



Centre for  
Ecology & Hydrology  
NATURAL ENVIRONMENT RESEARCH COUNCIL



## Distribution of Oak trees (*Quercus sp.*) in GB and Wales

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## Summary

This report provides estimates of Oak trees (*Quercus sp.*) from two national surveys covering; 1) Great Britain (including Wales), (2007) and 2) Wales only, (2013-2016). Oak tree estimates were calculated for; all woodland, all woodland areas <0.5ha in size, individual Oak trees, the extent of Oak in linear features and Oak in fixed vegetation plots.

The data used in this report comes from Countryside Survey (CS) which is a unique study or 'audit' of the natural resources of the UK's countryside and the Glastir Monitoring and Evaluation project (GMEP) which collected data using a similar methodology to CS across Wales to determine the impacts of the Welsh agri-environment scheme 'Glastir'. The Countryside Survey has been carried out at regular intervals since 1978. The countryside is mapped and sampled using rigorous scientific methods, allowing us to compare new results with those from previous surveys. In this way we can detect the gradual and subtle changes that occur in the UK's countryside over time. GMEP was carried out between 2013 and 2016 and all of the data from this period has been amalgamated.

## Key Findings

- The area of Oak woodland (all sizes of woodland) in Great Britain (CS2007) was estimated to be **249 416 ha**. It was most abundant in woodlands in England **190 189** ha, with **39 557** in Wales and **17 072** ha in Scotland.
- In Wales (GMEP 2013-2016) the area of Oak in all woodlands was estimated to be **31 932** ha (within the 95% Confidence Interval of the GB 2007 estimates).
- The estimated area of Oak in small woodlands <0.5ha, in GB (CS2007) was **15 653** ha. In England it was **10 770** ha with **3163** ha in Wales and **1442** ha in Scotland.
- In Wales (GMEP 2013-2016) the area of Oak in small woodlands (<0.5ha) was estimated to be **2140** ha (marginally outside of the 95% Confidence Interval of the GB 2007 estimates).
- Oak is found in different landscape components, in fields and field boundaries, alongside rivers and streams and particularly in hedgerows in Great Britain and Wales.
- There were estimated to be **2.3 million** individual Oak trees (outside of woodland) in the GB countryside in 2007 and Oak was the most common species of individual tree recorded in CS2007. Most of these were in England (**1.9 million**) with Scotland and Wales having relatively fewer numbers (**114 000** and **238 000** respectively).
- There were estimated to be **243 249** individual Oak trees outside of woodlands in Wales (using GMEP data 2013-2016). This is within the 95% Confidence Interval of the GB 2007 estimates.
- Most individual Oak trees were in the 75cm-1m diameter at breast height (DbH) category.
- Oak was the most common hedgerow tree species (i.e. species growing as a full standard as part of a hedgerow).
- The estimated length of woody linear features (hedgerows and lines of trees) composed of Oak in thousands of kilometres ('000km) was **105.7** across GB in CS2007 with most of this (**91.2**) found in England, then Wales (**12.7**) and Scotland (**1.8**). Most of the Oak in woody linear features was found in lines of trees (**75.3**) with the rest as proportion of hedgerows (**28.4**).
- The estimated length of linear features in thousands of kilometres ('000km) composed of Oak was **10.06** across Wales (GMEP 2013-2016).
- In analyses based on repeated vegetation plots in CS2007 Oak trees increased in the number of plots occupied on linear features (including hedgerows), between 1978 and 2007 but not in the number of area plots occupied between 1978 and 2007.

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## 1. Introduction

This report uses national scale data (GB<sup>1</sup> and Wales<sup>2</sup>) to estimate the extent and distribution of Oak trees in the British countryside, both inside and outside of woodlands (in hedgerows, lines of trees, small clumps of trees and individual trees).

## 2. Methodology

The Countryside Survey samples 1km squares across GB using a stratified random sampling system (based on land classes which are comprised of the major national ecological gradients e.g. soils, geology and climate-Barr, 2000, Bunce *et al.* 1996, Carey *et al.* 2008). This enables scaling up from samples to produce national estimates using the land classes. In CS2007, 591 1km squares were sampled based on a land classification with 45 environmental strata. This enabled reporting of estimates for individual countries (Wales, England and Scotland) (<https://doi.org/10.5285/5f0605e4-aa2a-48ab-b47c-bf5510823e8f>). The 2007 classification was used for country reporting and for GMEP. A previous classification from 1990 (<https://doi.org/10.5285/ab320e08-faf5-48e1-9ec9-77a213d2907f>) with 32 land classes, was used to map data due to its greater simplicity (both classifications are mutually compatible).

Data from the Glastir Monitoring and Evaluation project (GMEP <https://gmep.wales/>) was used to estimate the extent of Oak across Wales. The Glastir methodology is based on that of Countryside Survey (Emmet *et al.*, 2015). Over 4 years, 300 squares were sampled, half of these were based on a stratified random sample by land class (geology, soils, Bunce 1996) and the other half were weighted towards Welsh government priorities for options within Glastir. Data extraction and analysis for GMEP was carried out in the same way as for the CS2007 data.

### 2.1 Areas

In each CS 1km square areas of habitats are mapped (minimum mappable unit (mmu) 20\*20m) and assigned to a Broad or Priority Habitat, the dominant species are recorded according to Percentage cover categories (e.g. <10%, 10-25%, 25-50%, 50-75%, 75-95%, 95-100%). This data has been used to extract areas where Oak is present. In the CS area data a number of *Quercus* sp. have been recorded; *Quercus petraea*, *Q. robur*, *Q. cerris* and *Q. rubra* and *Quercus* sp. For the purposes of this study *Q. petraea*, *Q. robur* and *Quercus* sp. have been amalgamated for all woodlands recorded in CS. Results have been calculated for all woodland in GB.

We have calculated results for woods <0.5ha separately because it is below the minimum area recorded by the Forestry Commission in the National Forestry Inventory. There are differences in methodology between NFI/FC and CS which mean that it is useful to provide estimates for both large and small woodland with an understanding of why the results for large woodlands might be slightly different to the FC. FC report on stocked areas (i.e. areas that are clear-felled but still part of a woodland management cycle are recorded as woodland), whereas CS records land cover at the time of survey (i.e. felled woodland would be recorded as the habitats currently dominating that land).

Using the percentage cover data (mid-point of the range) the average area of Oak woodland within a 1km square by land class has been calculated. This is multiplied by the area of each land class and

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<sup>1</sup> <http://www.countrysidesurvey.org.uk/content/reports-2007>

<sup>2</sup> <http://gmep.wales/>

summed over all land classes to create a national estimate in hectares for the areal extent of Oak for GB. Upper and lower confidence intervals around the estimates are also given. More information about methods can be found on [www.countrysidesurvey.uk](http://www.countrysidesurvey.uk) or <https://gmep.wales>.

## **2.2 Individual trees**

Within each 1km square each individual tree (>3cm DbH) outside of woodland, including standard trees in hedgerows (where they don't form a line of trees) is recorded as a point feature along with an estimate of modal DbH. In the analyses presented here trees that were recorded as small clumps (up to 6 trees) or scattered (up to 5 trees) were also included (point features, less than a minimum mappable unit (mmu) of 20m x 20m). National estimates were created in a similar way to the areas from the number of individual trees within each 1km square which were recorded as point features using land classes. Actual data on numbers of individual trees recorded in the CS squares is also presented to show the frequency of Oak compared to other tree species. Spatial analysis of CS data overlaying individual tree point data with linear data (hedgerows) was used to identify hedgerow trees and these are also reported on (though not as national estimates). Surveyors were also asked to record up to 10 veteran trees within each 1km square (maximum 2 per species), for these, additional information was collected such as presence of epiphytic species, presence of dead wood or hollow trunk. Some information on these is provided below.

## **2.3 Woody Linear features (hedgerows and lines of trees)**

Linear features are landscape elements less than 5m wide that form lines in the landscape. CS reports on the length and condition (and changes in these over time) of a range of linear features including woody linear features (hedgerows or lines of trees), walls and fences. Linear features have a minimum length of 20m and may include gaps of up to 20m. Two types of Woody Linear feature were recorded; those with Natural Shape (e.g. lines of trees, belts of trees) and those of Unnatural shape (hedgerows).

### *Lines of trees*

In those with a Natural Shape, a proportion is recorded against each species present (recorded as: <10%, 10-25%, 25-50%, 50-75%, 75-95%, 95-100%, 'Individual Tree'). In order to calculate national estimates of Oak within lines of trees, the length of Oak recorded in each proportion band was calculated per 1km square (using the midpoint of the band i.e. 5%, 17.5%, 37.5%, 62.5%, 85%, 97.5%, 100%) similarly to areas. A mean length lines of trees containing Oak (in km) was obtained per sampling strata (Bunce et al. 1996). To obtain the final length estimate per country, the mean was multiplied by the area of each Land Class and totalled per country. To calculate the amount of Oak contained in belts of trees (recorded as linear features in Countryside Survey) the same methodology was followed as per the lines of trees, the difference being that features recorded as 'Belts of trees' or 'Belts of scrub' were included in the analysis.

### *Hedgerows*

In WLF's with an unnatural shape (hedgerows), species composition is surveyed in a slightly different way to lines of trees in that individual species and their proportions are not recorded against the length of the linear feature, instead they are recorded as 'mixed species', '>50% hawthorn' and '>50% other'. Hence different methods were used to estimate the proportion of Oak in hedgerows. D plots sample woody linear features in CS, with each square containing up to 10 plots (30m in length) in which woody species vegetation cover is recorded. To obtain a mean length of Oak, the mean

percentage cover from 'D' plots on hedges was calculated per sampling strata (Land class, as above) and multiplied by the total amount of hedge measured in all sampled 1km squares in each strata (Land Class). The 1km means of these totals were multiplied by the area of the Land Class strata and then totalled per country.

## 2.4 Vegetation plots

A series of vegetation plots were located within each 1 km square using a restricted randomisation procedure designed to reduce aggregation (Figure 1). Linear features (road verges, watercourse banks, hedges, arable margins and field boundaries) and areal features (fields, unenclosed land and small semi-natural biotope patches) were sampled. Linear plots were 1 x 10 m laid out along a feature whilst unenclosed land and small biotopes were sampled using 2 m x 2 m plots. Larger randomly-placed plots were nested 14 m<sup>2</sup> plots with an inner nest of 2 m x 2 m. The significance of the change in occupancy of Oak across these vegetation plots and between pairs of surveys was based on the value of a change index calculated using the same methods as Atlas 2000 but additionally accounting for the nested design of the survey.



**Figure 1:** Distribution of vegetation plots within a 1km square. Colour coding of the text is as follows; red=plot types first established in 1978; brown=first established in 1990; green=1998; blue=2007.

## 3. Results: National estimates for GB from Countryside Survey data

### 3.1 Areas: All woodlands

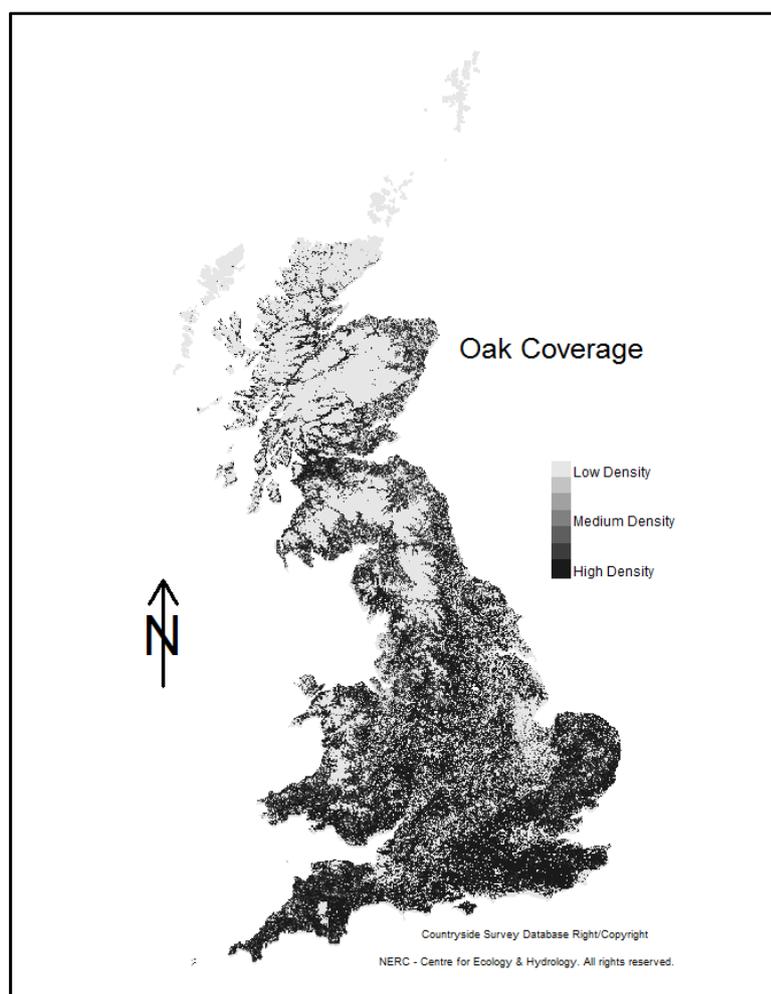
The total area of Oak woodland in Great Britain was estimated to be **249 416ha** with a 95% confidence interval of between **197 776ha** and **301 055ha** (figure 2).

Estimates for individual countries are shown below (Table 1). Note that the GB area differs slightly from that above due to using the 2007 land class rather than the 1990 land classification as used for the estimate quoted above.

**Table 1: National estimates of the area extent of Oak (*Quercus* sp.) in all woodlands**

	Area(ha)		
	Estimate	Lower 95%	Upper 95%
<b>GB</b>	246818	192150	301485
<b>England</b>	190189	138058	242321
<b>Scotland</b>	17072	7405	26738
<b>Wales</b>	39557	26237	52876

Figure 2 shows the estimated distribution of Oak in all woodland patches. The map has been produced by using estimates of Oak area cover within a 1km square (for each of the 32, 1990 land classes) weighted by the proportion of Broadleaved woodland in that 1km square, as taken from the Land Cover Map. Land class means used in the creation of this map can be found in Appendix 1. This is not an accurate spatially explicit map (below 1km) but it does give an indication of where Oak is most abundant (South-east England) and where it is least likely to be found (i.e. North-West Scotland).



**Figure 2:** Areal extent of Oak based on its % cover in all Broadleaved woodland habitat parcels recorded in GB in CS2007. Distribution has been mapped using mean % of Oak per land class (based on the 32 land classes for GB used for the 1990 CS survey) then scaled to % of 1km by weighting by the proportion of Broadleaved woodland in each 1km square according to Land Cover Map 2007. High, medium and low densities are shaded.

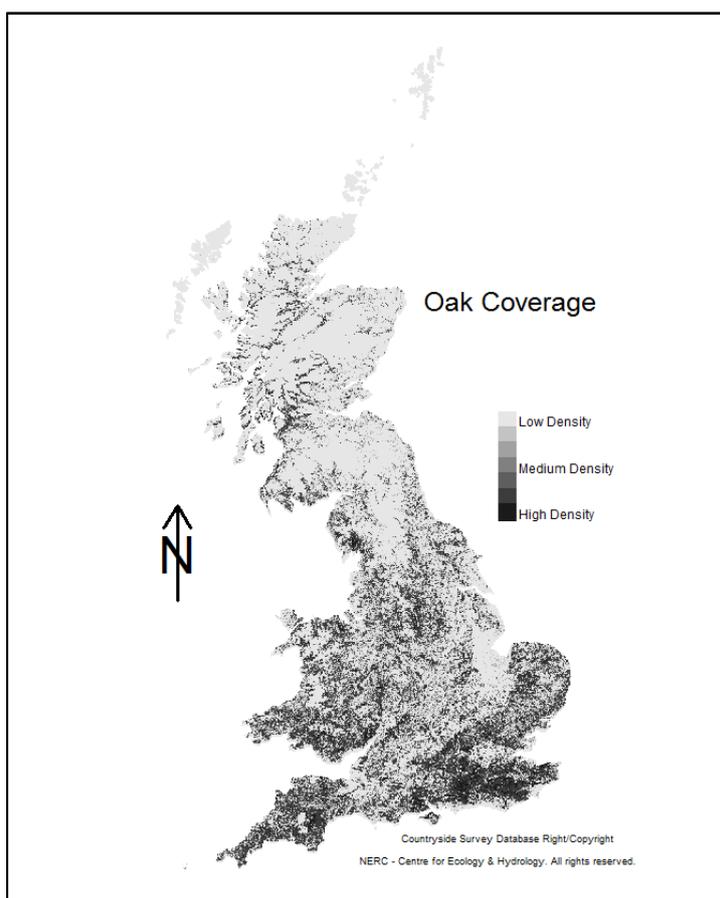
### 3.2 Areas: Small woodlands <0.5 ha

The total area of small Oak woodland (<0.5ha) in Great Britain was estimated to be **15 653ha** with a 95% confidence interval of between **12 906ha** and **18 399ha** (figure 3).

Estimates for individual countries are shown below. Note that the GB area differs slightly from that above due to using the 2007 land class rather than the 1990 land classification as used for the estimate quoted above. Figure 3 shows the estimated distribution of Oak in small woodland patches (<0.5 ha) using the same methods as the map of all woodland (above).

**Table 2: National estimates of the area extent of Oak in woodlands <0.5 ha**

	Area(ha)		
	Estimate	Lower 95%	Upper 95%
<b>GB</b>	15375	12569	18181
<b>England</b>	10770	8377	13163
<b>Scotland</b>	1442	374	2510
<b>Wales</b>	3163	2161	4164



**Figure 3:** Areal extent of Oak based on % cover in Broadleaved woodland habitat parcels < 0.5 ha in size recorded in GB in CS2007. Distribution has been mapped using mean % of Oak per land class (based on 32 land classes for GB used for the 1990 CS survey) then scaled to % of 1km by weighting by the proportion of Broadleaved woodland in each 1km square according to Land Cover Map 2007. High, medium and low densities are shaded.

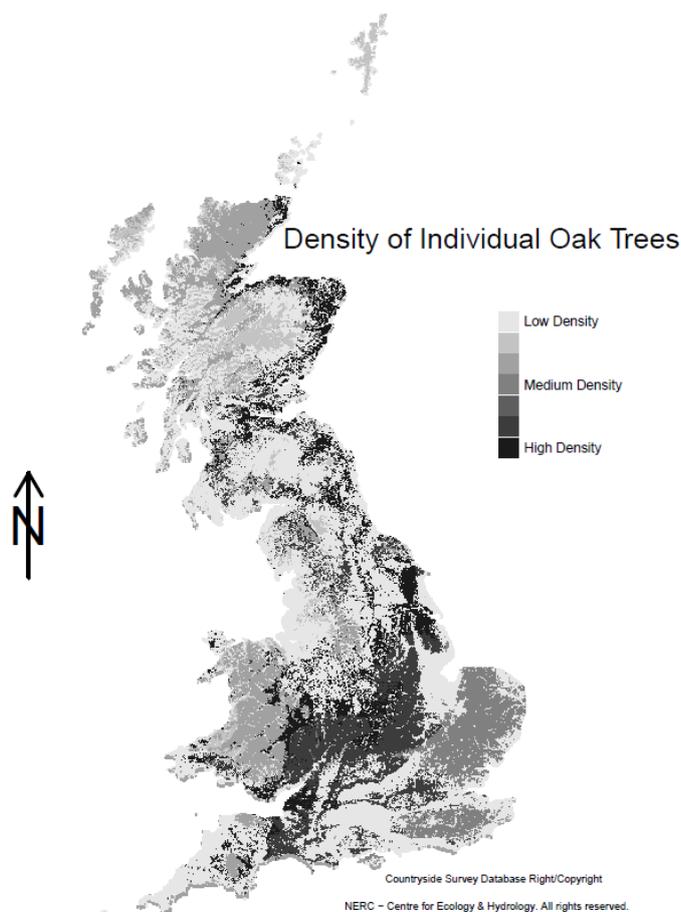
### 3.3 Individual Trees

There are estimated to be **2.3 million** individual Oak trees either as single, clumped or scattered trees outside of woodlands in GB (Table 3). Most of these are found in England (**1.9 million**) with Scotland and Wales having relatively few numbers (**114 000** and **238 000** respectively).

Figure 4 shows the distribution of individual trees displayed as a mean per land class. Unlike the area map we were unable to scale by the Land cover Map (as it does not record non-areal features) so the land classes themselves have been mapped and shaded. Land class means used in the creation of this map can be found in Appendix 2.

**Table 3: National estimates of the number of individual Oak trees in GB**

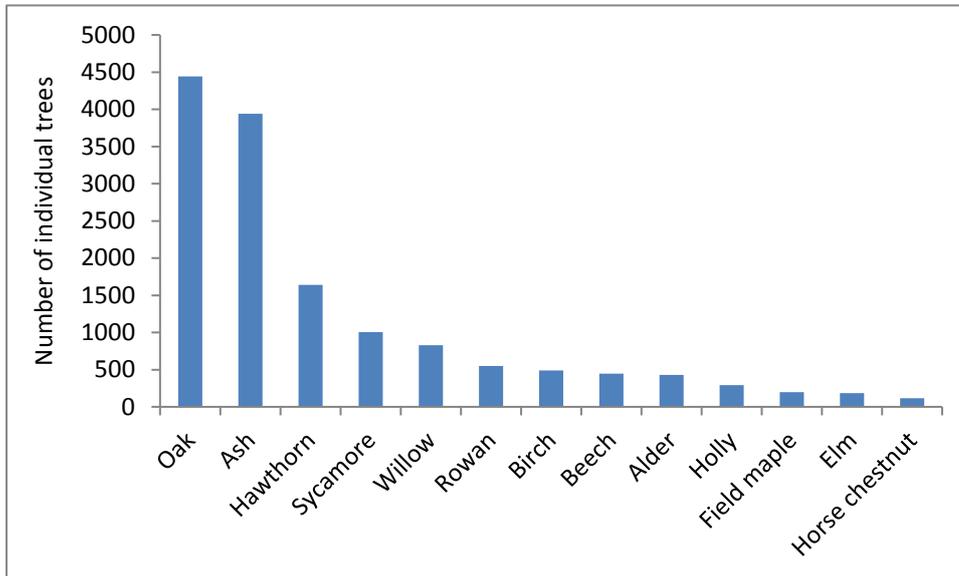
	Number of Trees	Lower (95%) confidence limit	Upper (95%) Confidence limit
<b>Great Britain</b>			
Individual Oak trees	2264947	1945193	2584701
<b>England</b>			
Individual Oak trees	1912689	1602536	2222842
<b>Scotland</b>			
Individual Oak trees	114091	58506	169676
<b>Wales</b>			
Individual Oak trees	238167	183780	292554



**Figure 4:** Distribution of individual Oak trees in GB using CS 2007 point data. The mean number of individual Oak trees per land class has been scaled up using land class extent.

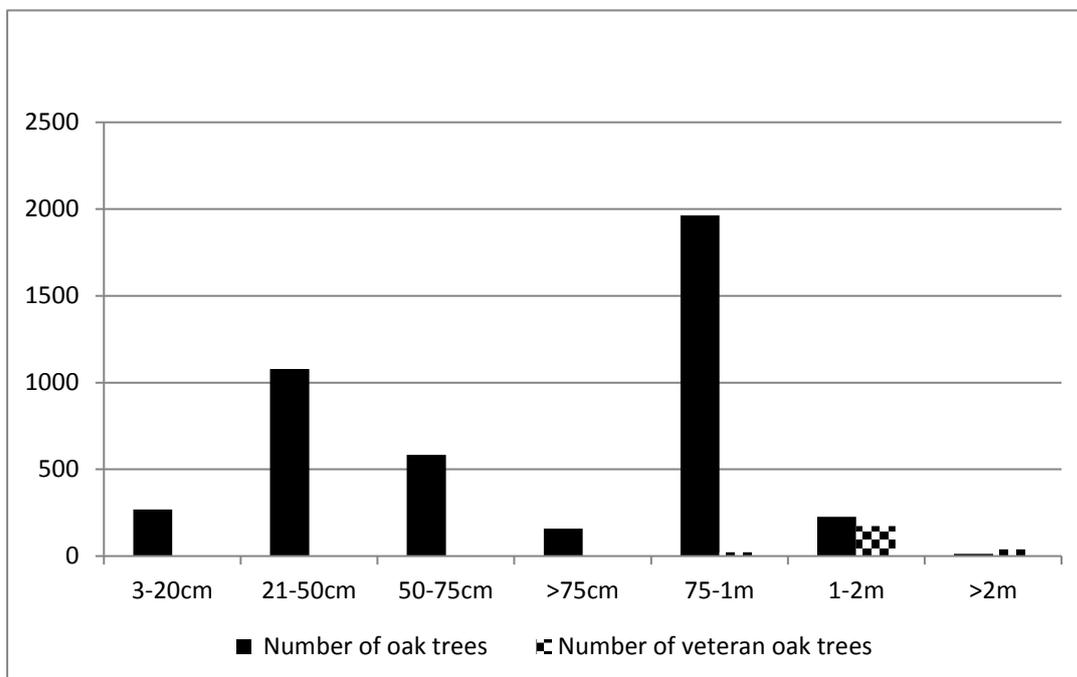
*Species information from raw data*

Oak was the most common species of individual tree recorded in CS2007 (Figure 5). This data constitutes an actual count of all the individual trees recorded in the 591 CS squares.



**Figure 5:** Number of individual trees recorded in CS 1km squares by species in total across GB

Figure 6 shows the age distribution (by DbH) of individual Oak trees recorded in CS 1km squares. Most of the Oaks had a DbH of 75cm-1m with a few veteran trees being recorded at greater than 1m DbH.



**Figure 6:** Distribution of age classes (DbH) of Oak (*Quercus sp.*) mapped as individual trees in GB

### 3.4 Individual trees: Hedgerow trees

Oak was the second most frequent hedgerow tree species (Figure 7) (this doesn't include the hedgerow itself only the individual trees (standards) associated with a hedgerow). Ash was the most frequent hedgerow tree species, with none of the other species close to the frequency of ash and Oak.

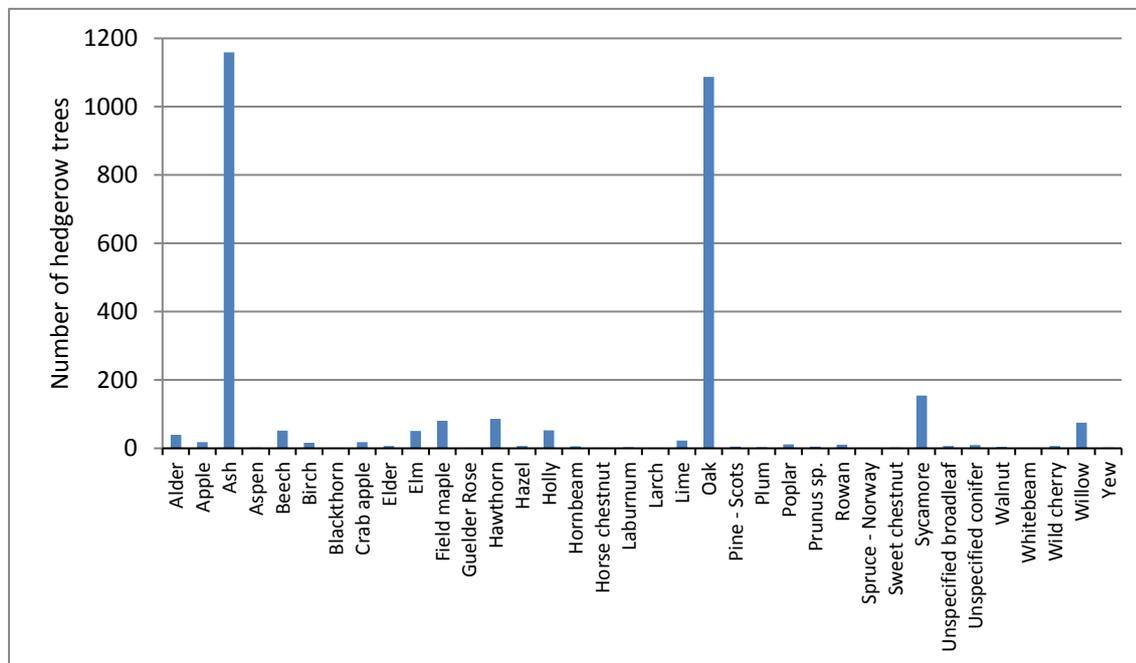


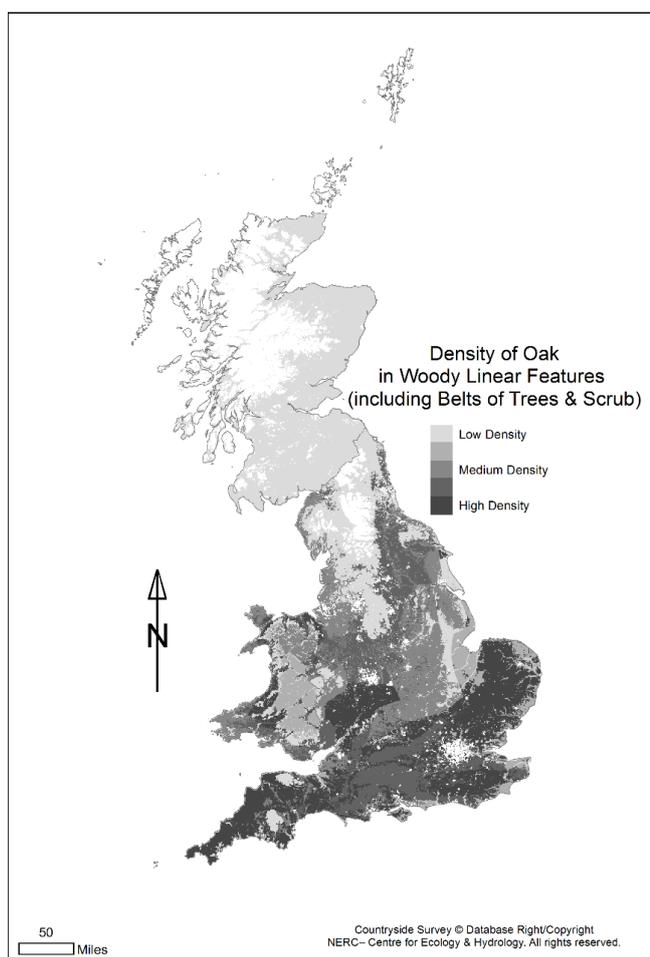
Figure 7: Numbers and species of hedgerow trees recorded in GB.

### 3.5 Woody Linear Features (Hedgerows and Lines of Trees)

The estimated length of linear features across GB composed of Oak, in thousands of km ('000km), was **105.7** (Table 7). Across GB, Oak was most abundant as a component of woody linear features in England (**91.2**) where it was most often found in lines of trees (**66.5**) (in addition to its occurrence as standard hedgerow tree as discussed above), rather than as a managed hedge species (**23.05**). Oak was much less frequent in linear features in Scotland and Wales. Figure 8 shows the mapped distribution of Oak in woody linear features across Wales, the map has been created by calculating a mean woody linear length per km square per land class then scaled up to GB using land class extent. Land class means used in the creation of this map can be found in Appendix 3. Highest densities are found in the South East and South west of England with low densities in Scotland

**Table 4: Total length of Woody Linear Features (WLF) ('000s km) containing Oak in GB**

	Lines of Trees	Hedgerows	Belts	Total WLF
<b>Great Britain</b>				
Length of woody linear feature ('000s km)	75.35	28.42	1.96	105.72
<b>England</b>				
Length of woody linear feature ('000s km)	66.48	23.05	1.67	91.20
<b>Scotland</b>				
Length of woody linear feature ('000s km)	0.42	1.27	0.10	1.79
<b>Wales</b>				
Length of woody linear feature ('000s km)	8.45	4.10	0.19	12.73



**Figure 8:** Distribution of Oak trees in woody linear features in GB using CS 2007 linear data. Data from lines of trees, belts of trees and hedgerows has been scaled up to GB using land class extent.

### 3.6 Vegetation plots

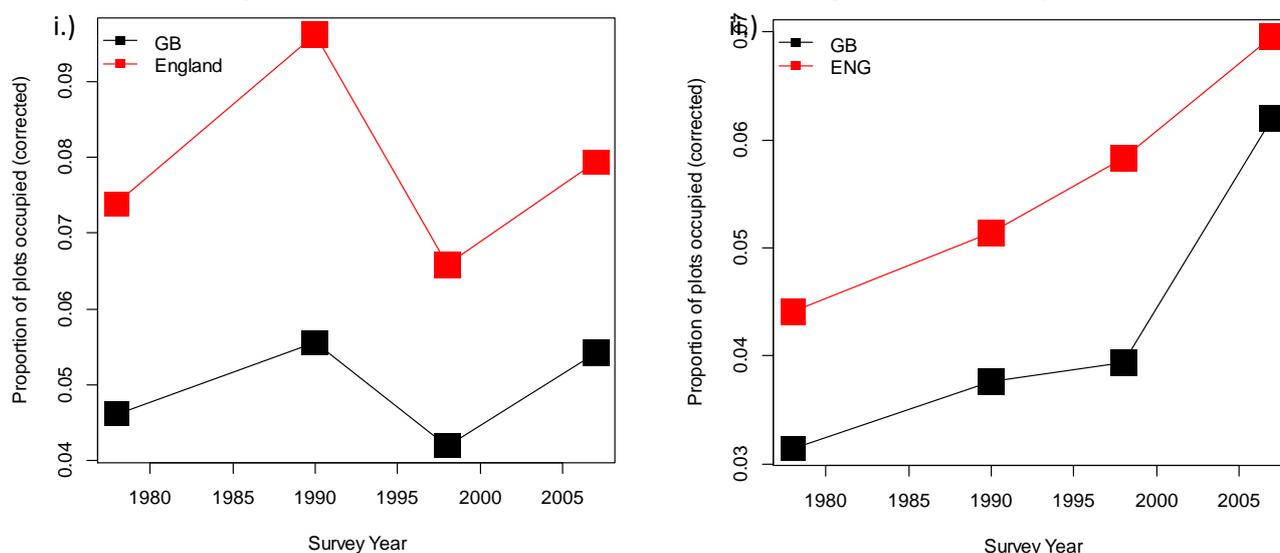
Oak was found in plots sampling different landscape components, in field boundaries, alongside rivers and streams and particularly in hedgerows. It was found in 30% of hedgerow (H) plots (Table 5) which sample a 1\*10m length from the centre of a hedge outwards (including woody and ground vegetation). X and Y plots are area plots (2m x 2m), 17.8% of X plots contained Oak (X plots are randomly placed in a land parcel, this could be a field or a woodland). Y plots are plots sampling small patches of habitat (particularly focusing on priority habitat) and 48.5% of these contained Oak. Oak is an important component of the priority habitats Upland Oak woodland and Lowland Mixed Deciduous woodland.

**Table 5: Data from CS 2007 Vegetation plots, number of plots containing Oak (Quercus sp.) percentage of total plots containing Oak and mean cover of Oak in those plot types.**

Plot types	Number of plots	Percentage of total plots Containing Oak	Mean cover
B (Boundary)	190	11.9	35.2
D (Hedge diversity – woody component only)	513	32.2	22.7
H (Hedge)	81	5.1	29.8
M (Arable margins)	6	0.4	9.8
RV (Roadside)	183	11.5	32.2
SW (Streamside)	171	10.7	41.4
U Upland	13	0.8	16.8
X (Fields/large parcels)	196	12.3	17.8
Y (Small habitat patches)	200	12.5	48.5

#### Changes in distribution of Oak in plots

There was no statistically significant change in the extent to which Oak was recorded in area plots (X) between 1978 and 2007. However, Oak increased across the countryside (as recorded in CS linear plots, B, H, RV and SW) between 1978 and 2007 (Figure 9). Results were significant between 1978 and 2007 (England  $p < 0.05$ , GB  $p < 0.01$ ), and between 1978 and 1998 (for both England and GB  $p < 0.05$ ) and between 1990 and 2007 (for both England and GB  $p < 0.05$ ). Statistically significant change reflects the size of the change index value relative to the distribution of change indices for all species tested.



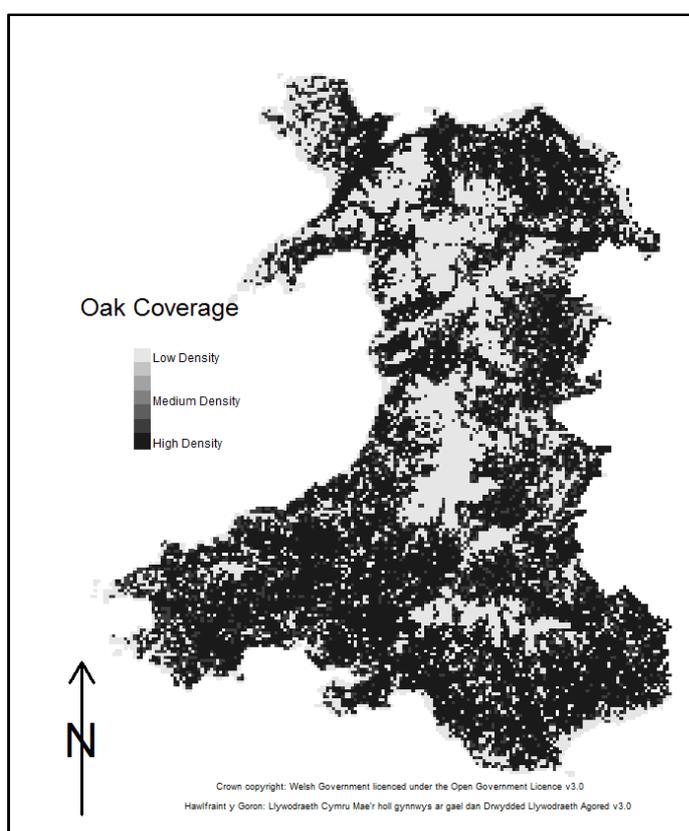
**Figure 9:** Changes in proportion of plots containing Oak (Quercus sp.) across GB between 1978 and 2007 in i.) area plots, ii). Linear plots only.

#### 4. Results: National estimates for Wales from Glastir Monitoring and Evaluation project 2013-2016.

##### 4.1 Areas all woodlands

The total area of woodland in Wales from GMEP data (2013-2016) was estimated to be **31 932** ha (confidence interval: **23 310** ha – **40 554** ha). Although this is a slightly different figure to the Wales estimate from 2007, it is within the 95% Confidence Interval of the CS estimates.

Figure 10 shows the estimated distribution of Oak in all woodland patches. The map has been produced by using estimates of Oak area cover within each land class and weighting by the proportion of broadleaved woodland taken from the Land Cover Map. Land class means used in the creation of this map can be found in Appendix 1.

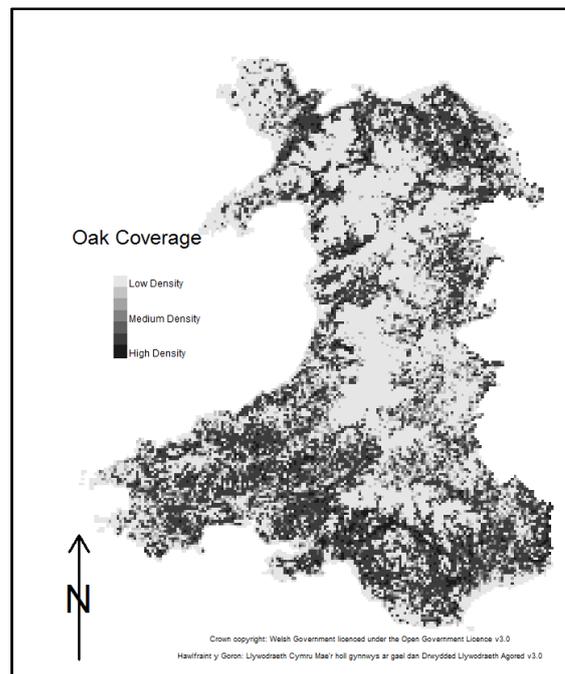


**Figure 10:** Areal extent of Oak based on % cover in all Broadleaved woodland habitat parcels recorded in Wales (GMEP data)

##### 4.2 Areas: Small woodlands <0.5 ha

The total area of small Oak woodland (<0.5ha) in Wales using GMEP data (2013-2016) was estimated to be: **2140**ha (confidence interval: **1567**ha – **2714**ha). This was very slightly lower than the 95% confidence intervals for the CS2007 Wales estimate. This could be due to a loss of Oak in small woodlands over this time period but may also be related to differences in sample size, the GMEP sample of 300 1km squares is considerably larger than the 107 sampled in CS in 2007 and therefore likely to produce more accurate estimates.

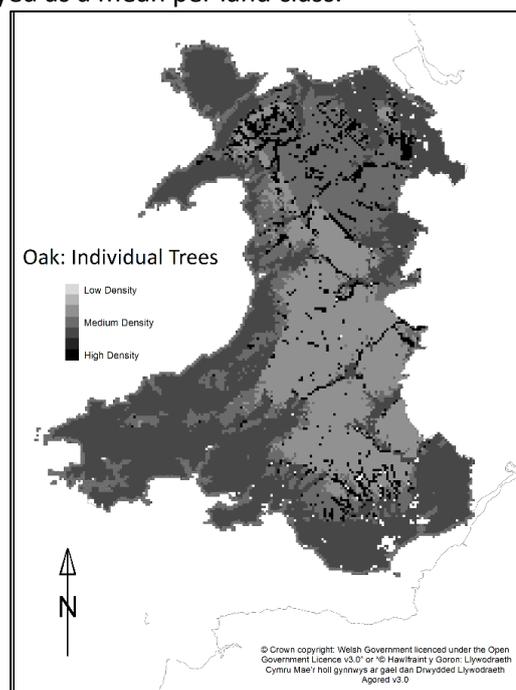
Figure 11 shows the estimated distribution of Oak in small woodland patches (<0.5 ha) using the same methods as the map of all woodland (above).



**Figure 11:** Areal extent of Oak based on % cover in Broadleaved woodland habitat parcels < 0.5 ha in size recorded in Wales in GMEP data

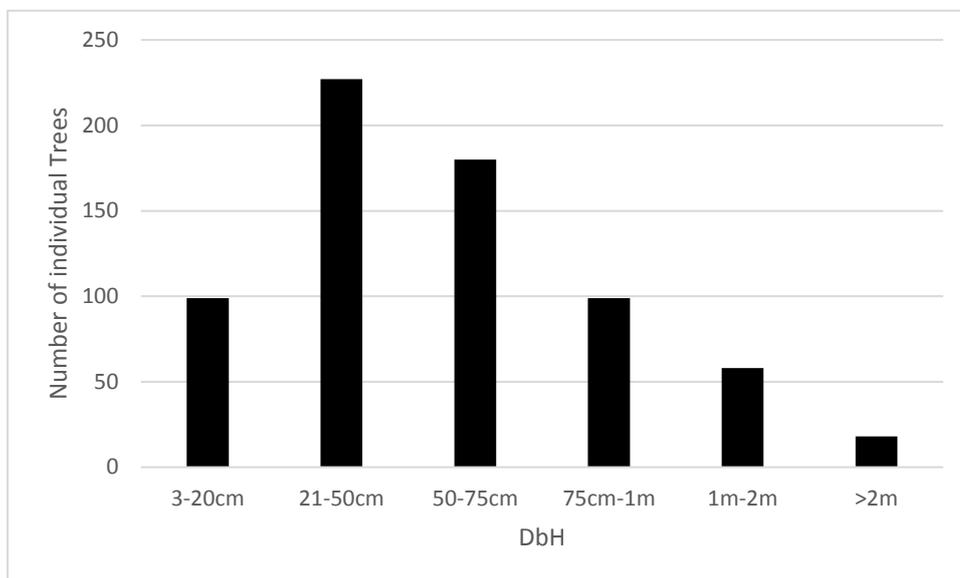
### **4.3 Individual trees**

There were estimated to be **243 249** (confidence interval: **208 029 – 278 469**) individual Oak trees either as single, clumped or scattered trees outside of woodlands in Wales (GMEP 2013-2016). This estimate is within the 95% Confidence Interval of the CS estimates. Figure 12 shows the distribution of individual trees displayed as a mean per land class.



**Figure 12:** Distribution of individual Oak trees in Wales using GMEP point data

Figure 13 shows the age distribution (by DbH) of individual Oak trees recorded in GMEP 1km squares. Unlike CS2007 results, the GMEP results indicated that there were more smaller/younger Oak trees with most individual trees in the 21-50cm DbH category compared to 75cm-1m in CS2007. There are still older/larger trees in the 50-75cm, 75cm-1m, 1m-2m and >2m DbH categories.



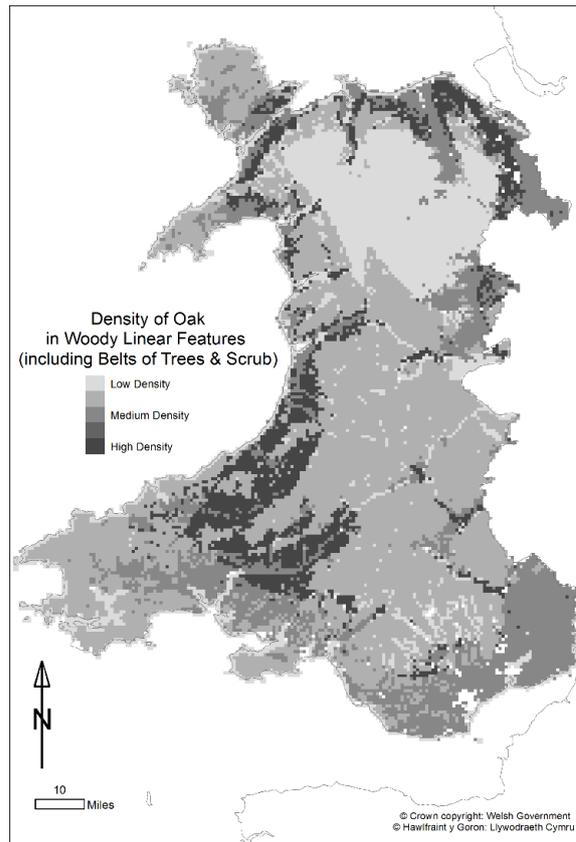
**Figure 13:** Distribution of age classes (DbH) of *Oak (Quercus sp.)* mapped as individual trees in Wales

#### **4.4 Woody Linear Features (Hedgerows and Lines of Trees)**

The estimated length of linear features composed of Oak in thousands of km ('000km) is **10.06** across Wales (GMEP 2013-2016), (Table 6). This is slightly less than was estimated for Wales in CS2007 and appears to be due to lower estimates of lines of trees. This could be due to a loss in trees over this time period but as discussed above could be due to differences in sample size.

**Table 6: Total length of Woody Linear Features (WLF) ('000s km) containing Oak in Wales**

	Lines of Trees	Hedgerows	Belts	Total WLF
Wales (GMEP 2013-2016)				
Length of woody linear feature ('000s km)	5.51	4.43	0.12	10.06



**Figure 14:** Distribution of Oak trees in woody linear features in Wales using GMEP linear data. Data from lines of trees, belts of trees and hedgerows has been scaled up to GB using land class extent

#### **4.5 Vegetation plots**

As in CS2007 Oak was found in plots sampling different landscape components across Wales, in fields and field boundaries, in small and priority habitat patches, alongside rivers and streams and in hedgerows. It was found in 32% of hedgerow diversity plots (Table 7).

**Table 7: Distribution of Oak in vegetation plots in Wales**

Plot types	Number of plots	Percentage of total plots	Mean cover
B (Boundary)	136	15.2	38.5
D (Hedge diversity – woody component only)	283	31.7	32.1
H (Hedge)	52	5.8	27.1
RV (Roadside)	6	0.7	17.2
SW (Streamside)	109	12.2	44.1
U Upland	9	1.0	11.4
X (Field/large parcels)	98	11.0	17.8
Y (Small habitat patches)	110	12.3	62.7

## Discussion

This report uses Countryside Survey (CS2007) data for GB and Glastir Monitoring and Evaluation project (GMEP 2013-2016) data for Wales to estimate the extent of Oak in all woodland areas, small woodland patches (<0.5ha), as individual trees and on linear features. We have also attempted to create spatially explicit products i.e. maps either based on land class distribution or where possible using the Land Cover Map 2007.

These results show that Oak is a significant component of the British countryside. It is the most important tree species within woodland areas (although ash, birch and hawthorn are also important particularly in small woodland patches). Oak is the most frequent individual tree species and much more common than most other tree species (except ash). Individual Oak trees tend to be medium to large in size (75cm-1m DbH) as an average across GB although in the more recent Wales survey there most individuals were in the 21-50cm DbH category, suggesting more recent tree recruitment. Veteran Oak trees that are likely to provide habitat for a huge range of species including birds and invertebrates are common and an important component of the countryside.

Oak is an important component of landscape features in GB and is estimated to make up 105.7 000kms in length of woody linear features (hedgerows and lines of tree) across GB (mostly in England and to a lesser extent, in Wales). Oak is the second most common hedgerow tree (as a hedgerow standard) after Ash, all of the other hedgerow tree species are much less frequent.

There are slight differences in results between the national estimates for Wales from CS2007 and GMEP. There are several reasons for this, firstly GMEP is more recent and there may have been genuine changes across this period. Secondly CS sampled 107 squares in Wales, whilst GMEP sampled a total of 300 squares with only 22 of these squares common to both surveys. Differences between estimates could be attributed to overall sample sizes in each of the land classes surveyed. GMEP has a larger sample size and is likely to be more accurate.

The vegetation plot data has been used to determine the location of Oak trees within the landscape and change over time. Oak is found along linear features particularly streamsides and hedgerows both in GB in CS and in Wales in GMEP. It does appear to be more prevalent in small habitat patches than in larger areas of woodland, but this may reflect the likelihood of encountering small habitat patches as opposed to large areas of woodland using this type of sampling approach. Between 1978 and 2007 Oak increased along linear features, but did not increase in the number of area plots, reflecting the relative stability of larger woodland patches compared to smaller ones. Oak is a species that has become more abundant in many parts of the landscape over recent years.

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## Appendix 1 Land class means for area habitats

CS 2007

Land Class	Estimated Area Oak in all woodlands (ha)	Estimated Area Oak in small <0.5 ha woodlands (ha)
1	32148.0	18.35
2	37174.45	17.76
3	20586.33	26.33
4	14398.56	5.51
5	7971.26	4.71
6	17414.28	11.32
7	157.73	1.10
8	783.62	1.76
9	32899.96	6.59
10	12377.84	9.90
11	7925.07	6.23
12	365.85	0.25
13	1807.93	3.73
14	31.49	0.16
15	7533.36	3.27
16	5525.52	3.09
17	23306.56	17.17
18	5600.28	2.38
19	1323.82	0.47
20	445.52	0.91
21	3601.53	4.32
22	6.70	0.00
23	0	0
24	1265.49	0
25	1712.11	0.09
26	3060.49	3.75
27	2973.98	1.03
28	1515.96	2.83
29	5084.90	3.13
30	416.96	0.42
31	0	0
32	0	0

<b>GMEP 2013-2016</b>		
<b>Land Class</b>	<b>Estimated Area Oak in all woodlands (ha)</b>	<b>Estimated Area Oak in small woodlands &lt;0.5ha (ha)</b>
17	121.65	1041.35
18	190.61	4121.91
19	197.87	4193.83
41	613.93	10834.14
42	318.49	3677.21
43	67.49	979.94
44	451.51	5095.95
45	178.68	1987.70

## Appendix 2: Land class means for individual trees

### CS2007

Land Class	CS Trees per KM
10e	20.17
11e	10.64
12e	4.90
13e	27.89
13s	0.50
15e	10.25
15w	14.25
16e	8.93
17e	5.38
17w1	12.88
17w2	4.11
17w3	6.60
18e	4.38
18s	0.00
18w	17.17
19e	2.94
19s	0.00
1e	23.96
21s	1.32
22e	0.00
22s	0.33
23e	0.00
23s	0.00
24s	0.31
25e	4.43
25s	3.11
26s	5.46
27s	1.07
28s	3.92
29s	2.13
2e	14.62
30s	0.45
31s	0.00
32s	0.00
3e	25.43
4e	8.39
5e	28.50
5w	19.70
6e	20.13
6w	10.57

7e	1.27
7s	0.65
7w	7.44
8e	7.04
9e	11.05

**GMEP**

<b>Land Class</b>	<b>Trees per KM</b>
17	9.34
18	7.84
19	9.71
41	13.92
42	12.00
43	11.00
44	14.00
45	22.08



**Appendix 3: Land class means for Woody Linear Features**

<b>CS2007 COUNTRY_ CODE</b>	<b>LC_2007</b>	<b>Size_of_LC</b>	<b>WUS_km</b>	<b>WNS_km</b>	<b>Belt_km</b>	<b>All_WLF_km</b>	<b>Mean_km_km</b>
ENG	1e	12422.30	10194.40	3461.78	358.89	14015.07	1.13
ENG	2e	14023.90	8523.16	4748.62	236.93	13508.72	0.96
ENG	3e	15337.80	12359.64	6254.85	766.68	19381.17	1.26
ENG	4e	8044.40	1499.24	1478.41	38.81	3016.46	0.37
ENG	5e	2375.60	989.97	636.00		1625.97	0.68
ENG	6e	7176.60	6412.53	1776.60	67.06	8256.19	1.15
ENG	7e	1435.50	7.99			7.99	0.01
ENG	8e	2812.10	201.92	76.44	4.72	283.08	0.10
ENG	9e	10310.70	5995.81	705.18		6700.99	0.65
ENG	10e	13250.50	10254.10	2210.24	55.35	12519.70	0.94
ENG	11e	8699.00	4391.62	542.33	94.28	5028.22	0.58
ENG	12e	3412.70	641.28	229.93		871.21	0.26
ENG	13e	4245.60	2976.99	300.32		3277.31	0.77
ENG	15e	1266.30	692.71	202.77		895.48	0.71
ENG	16e	3866.00	758.52	103.12	27.31	888.95	0.23
ENG	17e	3934.00	404.01	145.26	8.17	557.44	0.14
WAL	17w1	1941.00	784.43	293.58	18.45	1096.46	0.56
WAL	17w2	4978.00	909.89	547.55	12.43	1469.86	0.30
WAL	17w3	2082.00	42.45	179.02		221.47	0.11
ENG	18e	2024.00		112.98		112.98	0.06
ENG	19e	5384.00	58.75	38.58		97.34	0.02
ENG	22e	3305.00				0.00	0.00
ENG	23e	1041.00				0.00	0.00
ENG	25e	2917.40	114.67	28.78	8.41	151.86	0.05
SCO	7s	645.90	94.53	1.00		95.53	0.15

SCO	13s	2199.90		8.65		8.65	0.00
SCO	18s	3629.90				0.00	0.00
SCO	19s	3214.00	1.41	14.79		16.20	0.01
SCO	21s	9706.40				0.00	0.00
SCO	22s	9249.30		1.04		1.04	0.00
SCO	23s	6066.00				0.00	0.00
SCO	24s	7008.70				0.00	0.00
SCO	25s	8545.10	256.40	526.68	67.94	851.02	0.10
SCO	26s	5262.00			12.60	12.60	0.00
SCO	26s	5262.00		359.52		359.52	0.07
SCO	27s	5619.90	68.88	56.04		124.92	0.02
SCO	28s	6411.40	0.00	234.81		234.81	0.04
SCO	29s	3043.30		67.94		67.94	0.02
SCO	29s	3043.30			17.33	17.33	0.01
SCO	30s	3649.50				0.00	0.00
SCO	31s	1918.40				0.00	0.00
SCO	32s	3680.10				0.00	0.00
WAL	5w	4323.60	3035.16	1387.16	67.84	4490.15	1.04
WAL	6w	2686.60	1099.36	516.68	64.74	1680.79	0.63
WAL	7w	1395.50	158.98	80.33		239.31	0.17
WAL	15w	2426.70	2234.64	994.34	28.72	3257.69	1.34
WAL	18w	1258.00	181.90	97.08		278.97	0.22

<b>GMEP</b>											
<b>COUNTRY</b>	<b>LC_2007</b>	<b>Size_of_LC</b>	<b>WUS_km</b>	<b>WUS_000km</b>	<b>WNS_km</b>	<b>WNS_000km</b>	<b>Belt_km</b>	<b>Belt_000km</b>	<b>All_WLF_km_2</b>	<b>All_WLF_000km</b>	<b>Mean_km_km</b>
WAL	17w1	1941	54.27	0.05	173.80	0.17	7.80	0.01	235.87	0.24	0.12
WAL	17w2	4978	690.73	0.69	771.87	0.77	26.91	0.03	1489.51	1.49	0.30
WAL	17w3	2082	465.26	0.47	283.25	0.28			748.51	0.75	0.36
WAL	5w	4323.6	2081.05	2.08	1348.17	1.35	28.52	0.03	3457.74	3.46	0.80
WAL	6w	2686.6	476.84	0.48	287.56	0.29	15.41	0.02	779.81	0.78	0.29
WAL	7w	1395.5	116.48	0.12	121.05	0.12			237.53	0.24	0.17
WAL	15w	2426.7	1589.00	1.59	1226.67	1.23	36.46	0.04	2852.12	2.85	1.18
WAL	18w	1258	31.43	0.03	220.10	0.22	7.48	0.01	259.01	0.26	0.21