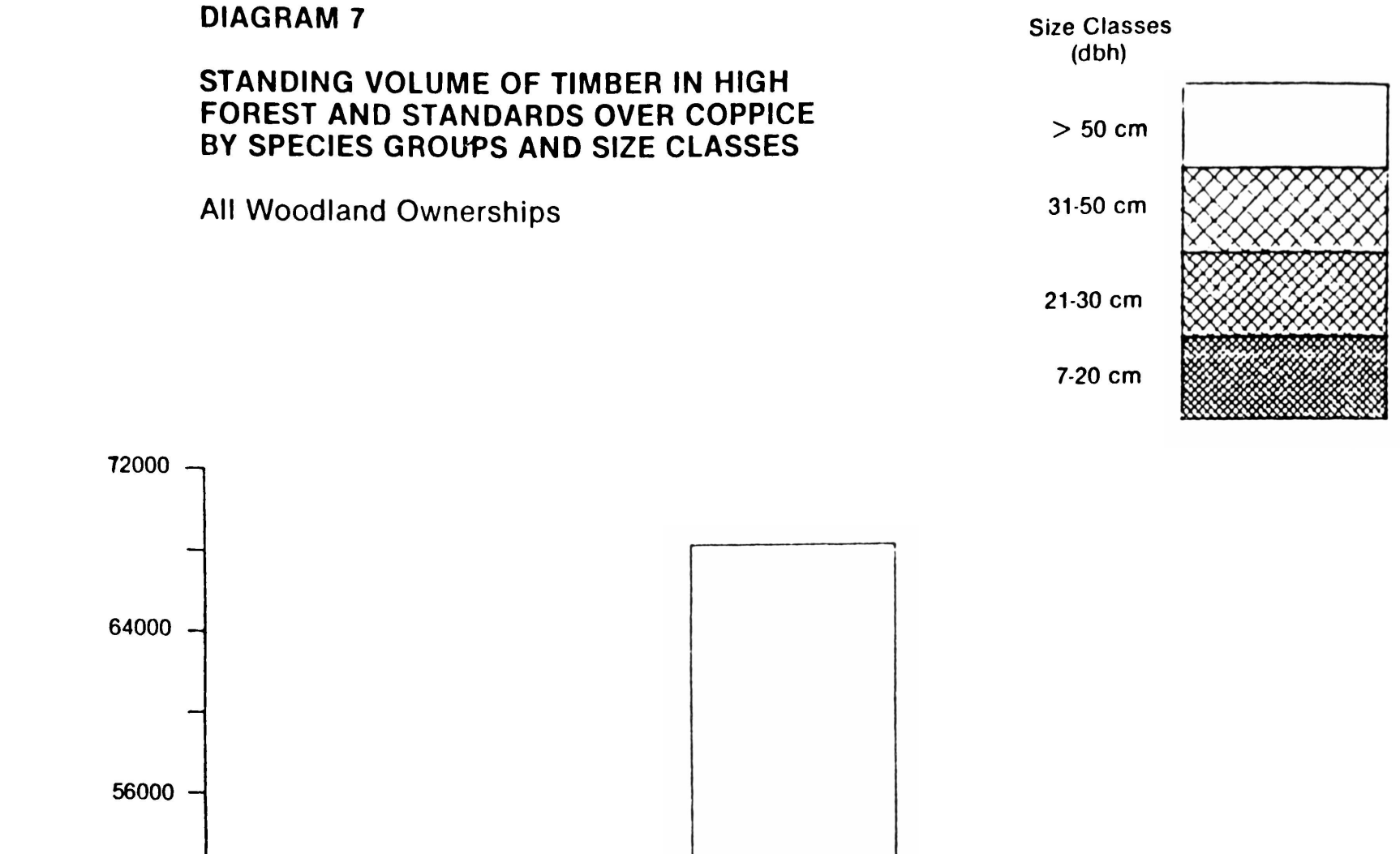


TABLE 13 STANDING VOLUME OF TIMBER IN HIGH FOREST AND STANDARDS OVER COPPICE BY PRINCIPAL SPECIES AND SIZE CLASSES

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	4 090.3	4 099.7	3 561.9	714.2	12 466.1
Corsican pine	2 116.6	1 637.9	1 267.4	175.7	5 197.6
Lodgepole pine	495.4	31.3	3.2	—	529.9
Sitka spruce	4 048.7	1 512.5	558.1	53.9	6 173.2
Norway spruce	2 598.9	1 085.6	605.3	113.2	4 403.0
European larch	724.6	1 137.5	1 191.7	106.7	3 160.5
Jap./Hybrid larch	1 777.6	1 550.9	845.6	66.4	4 240.5
Douglas fir	1 386.5	505.9	973.9	347.4	3 213.7
Other conifers	767.3	183.8	174.1	120.2	1 245.4
Mixed conifers	809.7	561.7	490.0	279.2	2 140.6
Total conifers	18 815.6	12 306.8	9 671.2 (± 2.6%)	1 976.9 (± 7.7%)	42 770.5 (± 1.2%)
Oak	1 831.6	3 615.6	10 664.0	8 918.6	25 029.8
Beech	1 161.3	865.9	3 510.6	5 645.8	11 183.6
Sycamore	1 045.4	1 364.7	2 328.0	895.6	5 633.7
Ash	1 663.1	2 181.6	3 102.6	1 121.3	8 068.6
Birch	2 099.5	1 234.0	637.2	71.5	4 042.2
Poplar	85.0	286.1	698.5	112.3	1 181.9
Sweet chestnut	269.5	296.3	562.2	1 114.5	2 242.5
Elm	165.8	210.1	517.8	373.7	1 267.4
Other broadleaves	719.5	661.1	770.8	661.8	2 813.2
Mixed broadleaves	1 120.1	2 184.6	1 616.0	1 812.1	6 732.8
Total broadleaves	10 160.8	12 900.0	24 407.7 (± 2.4%)	20 727.2 (± 5.1%)	68 195.7 (± 2.2%)
Total	28 976.4	25 206.8	34 078.9 (± 1.9%)	22 704.1 (± 4.7%)	110 966.2 (± 1.4%)

NOTE:
The figures in brackets are standard errors.

Part Two

Non-Woodland Trees

COMMENTARY ON THE RESULTS FOR NON-WOODLAND TREES IN ENGLAND

PREVIOUS FORESTRY COMMISSION SURVEYS

Both the 1951 Census of Hedgerow Trees and Small Woods and the 1965 Hedgerow Survey provided estimates of the volume of hedgerow and park trees by Country but published information on tree numbers was confined to the 1951 Survey.

SAMPLE STRATA USED IN THE 1980 CENSUS

Soil groups were used as the basis for the selection of sample strata. Seventeen soil groups were recognised for the whole of England and Wales and all seventeen were present in England. The names and identification 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 not more than ± 25 per cent, and secondly the species, health, size classes and timber volumes for all non-woodland trees. As the figures in the tables of this Report are a summation of all the English county totals, the precision of the estimates is normally higher than those of the individual counties. For England the precision of the estimate of isolated trees is 3.8 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 England with a diameter at breast height of 7 cm or more is 62.4 million (± 4 per cent) distributed as shown below.

Millions of trees

	Conifers	Broadleaves	Total	Per cent of total
Isolated Trees	1.3	13.0	14.3	23
Clumps	2.5	21.0	23.5	38
Linear Features	1.4	23.2	24.6	39
Total	5.2	57.2	62.4	100

Coniferous species account for a little over 8 per cent of the total number of measurable trees and, as with all English Conservancies, and indeed most counties, cypresses are the most widely represented species with over 40 per cent of the conifer total. Pines are next with 22 per cent followed by Other conifers with 21 per cent. Spruces and larches each occupy less than 10 per cent.

The predominant broadleaved species is ash with 22 per cent followed by oak with 16 per cent, sycamore with 12 per cent and alder with 11 per cent.

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

Conservancy	Total number of trees of 7 cm dbh and greater (millions)	Per cent of total	Tree density per square kilometre	
			Average	Range
North West England	16.6	27	545	168-1033
North East England	7.1	11	304	116-1022
East England	11.7	19	344	140- 814
South East England	10.3	16	654	313-1216
South West England	16.7	27	620	270-1085
England	62.4	100	478	116-1216

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

From the previous table it will be seen that North West and South West England Conservancies hold the largest number of trees, followed by East, South East and North East Conservancies in that order. Tree densities, on the other hand, show South East to have the highest and North East the lowest. Average conservancy density, however, does hide the range of individual county values within it and so, although the mean density in the South East Conservancy is twice that of the North East, the range in each case is much the same. The upper value is, however, largely conditioned by the degree of urbanisation in the counties comprising a Conservancy, and not surprisingly, South East England has the highest value partly because of the extensive area of parks and gardens within it.

Isolated Trees

There are 14.3 million isolated trees divided into two sub-categories; 6.0 million trees growing on major land use boundaries such as hedges, walls and fences and 8.3 million trees 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 their 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 over ten times as many trees in open grown positions as on boundaries, account for 9 per cent of the isolated tree population. North West and North East Conservancies each have a below average conifer percentage, 6 and 7 per cent respectively; in East and South West Conservancies it is just above the mean, and in the South East Conservancy, at 16 per cent, it is well above average. Cypresses, as might be expected, account for nearly half the total followed by Other conifers and pines at 27 and 14 per cent respectively. Spruces and larches combined account for about 10 per cent of the conifer total with the former four times as prevalent as the latter.

Among broadleaved trees about 45 per cent are classed as being on boundaries and 55 per cent open grown. Ash is the most frequently represented species, with just under a quarter of the total, and is closely followed by oak with 22 per cent; in both cases, boundary trees are more than twice as prevalent as those in open grown positions. Other broadleaves, the next most important species group, accounts for just under a fifth of the total, but, as many of these trees have been planted for amenity and consequently are usually found in urban areas, open grown trees of this species group outnumber boundary trees in a ratio of eight to one.

Clumps

There are approximately 4.2 million clumps covering an area of just over 73 thousand hectares and including about 23.5 million trees. The average number of trees per clump lies between 5 and 6. Most Conservancies fall near to this average but in South East England the figure lies between 6 and 7.

Conifers account for 10 per cent of the total and the species order is the same as that for Isolated trees, namely cypresses, pines and Other conifers. In broadleaves, ash is the clear leader with 24 per cent of the total followed by oak with 14 per cent and sycamore with 13 per cent. Birch and alder are also of importance. Ash is the dominant species in the North West, East and South West Conservancies, oak in the South East Conservancy and birch in the North East Conservancy. Sycamore or Other broadleaves are usually the second most prevalent species.

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 24.6 million trees. Coniferous species, among which cypresses again dominate, account for only 6 per cent of the total and so are less important in this category in percentage terms than in the Isolated tree category or in clumps. Ash is again the dominant species with 20 per cent, but followed closely by alder, with oak third in importance. The relatively high ranking of alder in this category reflects its frequent occurrence along streamsides. Ash is the dominant species in East and South West England Conservancies, alder in the North West and North East Conservancies and oak in the South East Conservancy. Sycamore is second in importance in both northern Conservancies.

Size Class Distribution

In addition to the trees with a minimum dbh of 7 cm, there are 13.0 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 obviously intended 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 England increases from 62.4 million to 75.4 million, a rise of just over a fifth. The percentage number of trees in each of the diameter classes is as follows:

Diameter Class	Conifers	Broadleaves	Total
Under 7 cm	6%	11%	17%
7-20 cm	4%	37%	41%
21-30 cm	1%	13%	14%
31-50 cm	1%	15%	16%
Over 50 cm	1%	11%	12%
Total	13%	87%	100%

The effect of the inclusion of these small trees is perhaps most striking in the coniferous category where the tree count is nearly doubled, with cypresses and pines both more than doubling their numbers. East and North West England Conservancies together account for about two thirds of the tree numbers in this smallest class. The overall species order of cypresses, pines and Other conifers is unchanged by the inclusion of these small trees.

The addition of the small trees class to the broadleaved total increases that total by 8.7 million trees, a rise of about 15 per cent. The young trees are primarily Other broadleaves, probably mainly as a consequence of urban planting, but there are also substantial numbers of sycamore, birch and ash. The inclusion of the small tree category does not materially alter the overall species ranking in broadleaves; ash and oak still occupy first and second places but, because of the large numbers of Other broadleaves in the smallest size class, this species group takes over third position from sycamore, which is now fourth. Alder and birch now occupy fifth and sixth places. East and North West England Conservancies again contain the bulk of the trees in the smallest size category.

In the conifer size class distribution, the less than 7 cm dbh size class holds 45 per cent of the total numbers and the 7-20 dbh size class holds 33 per cent. The balance is spread over the three remaining classes with the largest, the over 50 cm dbh size class, accounting for only 4 per cent of the total. In broadleaves, however, the pattern differs in that the two smallest size classes together hold only 56 per cent of the broadleaved total with the majority of the trees in the 7-20 cm dbh size class. Of the remainder, the 31-50 cm dbh size class accounts for slightly more trees than the two classes on either side of it. When species are considered, oak and beech tend to be weighted toward the larger size classes, while ash, sycamore and alder tend to occur in the middle and smaller size classes. Birch and Other broadleaves are predominantly small sized.

Elm is now much less important in numerical terms than it once was and now ranks only ninth in the broadleaved species and tenth over all. Its numbers can be expected to decline further as more trees of the remaining stock become infected with Dutch elm disease.

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 disease and in a dying condition.

Table 18a shows the overall position with 73 per cent of the trees in good health, 17 per cent in moderate health, 3 per cent in poor health and 7 per cent dead and dying. Leaving aside the special features of elm, declining health is generally correlated with advancing age.

Elm, with 4.2 million dead and dying trees, accounts for 88 per cent of the tree numbers in this category. Considerable numbers of ash, oak and birch have also been classed as dead but they represent only a relatively small proportion of the tree numbers of each of these species. In the poor health category, ash

accounts for well over a quarter of the trees with the major totals in North West, East and South West England Conservancies; elm is next with nearly 20 per cent of the total of this category, concentrated mainly in East England Conservancy.

Standing Volume

It is estimated that there is a standing volume of 20.9 million cubic metres (± 4.9 per cent) in non-woodland trees in England. Of this total, 2.0 million cubic metres are coniferous and 18.9 million cubic metres broadleaved. Table 19 analyses volume by species and size class and shows that the distribution of volume differs from that of numbers of trees. Nearly 80 per cent of the conifer volume is composed of two species, pines and Other conifers, with the pine volume fairly equally represented in the two largest size classes, but the volume of Other conifers is held mainly in the largest size class, the over 50 cm dbh class. Most of the conifer volume is in South West England Conservancy, which contains a third of the total, followed by East and South East England Conservancies with 20 per cent each.

In broadleaved species, oak accounts for over a third of the overall volume, ash is next with 17 per cent and sycamore and beech each hold about 10 per cent. Nearly 70 per cent of the broadleaved volume occurs in the largest size class and the two largest size classes together account for no less than 91 per cent of the total. Oak, beech and Horse chestnut have 80 per cent or more of their volume in the largest size class. Ash has a better spread of volume between the classes but over half is over 50 cm dbh. Birch and alder, on the other hand are, as expected, better represented in the middle diameter ranges.

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	16	4	12	22	7	3	<1	1	11	2	4	5	13
of volume	36	9	10	17	1	4	2	3	4	5	4	2	3

North West England Conservancy holds the highest proportion of the broadleaved volume at 30 per cent followed by East England Conservancy with 24 per cent and South West England Conservancy with 21 per cent. 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 metre 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 and 1965 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 previous surveys. In 1951 and 1965 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. Elm disease has had a dramatic effect on the elm population which hitherto held an important place in the landscape of many counties.

4. Although the minimum size of tree considered in all the surveys was approximately 7 cm dbh, the minimum size of tree measured for volume in 1951 was 20 cm dbh compared with 7 cm dbh in later surveys.

5. In the 1965 Survey, only that part of England that lay south of the Mersey-Humber line was sampled for volume.

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.

Comparison of Tree Numbers

In 1951 the total numbers of trees of 7 cm dbh and over recorded for England and Wales was 55.8 million, whereas the figure for the 1980 Survey is 62.4 million. Because the 1951 figure includes trees in woods of 0.25-0.4 ha it needs to be reduced to make it comparable with the 1980 total. Once this adjustment is made the 1951 total is estimated to be 54 million trees. During the last 30 years therefore the total number of non-woodland trees has apparently risen by about 8.4 million or about 15 per cent on the adjusted 1951 total. This, however, is the overall trend and there have been increases in the numbers in certain diameter classes and reductions in others. The extent of the changes are difficult to quantify partly because of the change from the quarter girth system of measurement 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 those with crooked, shortboled or defective stems, or 'short' trees ie those with stem lengths of between 6 and 10 feet (2-3 metres). The absence of this information means that an overall tree distribution by size classes cannot be produced.

Millions of trees

Conservancy	1951			1980		
	Total No of trees	Trees in 7-20 cm dbh size class	Per cent of total	Total No of trees	Trees in 7-20 cm dbh size class	Per cent of total
North West England	10.7	4.3	40	16.6	7.0	42
North East England	11.2	4.0	36	7.1	3.7	52
East England	8.6	2.2	26	11.7	5.7	49
South East England	6.2	1.0	16	10.3	5.4	52
South West England	19.1	5.6	29	16.7	9.4	56
England	55.8	17.1	31	62.4	31.2	50

However, the 7-20 cm dbh size class does correspond with the 3-6 inches breast height quarter girth size class used in 1951, and shows a rise from 17.1 million trees to 31.2 million trees in 1980. The extent of this increase is so great as to be little affected by adjustments for such factors as differing diameter limits, minimum wood size etc. The substantial total in this class, combined with the 13 million trees which are below measurable size should ensure that, taking England as a whole, there are sufficient small trees to maintain the present diameter distribution.

Regionally it is only in North East England Conservancy that tree numbers in the 7-20 cm dbh size class appear to be lower now than they were 30 years ago.

Volume Comparison

The results of the three Surveys are shown in the following table after adjustments to the 1951 and 1965 figures to exclude the volume occurring in woods of 0.25-0.4 ha and to allow, in the case of the 1951 figures, for the fact that volume measurements were confined to trees of over 20 cm diameter.

Millions of cubic metres

	1951	1965	1980
Coniferous volume	1.6	2.9	2.0
Broadleaved volume	22.4	25.4	18.9
Total	24.0	28.3	20.9

The figures indicate that there was a rise in non-woodland volume between 1951 and 1965 followed by a drop between 1965 and the present day. The rise between 1951 and 1965 has already been discussed in the 1965 Census Report, where it was considered likely that it had been exaggerated by a few high volume ground samples in South East England. Because of this, and the fact that there are no estimates of volume by species for the 1965 Survey, it is advisable to confine further analysis to the 1951 and 1980 Surveys. The results indicate that there has been a drop in volume in the last 30 years and while the factors influencing these changes are complex an examination of the species distribution at the two survey dates shows the major cause of the reduction.

The figures quoted below for 1951 are unadjusted values and have been taken directly from the Report.

Millions of cubic metres

1951			1980		
Species	Volume	Per cent	Species Group	Volume	Per cent
Scots pine	0.7	3	Pines	0.8	4
Norway spruce	0.1	1	Spruces	0.2	1
European larch	0.1	—	Larches	0.1	1
Other conifers	0.7	3	Other conifers	0.9	4
Total conifers	1.6	7	Total conifers	2.0	10
Oak	7.7	31	Oak	6.8	32
Beech	2.0	8	Beech	1.7	8
Sycamore	1.5	6	Sycamore	1.9	9
Ash	3.1	13	Ash	3.1	15
Birch	0.1	—	Birch	0.2	1
Sweet chestnut	0.1	—	Sweet chestnut	0.4	2
Elm	5.2	21	Elm	0.7	3
Other broadleaves	3.2	14	Other broadleaves	4.1	20
Total broadleaves	22.9	93	Total broadleaves	18.9	90
Total	24.5	100	Total	20.9	100

The coniferous species groups recognised at each survey do not correspond exactly but it can be seen that these show a similar distribution both in absolute terms and the percentages they represent of the total.

It is in the broadleaved category that the most dramatic change has occurred in that elm, which in 1951 was next in importance to oak, and accounted for 21 per cent of the total, now represents only 3 per cent of the total resource. Its place has largely been taken by the Other broadleaved category which now accounts for a fifth of the total. Ash is currently more important in percentage terms than it was in 1951, although its volume appears to have altered little. Sycamore, Sweet chestnut and birch, on the other hand, have gained both in volume and percentage terms, while oak and beech have maintained their places, although on a reduced volume.

Oak remains the most important species in volume terms and seems likely to be so for the foreseeable future. The importance of ash and sycamore is likely to increase as a consequence of the considerable tree numbers of these two species present in the smaller diameter classes.

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	14 341 (± 3.8%)
Total Number of Clumps	4 190 (± 4.8%)
Total Length of Linear Features	70 300 km (± 6.6%)

NOTES:

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

Number of Isolated trees	— 110
Number of Clumps	— 32
Length of Linear Features	— 0.54 km

TABLE 15 AREA OF CLUMPS BY SPECIES GROUPS

Hectares

Species Group	Clumps
Mainly Coniferous	4 275
Mainly Broadleaved	69 050
Total	73 325

DIAGRAM 8

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

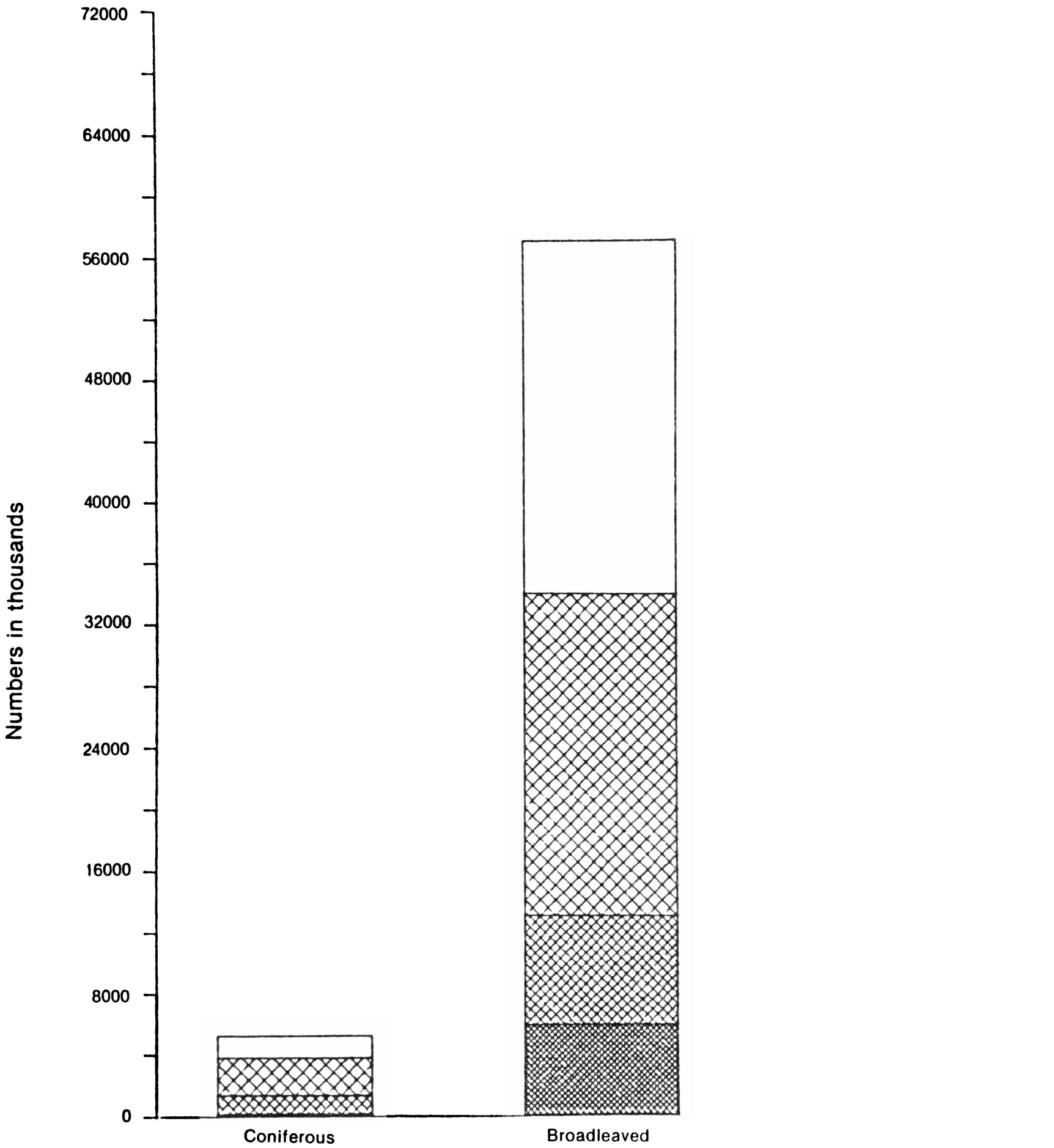


TABLE 16 **NUMBER OF LIVE TREES OF 7 CM DBH OR GREATER BY CATEGORY AND PRINCIPAL SPECIES**

Thousands of trees

Species	Isolated Trees		Clumps	Linear Features	Total (S.E.)
	Boundary	Open			
Pines	47	144	587	393	1 171
Spruces	21	88	200	154	463
Larches	7	23	178	141	349
Cypresses	31	626	979	515	2 151
Other conifers	25	342	500	247	1 114
Total conifers	131	1 223	2 444	1 450	5 248 (± 7%)
Oak	2 036	888	2 851	3 603	9 378
Beech	140	210	997	1 143	2 490
Sycamore	442	824	2 761	2 966	6 993
Ash	2 154	845	4 959	4 620	12 578
Birch	105	613	2 138	1 183	4 039
Poplar	76	300	510	829	1 715
Sweet chestnut	17	15	105	336	473
Horse chestnut	49	222	195	237	703
Alder	154	125	1 894	4 192	6 365
Lime	38	358	311	479	1 186
Elm	134	164	855	1 197	2 350
Willow	230	364	1 245	1 033	2 872
Other broadleaves	304	2 180	2 196	1 333	6 013
Total broadleaves	5 879	7 108	21 017	23 151	57 155 (± 4%)
Total	6 010	8 331	23 461	24 601	62 403 (± 4%)

NOTE:
In addition, within the Country the following trees are present:

Species	Isolated Trees	Clumps	Linear Features	Total (S.E.)
Trees < 7cm dbh All species	8 131	2 054	2 827	13 012 (± 10%)
Dead and Dying All species	1 418	1 361	1 984	4 763 (± 9%)

DIAGRAM 9

NUMBER OF ALL LIVE TREES BY SPECIES GROUPS AND SIZE CLASSES

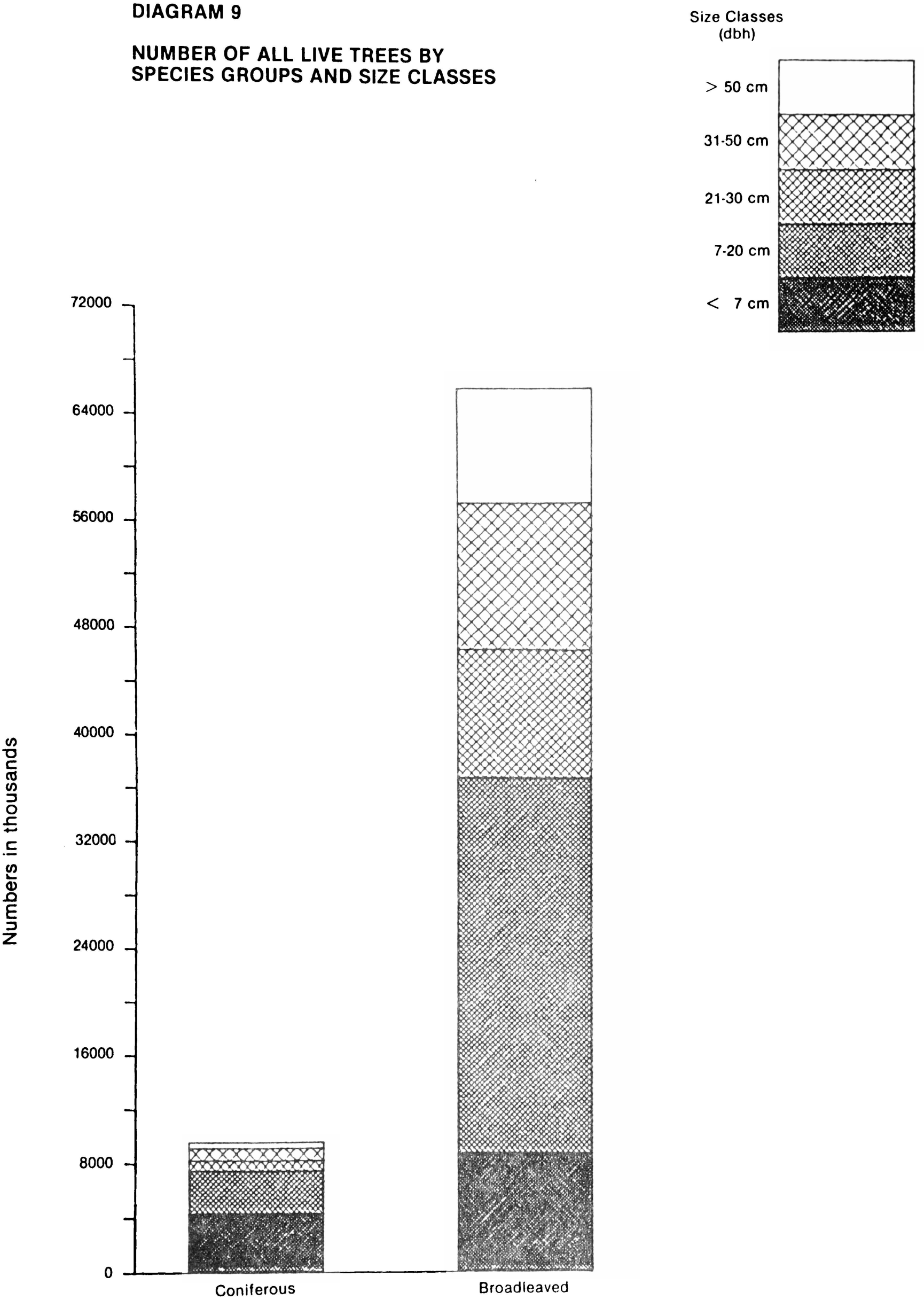


TABLE 17 **NUMBER OF ALL LIVE TREES BY PRINCIPAL SPECIES AND SIZE CLASSES**

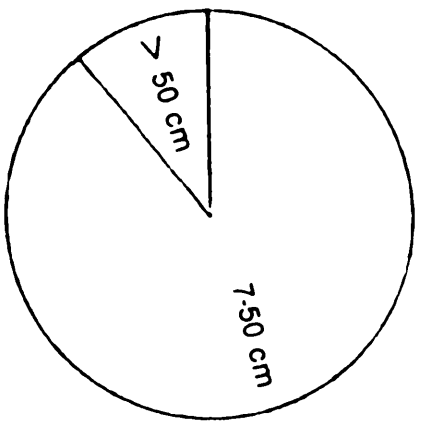
Thousands of trees

Species	Size Class (dbh)					Total
	< 7 cm	7-20 cm	21-30 cm	31-50 cm	> 50 cm	
Pines	1 122	263	242	479	187	2 293
Spruces	744	369	37	42	15	1 207
Larches	39	126	85	96	42	388
Cypresses	2 048	1 880	170	87	14	4 199
Other conifers	353	544	202	217	151	1 467
Total conifers	4 306	3 182	736	921	409	9 554
Oak	440	2 182	1 376	2 453	3 367	9 818
Beech	188	919	343	549	679	2 678
Sycamore	1 201	3 916	1 024	1 306	747	8 194
Ash	1 023	6 641	1 802	2 516	1 619	13 601
Birch	1 105	2 988	633	384	34	5 144
Poplar	420	782	325	400	208	2 135
Sweet chestnut	11	252	107	55	59	484
Horse chestnut	148	142	104	176	281	851
Alder	540	3 274	1 804	1 127	160	6 905
Lime	155	328	202	381	275	1 341
Elm	140	1 169	397	447	337	2 490
Willow	574	1 339	431	445	657	3 446
Other broadleaves	2 761	4 094	1 020	727	172	8 774
Total broadleaves	8 706	28 026	9 568	10 966	8 595	65 861
Total	13 012	31 208	10 304	11 887	9 004	75 415

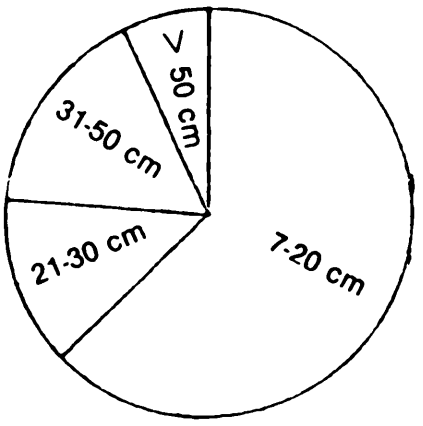
NOTE:
The average number of all live trees per square kilometre is 578.

DIAGRAM 10

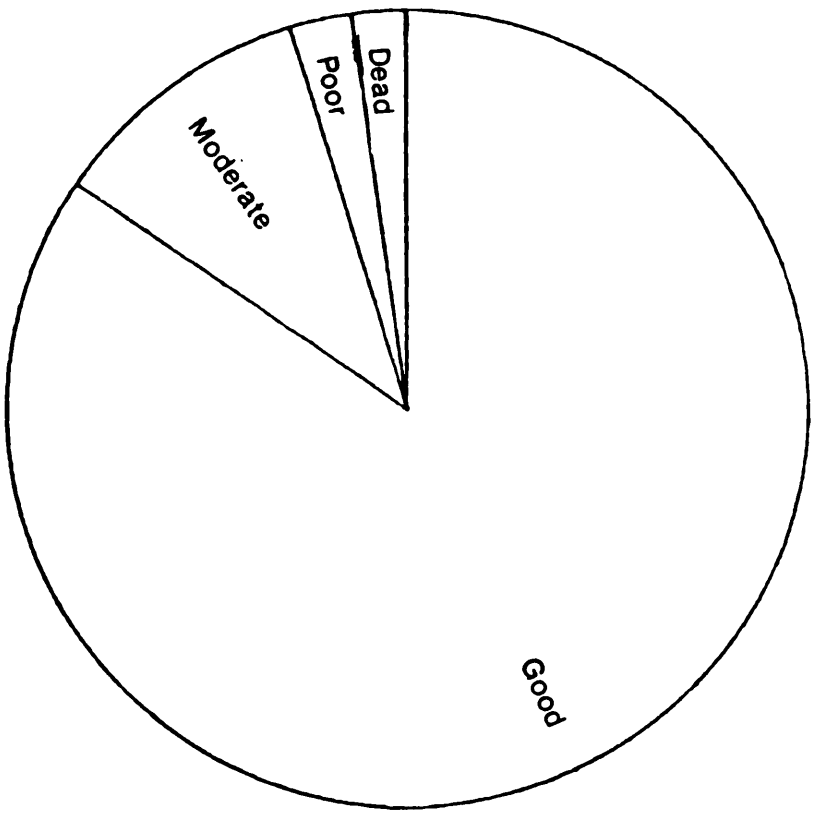
HEALTH OF ALL CONIFEROUS TREES OF 7 CM DBH OR GREATER BY SIZE CLASSES



Dead

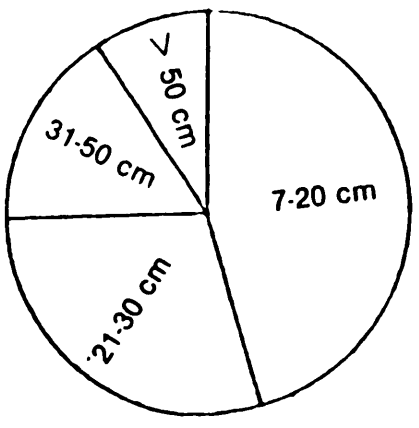


Good

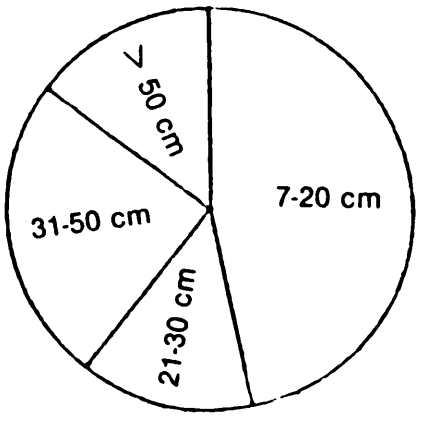


Health expressed as a proportion of the total population

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 18a **ALL SPECIES**

Thousands of trees

Species	dbh class cm	Health Class			Dead and Dying
		Good	Moderate	Poor	
Total conifers	7-20	2 852	269	61	)
	21-30	619	79	38	) 105
	31-50	758	142	21	)
	> 50	312	84	13	13
	Total	4 541	574	133	118
Total broadleaves	7-20	23 475	4 015	536	)
	21-30	7 468	1 812	288	) 3 997
	31-50	7 970	2 467	529	)
	> 50	5 454	2 385	756	648
	Total	44 367	10 679	2 109	4 645
Total	7-20	26 327	4 284	597	)
	21-30	8 087	1 891	326	) 4 102
	31-50	8 728	2 609	550	)
	> 50	5 766	2 469	769	661
	Total	48 908	11 253	2 242	4 763

671

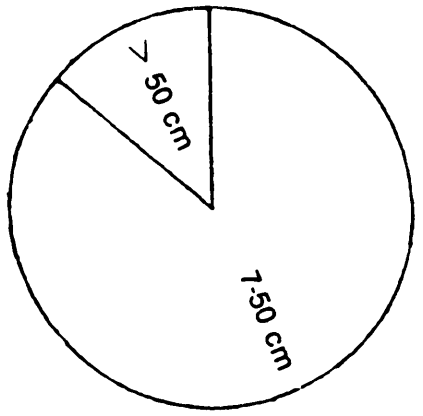
TABLE 18b **CONIFERS**

Thousands of trees

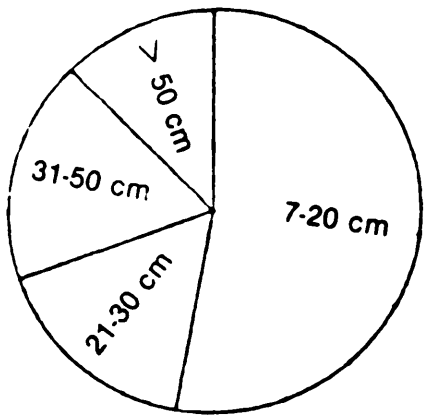
Species	dbh class cm	Health Class			Dead and Dying
		Good	Moderate	Poor	
Pines	7-20	233	28	2	)
	21-30	210	31	1	) 35
	31-50	411	60	8	)
	> 50	142	41	4	8
	Total	996	160	15	43
Spruces	7-20	278	79	12	)
	21-30	26	9	2	) 33
	31-50	27	9	6	)
	> 50	8	6	1	—
	Total	339	103	21	33
Larches	7-20	76	27	23	)
	21-30	50	7	28	) 20
	31-50	47	44	5	)
	> 50	31	10	1	—
	Total	204	88	57	20
Cypresses	7-20	1 814	60	6	)
	21-30	163	7	—	) 3
	31-50	85	2	—	)
	> 50	14	—	—	—
	Total	2 076	69	6	3
Other conifers	7-20	451	75	18	)
	21-30	170	25	7	) 14
	31-50	188	27	2	)
	> 50	117	27	7	5
	Total	926	154	34	19
Total conifers	7-20	2 852	269	61	)
	21-30	619	79	38	) 105
	31-50	758	142	21	)
	> 50	312	84	13	13
	Total	4 541	574	133	118

DIAGRAM 11

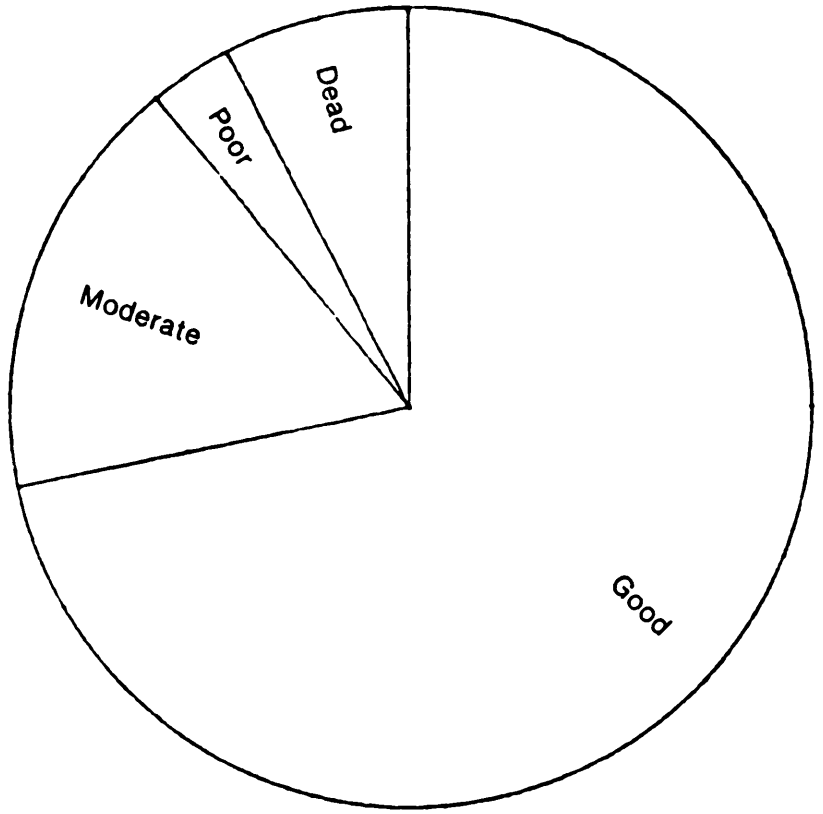
HEALTH OF ALL BROADLEAVED TREES OF 7 CM DBH OR GREATER BY SIZE CLASSES



Dead

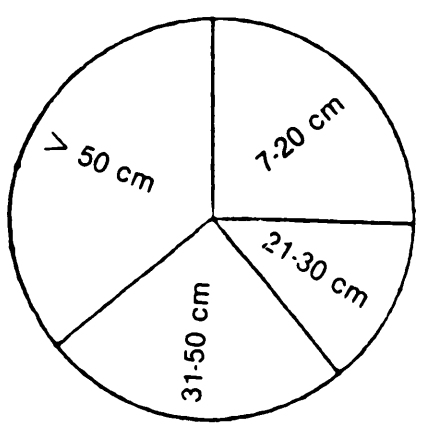


Good

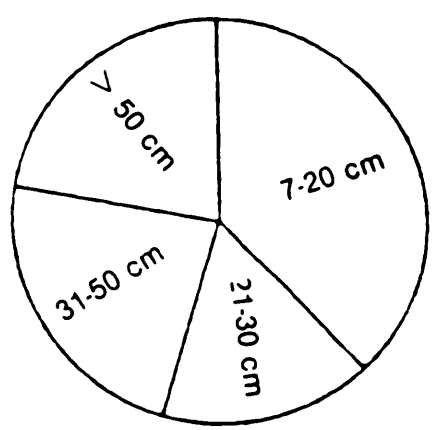


Health expressed as a proportion of the total population

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 18c

BROADLEAVES

Thousands of trees

Species	dbh class cm	Health Class			Dead and Dying
		Good	Moderate	Poor	
Oak	7-20	1 915	237	30	)
	21-30	1 144	210	22	) 54
	31-50	1 902	493	58	)
	> 50	2 320	854	193	19
	Total	7 281	1 794	303	73
Beech	7-20	822	93	4	)
	21-30	286	51	6	) 25
	31-50	411	126	12	)
	> 50	552	105	22	9
	Total	2 071	375	44	34
Sycamore	7-20	3 481	409	26	)
	21-30	837	173	14	) 30
	31-50	1 083	192	31	)
	> 50	512	216	19	5
	Total	5 913	990	90	35
Ash	7-20	5 245	1 268	128	)
	21-30	1 282	452	68	) 68
	31-50	1 657	656	203	)
	> 50	838	574	207	27
	Total	9 022	2 950	606	95
Birch	7-20	2 675	303	10	)
	21-30	524	86	23	) 63
	31-50	230	152	2	)
	> 50	20	3	11	1
	Total	3 449	544	46	64
Poplar	7-20	615	163	4	)
	21-30	272	45	8	) 16
	31-50	315	78	7	)
	> 50	153	51	4	1
	Total	1 355	337	23	17
Sweet chestnut	7-20	74	167	11	)
	21-30	24	82	1	) 3
	31-50	24	20	11	)
	> 50	41	16	2	—
	Total	163	285	25	3

Thousands of trees

Species	dbh class cm	Health Class			Dead and Dying
		Good	Moderate	Poor	
Horse chestnut	7-20	128	12	2	)
	21-30	95	8	1	) 2
	31-50	145	30	1	)
	> 50	224	52	5	—
	Total	592	102	9	2
Alder	7-20	2 763	458	53	)
	21-30	1 403	361	40	) 56
	31-50	810	291	26	)
	> 50	77	61	22	4
	Total	5 053	1 171	141	60
Lime	7-20	252	68	8	)
	21-30	172	29	1	) 2
	31-50	336	43	2	)
	> 50	201	70	4	—
	Total	961	210	15	2
Elm	7-20	816	203	150	)
	21-30	241	100	56	) 3 625
	31-50	241	109	97	)
	> 50	139	93	105	569
	Total	1 437	505	408	4 194
Willow	7-20	1 106	183	50	)
	21-30	325	79	27	) 10
	31-50	282	106	57	)
	> 50	291	215	151	13
	Total	2 004	583	285	23
Other broadleaves	7-20	3 583	451	60	)
	21-30	863	136	21	) 43
	31-50	534	171	22	)
	> 50	86	75	11	—
	Total	5 066	833	114	43
Total broadleaves	7-20	23 475	4 015	536	)
	21-30	7 468	1 812	288	) 3 997
	31-50	7 970	2 467	529	)
	> 50	5 454	2 385	756	648
	Total	44 367	10 679	2 109	4 645

DIAGRAM 12

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

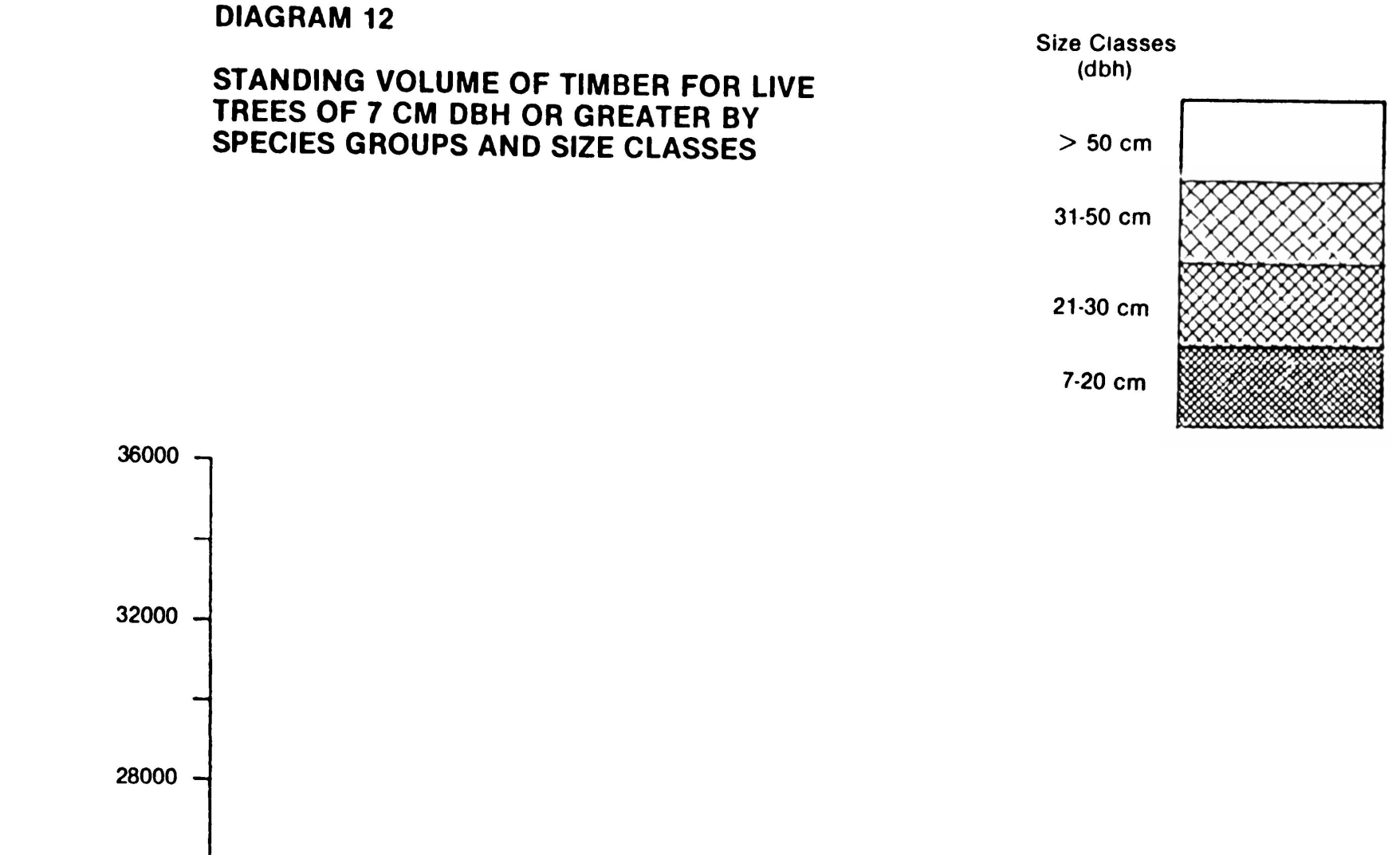


TABLE 19 STANDING VOLUME OF TIMBER FOR LIVE TREES OF 7 CM DBH OR GREATER BY PRINCIPAL SPECIES AND SIZE CLASSES

Thousands of cubic metres overbark

Species	Size Class (dbh)				Total
	7-20 cm	21-30 cm	31-50 cm	>50 cm	
Pines	13.9	65.6	394.0	370.4	843.9
Spruces	12.1	8.8	29.3	34.5	84.7
Larches	11.2	27.4	73.7	77.1	189.4
Cypresses	66.4	35.2	43.6	29.4	174.6
Other conifers	26.7	46.1	121.5	545.0	739.3
Total conifers	130.3	183.1	662.1 (± 14%)	1 056.4 (± 24%)	2 031.9 (± 15.0%)
Oak	34.4	128.5	923.6	5 687.8	6 774.3
Beech	13.5	48.0	286.2	1 379.7	1 727.4
Sycamore	89.5	143.8	501.0	1 144.6	1 878.9
Ash	149.7	240.8	974.8	1 826.2	3 191.5
Birch	45.0	54.1	70.6	24.0	193.7
Poplar	36.3	74.2	255.7	407.6	773.8
Sweet chestnut	20.7	26.4	29.9	281.7	358.7
Horse chestnut	2.3	12.6	84.5	536.9	636.3
Alder	78.7	238.8	336.0	170.3	823.8
Lime	7.4	28.3	190.6	667.1	893.4
Elm	19.3	45.2	153.7	472.1	690.3
Willow	27.8	45.4	95.3	291.0	459.5
Other broadleaves	21.1	37.8	128.1	277.9	464.9
Total broadleaves	545.7	1 123.9	4 030.0 (± 6%)	13 166.9 (± 6%)	18 866.5 (± 4.9%)
Total	676.0	1 307.0	4 692.1 (± 6%)	14 223.3 (± 6%)	20 898.4 (± 4.9%)

NOTE:

The figures in brackets are standard errors.

APPENDIX I

GLOSSARY OF TERMS AND ABBREVIATIONS

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	*Pinus sylvestris* L.
Corsican pine	CP	*Pinus nigra* var. *maritima* (Ait.) Melville
Lodgepole pine	LP	*Pinus contorta* Douglas ex Loud.
Sitka spruce	SS	*Picea sitchensis* (Bong.) Carr.
Norway spruce	NS	*Picea abies* (L.) Karst.
European larch	EL	*Larix decidua* Miller
Japanese/Hybrid larch	JL	*Larix kaempferi* (Lamb.) Carr.
	HL	*Larix x eurolepis* Henry
Douglas fir	DF	*Pseudotsuga menziesii* (Mirb.) Franco
Other conifers*	XC	
Mixed conifers	MC	
Oak	OK	*Quercus robur* L. *Quercus petraea* (Matt.) Lieblein.
Beech	BE	*Fagus sylvatica* L.
Sycamore	SY	*Acer pseudoplatanus* L.
Ash	AH	*Fraxinus excelsior* L.
Birch	BI	*Betulus* spp.
Poplar	PO	*Populus* spp.
Sweet chestnut	SC	*Castanea sativa* Mill.
Alder	AR	*Alnus* spp.
Elm	EM	*Ulmus* spp.
Hornbeam	HBM	*Carpinus betulus* L.
Hazel	HAZ	*Corylus avellana* L.
Willow		*Salix* 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	*Pinus* spp.
Other spruce	XS	*Picea* spp.
Western hemlock	WH	*Tsuga heterophylla* (Raf.) Sarg.
Western red cedar	RC	*Thuja plicata* D.Don.
Cypresses		*Cupressus* spp.
		Chamaecyparis spp.
		x Cupressocyparis leylandii (Jacks. Dallim.) Dallim.
Grand fir	GF	*Abies grandis* Lindl.
Noble fir	NF	*Abies procera* Rehd.
Other fir	XF	*Abies* spp.
Redwoods		*Sequoia sempervirens* (D.Don) End.
		Sequoiadendron giganteum (Lindl.) Buchholz
Yew		*Taxus baccata* L.
Other conifers	XC	
Other oak		*Quecus* spp.
Norway maple	NOM	*Acer platanoides* L.
Horse chestnut	HCH	*Aesculus hippocastanum* L.
Lime	LI	*Tilia* spp.
English elm**	EEM	*Ulmus procera* Salis.
Wych elm**	WEM	*Ulmus glabra* Huds.
Nothofagus	N	*Nothofagus* spp.
Prunus (Cherries)		*Prunus* 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	*Sorbus aucuparia* L.
Holly	*Ilex aquifolium* L.
Field maple	*Acer campestre* L.
Whitebeam	*Sorbus aria* agg.

APPENDIX 2 (contd)

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

English Name	Standard Abbreviation	Botanical Name
Pines		*Pinus* spp.
Spruces		*Picea* spp.
Larches		*Larix* spp.
Cypresses		*Cupressus* spp.
		Chamaecyparis spp.
		x Cupressocyparis leylandii (Jacks. Dallim.) Dallim.
Other conifers	XC	
Oak	OK	*Quercus robur* L.
		Quercus petraea (Matt.) Lieblein.
Beech	BE	*Fagus sylvatica* L.
Sycamore	SY	*Acer pseudoplatanus* L.
Ash	AH	*Fraxinus excelsior* L.
Birch	BI	*Betula* spp.
Poplar	PO	*Populus* spp.
Sweet chestnut	SC	*Castanea sativa* Mill.
Horse chestnut	HCH	*Aesculus hippocastanum* L.
Alder	AR	*Alnus* spp.
Lime	LI	*Tilia* spp.
Elm	EM	*Ulmus* spp.
Willow		*Salix* 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*	*Sorbus aucuparia* L.
Field maple*	*Acer campestre* L.
Blackthorn	*Prunus spinosa* L.
Hawthorn	*Crataegus monogyna* Jacq.
Rhododendron	*Rhododendron* spp.
Holly*	*Ilex aquifolium* L.
Elder	*Sambucus* spp.
Broom	*Sarothamnus scoparius* (L.) Wimmer ex Koch.
Gorse	*Ulex* spp.
Privet	*Ligustrum vulgare* L.
Dogwood	*Cornus sanguinea* L.
Sallow	*Salix caprea* L.
Box	*Buxus sempervirens* L.
Whitebeam*	*Sorbus aria* agg.
Spindle	*Euonymus europaeus* L.
Yew*	*Taxus baccata* L.
Hornbeam*	*Carpinus betulus* L.
Hazel	*Corylus avellana* L.
Willow*	*Salix* spp.
Other shrubs	
Mixed shrubs	

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

APPENDIX 3

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 symptons 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

Years

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		
Health	Good	Mod.	Poor	Good	Mod.	Poor	Good	Mod.	Poor	Good	Mod.	Poor	Good	Mod.	Poor	Good	Mod.	Poor
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.