

RESULTS FROM MAFF-FUNDED WORK IN THE CS2000 PROGRAMME

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Executive Summary

This report provides data analyses and initial interpretation of hedgerow data arising from Countryside Survey 2000. Data are presented from hedgerow diversity plots, D-plots; these are 30 m lengths of hedge, ten recorded at random positions within those 1 km sample squares where hedgerows were present. Woody species and gaps were recorded to estimate their contribution to the total length of hedge in each plot. Width and height of the hedge canopy base were also recorded to supplement other variables recorded as part of the standard Countryside Survey procedure. Data are also presented on hedgerow trees, observed in each square in 1990 and 1998 as either individual trees or lines of trees.

A total of 2,393 D-plots were recorded on 520 squares across GB. Of these, 0.2 % contained 10 or more native woody species, while at the other extreme 14 % contained only a single woody species. Species-rich hedgerows are defined by the BAP as containing five or more species in a 30 m length, except in the north of England, upland Wales and Scotland where the number is four. We interpret this as a minimum of five species in Environmental Zones 1 & 2 (the lowlands of England and Wales) and four species elsewhere. By this interpretation, 28 % of hedgerows are species-rich in Environmental Zones 1 & 2 and 38 % in Environmental Zone 3. A total of 26% of all D-plots sampled had five or more woody species.

Gaps constitute only small proportions of hedgerow length, very rarely exceeding 10 % (5 % of all D-plots had gaps accounting for up to 10 % of the total length). These figures exclude the vast majority of plots that had no gaps recorded at all. Around 68 % of hedgerows were between 1 - 2m wide and in 69 %, the base of the hedge canopy was less than 0.5 m high. These figures differ little between Environmental Zones, except that Scottish hedgerows tended to be taller than those in England (although based on a much smaller sample).

Around 90 % of hedgerows contained hawthorn (*Crataegus monogyna*), which was nearly twice as frequent as the species ranked second at the GB level (blackthorn - *Prunus spinosa*). The rankings of frequency differed between countries and regions; thus while blackthorn was the second most frequent species in England, it was ranked third in Wales and sixth in Scotland. 11 species occurred in 10 % or more D-plots in England, compared with 10 in Wales and only 5 in Scotland.

In 1998 there was an estimated 1.8 million individual (isolated) hedgerow trees in GB, 98 % found in England and Wales, reflecting the distribution of hedgerow lengths. This figure is around 3 % less than in 1990, within the margins of sampling error. The decline of 8 % in tree number in Environmental Zone 1 (the eastern lowlands of England) is, however, statistically significant ($p < 0.01$). Elm (*Ulmus* spp.) trees seem to have been lost the most (26 % since 1990), with gains of hawthorn. Oak (*Quercus* spp.) and ash (*Fraxinus excelsior*) were the most common species overall.

The majority of trees were recorded as appearing to be over 20 years old. The number of trees in the 1 – 4 year category declined significantly by around 40 %.

By contrast with declines in numbers of individual trees, there were significant increases in the lengths of lines of trees, by 55 % at the GB level. This increase appears too large to be a simple consequence of individual trees growing into lines (i.e. their canopies touching). Further research into the database is needed to clarify the flows between hedgerows, relict hedgerows, lines of trees and individual trees.

Background

To provide information to the work of the UK Steering Group for the Habitat Action Plan for Ancient and/or Species-rich Hedgerows, MAFF provided funding for the collection of additional hedgerow information within Countryside Survey 2000 (CS2000), specifically on the woody species composition of hedgerows and on hedgerow trees. This paper provides examples of the analyses that have been undertaken and some commentary on these. It should be noted that much fuller tables of results are available on the CS2000 results website..

Work undertaken

At the outset of CS2000, MAFF contributed funding to allow:

- (a) ten 'hedgerow diversity' plots (D-plots) to be recorded in sample squares from England and Wales. CEH contributed funding to allow the collection of some D-plots in Scotland. Each D-plot was a 30 metre length of hedge, chosen at random from all hedgerows in the square. Two of the ten D-plots overlapped with extant 10 metre vegetation plots.
- (b) data on hedgerow trees from the 1990 and 1998 surveys to be analysed. The analysis of comparable 1984 data would also be examined.

For each D-plot, surveyors recorded the presence of all woody species and estimated their percentage contribution to the 30m length of hedge. Gaps were treated as a separate attribute, thus all woody species records, plus gaps, added to 100%. In addition, surveyors recorded the mean width of the hedge in three width bands (<1m; 1-2m; >2m) and the height of the canopy base in four height bands (0m; 0-0.5m; 0.5-1.0m; >1.0m).

All individual trees, and lines of trees, in the sample squares were recorded in Countryside Survey 1990. In CS2000, lines of trees and individual trees in hedgerows were recorded, together with information on species and estimated age.

Results

Hedgerow Diversity (D) plots

The number and distribution of D-plots

The total number of D-plots surveyed in 1998 and 1999 is shown in Table 1; note the much smaller sample size in Scotland, reflecting the relative scarcity of hedgerows there.

Table 1. Total numbers of D-plots surveyed in 1998/9, by country.

	England	Scotland	Wales	GB
No. sqs	300	156	64	520
D-plots	2,052	89	252	2,393

Numbers of species-rich D-plots

Details of the numbers of species-rich D-plots are given by Environmental Zone (EZ) in Table 2. Ignoring the very small sample in EZ5, the zone with the largest proportion of species-rich D-plots was EZ3 (the uplands of England & Wales). In terms of absolute numbers of plots, EZ2 clearly supports the largest resource of species-rich hedgerows.

Table 2. Numbers of D-plots surveyed in 1998/9 which were species-rich, by country and environmental zone.

Environmental Zone*	No. plots surveyed	No plots with 4 spp* *or more	% of total plots	No of plots with 5 spp** or more	% of total plots
EZ1	1,043	397	38	222	21
EZ2	1,050	527	50	317	30
EZ3	237	131	55	89	38
England & Wales total	2,330	1055	45	628	27
EZ4	117	14	12	5	4
EZ5	2	1	50	1	50
EZ6	0	-	-	-	-
Scotland total	119	15	13	6	5
GB TOTAL	2,449	1070	44	634	26

*Environmental Zone 1: the more southerly and easterly lowlands of England & Wales; EZ2: the more northerly and westerly lowlands of England & Wales; EZ3 the uplands of England/Wales; EZ4: the lowlands of Scotland; EZ5: marginal uplands and islands in Scotland; EZ6: the uplands in Scotland.

** native, woody species

The frequency distribution of gaps in hedgerows, by proportion class

Information on gaps is given in Table 3. Overall, rather few plots had noticeable gaps along their length. Of those that did, the data show the highest proportion of gappiest hedges to have been recorded in Environmental Zone 4 covering the lowlands of Scotland (although the sample size was relatively small).

Table 3. Proportion of plots in each zone and country comprising different percentage lengths as gaps. Only D-plots with gaps recorded on the survey sheets were included.

Environmental Zone	No. plots	% of plots with gaps comprising up to x% of hedge:							
		5%	10%	15%	20%	25%	30%	50%	> 50%
EZ1	1,043	9	6	2	2	1	1	1	<1
EZ2	1,050	9	3	2	1	<1	<1	1	<1
EZ3	237	15	5	<1	<1	<1	<1	<1	0
England & Wales total	2,330	10	5	2	1	1	1	1	<1
EZ4	117	6	5	2	2	<1	<1	3	<1
EZ5	2	0	0	50	0	0	0	0	0
EZ6	0	-	-	-	-	-	-	-	-
Scotland total	119	7	5	3	<1	<1	2	3	<1
GB TOTAL	2,449	10	5	2	1	<1	1	1	<1

The frequency distribution of mean hedgerow width class

The largest proportion of the widest plots were recorded in the lowland zones 1 and 2 in England & Wales and the largest proportion of the narrowest hedgerows in zone 3.

Table 4. Proportion of D-plots in different hedge width classes by zone and country.

Environmental Zone	No. plots surveyed	% of plots with mean width of:		
		<1 m	1 – 2 m	>2 m
1	1,043	8	67	23
2	1,050	6	68	22
3	237	18	72	9
England & Wales total	2,330	9	68	21
4	117	15	68	12
5	2	0	1	1
6	0	-	-	-
Scotland total	119	15	68	13
GB TOTAL	2,449	9	68	21

The frequency distribution of mean hedgerow canopy base height class

There was little difference in the distribution of canopy height classes between zones. Overall, D-plots in zone 4 appeared to have a higher proportion of hedges with the largest basal canopy height than zones in England & Wales.

Table 5. Proportion of D-plots in different basal canopy height classes by zone and country.

Environmental Zone	No. plots surveyed	% of plots with mean basal canopy height of:			
		0m	0.1 – 0.5m	0.6m-1.0m	>1.0m
EZ1	1,043	11	57	26	4
EZ2	1,050	15	57	20	5
EZ3	237	18	49	26	5
England & Wales total	2,330	14	56	23	5
EZ4	117	5	50	27	13
EZ5	2	0	50	50	0
EZ6	0	-	-	-	-
Scotland total	119	5	50	28	13
GB TOTAL	2,449	13	56	24	5

The frequency of woody species, per plot

The frequency of woody species (native species and non-native species), in all Hedgerow Diversity (D) plots, is shown in Table 6. This shows that Hawthorn was the dominant species in all country units and all Environmental Zones. Other species varied by country and zone with Blackthorn and Hazel being rare in Scotland (where no species apart from Hawthorn occurred in more than 20% of plots) compared with England and Wales (with Hazel being particularly frequent in Wales).

Within England and Wales, many common species (such as Hawthorn, Blackthorn, Elder and Ash) are remarkably constant in their frequency when considered by zone whereas Hazel is far more common in the upland zone (EZ3) than in the lowland zones, where it is found more commonly in the west (EZ2). Dog rose and Field maple are more common in the east (EZ1) than elsewhere and Ivy and Oak are rarer in the upland zone (EZ3).

Table 6. Frequency of woody species in D-plots by (a) country and (b) Environmental Zone**Part (a) – by country**

Plant species	<i>Common name</i>	GB	%	ENG	%	SCO	%	WAL	%
<i>Crataegus monogyna</i>	Hawthorn	2205	90	1858	89	110	92	237	94
<i>Prunus spinosa</i>	Blackthorn	1167	47	984	47	9	8	174	69
<i>Sambucus nigra</i>	Elder	867	35	759	36	23	19	85	34
<i>Corylus avellana</i>	Hazel	707	29	526	25	1	1	180	72
<i>Rosa canina</i> agg.	Dog-roses	666	27	600	29	15	13	51	20
<i>Fraxinus excelsior</i>	Ash	628	26	535	26	18	15	75	30
<i>Hedera helix</i>	Ivy	605	25	547	26	12	10	46	18
<i>Acer campestre</i>	Field maple	375	15	351	17		0	24	10
<i>Quercus robur</i>	Pedunculate oak	342	14	326	16	2	2	14	6
<i>Ilex aquifolium</i>	Holly	279	11	241	12	3	3	35	14
<i>Rosa arvensis</i>	Field-rose	260	11	248	12	3	3	9	4
<i>Cornus sanguinea</i>	Dogwood	137	6	129	6		0	8	3
<i>Lonicera periclymenum</i>	Honeysuckle	121	5	101	5	1	1	19	8
<i>Crataegus laevigata</i>	Midland hawthorn	90	4	88	4		0	2	1
<i>Euonymus europaeus</i>	Spindle	88	4	87	4		0	1	<1
<i>Ligustrum vulgare</i>	Wild privet	82	3	78	4	1	1	3	1
<i>Sorbus aucuparia</i>	Rowan	76	3	29	1	3	3	44	18
<i>Tamus communis</i>	Black bryony	69	3	66	3		0	3	1
<i>Salix caprea</i>	Goat willow	52	2	46	2		0	6	2
<i>Salix cinerea</i>	Grey willow	50	2	40	2		0	10	4
<i>Clematis vitalba</i>	Traveller's-joy	49	2	47	2	1	1	1	<1
<i>Ulex europaeus</i>	Gorse	38	2	29	1	2	2	7	3
<i>Malus sylvestris</i>	Crab apple	37	2	31	1		0	6	2
<i>Rhamnus cathartica</i>	Buckthorn	31	1	30	1		0	1	<1
<i>Quercus petraea</i>	Sessile Oak	29	1	21	1		0	8	3
<i>Humulus lupulus</i>	Hop	26	1	25	1		0	1	<1
<i>Prunus avium</i>	Wild cherry	22	1	17	1	1	1	4	2
<i>Carpinus betulus</i>	Hornbeam	19	1	19	1		0		0
<i>Alnus glutinosa</i>	Alder	17	1	13	1		0	4	2
<i>Ulex gallii</i>	Western gorse	15	1	13	1	2	2		0
<i>Viburnum lantana</i>	Wayfaring-tree	15	1	15	1		0		0
<i>Viburnum opulus</i>	Guelder rose	14	1	9	<1		0	5	2
<i>Bryonia dioica</i>	White bryony	13	1	13	1		0		0
<i>Ribes uva-crispa</i>	Gooseberry	13	1	7	<1	4	3	2	1
<i>Rubus idaeus</i>	Raspberry	10	<1	6	<1	4	3		0
<i>Rosa rubiginosa</i>	Sweet-briar	8	<1	6	<1		0	2	1
<i>Rosa tomentosa</i>	Harsh downy-rose	8	<1	3	<1	3	3	2	1
<i>Taxus baccata</i>	Yew	8	<1	8	<1		0		0
<i>Solanum dulcamara</i>	Bittersweet	7	<1	5	<1		0	2	1
<i>Populus tremula</i>	Aspen	6	<1	6	<1		0		0
<i>Rosa caesia</i>	Hairy dog-rose	6	<1	6	<1		0		0
<i>Salix aurita</i>	Eared willow	5	<1	3	<1	2	2		0
<i>Cytisus scoparius</i>	Broom	4	<1	3	<1		0	1	<1
<i>Prunus padus</i>	Bird cherry	4	<1	3	<1		0	1	<1
<i>Rubus caesius</i>	Dewberry	4	<1	4	<1		0		0
<i>Sorbus torminalis</i>	Wild service-tree	4	<1	4	<1		0		0
<i>Calystegia sepium</i>	Hedge bindweed	3	<1	2	<1		0	1	<1
<i>Cornus suecica</i>	Dwarf cornel	2	<1	2	<1		0		0
<i>Tilia platyphyllos</i>	Large-leaved lime	2	<1	2	<1		0		0
<i>Frangula alnus</i>	Alder buckthorn	1	<1		0	1	1		0
<i>Lavatera arborea</i>	Tree mallow	1	<1	1	<1		0		0
<i>Ruscus aculeatus</i>	Butcher's-broom	1	<1	1	<1		0		0
<i>Sorbus aria</i>	Whitebeam	1	<1	1	<1		0		0
<i>Sorbus intermedia</i> agg.	Swedish whiteb.	1	<1	1	<1		0		0
<i>Tilia cordata</i>	Small-leaved lime	1	<1	1	<1		0		0
<i>Ulex minor</i>	Dwarf gorse	1	<1	1	<1		0		0

part (b) – by Environmental Zone (zones 5 and 6 excluded due to small sample sizes)

Plant species		Z1	%	Z2	%	Z3	%	Z4	%
<i>Crataegus monogyna</i>	Hawthorn	949	90	924	88	222	94	108	92
<i>Prunus spinosa</i>	Blackthorn	503	48	551	52	104	44	9	8
<i>Sambucus nigra</i>	Elder	379	36	392	37	73	31	23	20
<i>Corylus avellana</i>	Hazel	173	16	391	37	142	60	1	1
<i>Rosa canina</i> agg.	Dog-roses	371	35	228	22	52	22	14	12
<i>Fraxinus excelsior</i>	Ash	249	24	292	28	69	29	17	15
<i>Hedera helix</i>	Ivy	229	22	346	33	18	8	12	10
<i>Acer campestre</i>	Field maple	225	21	132	13	18	8		0
<i>Quercus robur</i>	Pedunculate oak	164	16	166	16	10	4	1	1
<i>Ilex aquifolium</i>	Holly	65	6	172	16	39	16	2	2
<i>Rosa arvensis</i>	Field-rose	121	12	125	12	11	5	3	3
<i>Cornus sanguinea</i>	Dogwood	76	7	57	5	4	2		0
<i>Lonicera periclymenum</i>	Honeysuckle	43	4	66	6	11	5	1	1
<i>Crataegus laevigata</i>	Midland hawthorn	71	7	17	2	2	1		0
<i>Euonymus europaeus</i>	Spindle	55	5	33	3		0		0
<i>Ligustrum vulgare</i>	Wild privet	45	4	36	3		0	1	1
<i>Sorbus aucuparia</i>	Rowan	1	<1	28	3	44	19	2	2
<i>Tamus communis</i>	Black bryony	31	3	38	4		0		0
<i>Salix caprea</i>	Goat willow	20	2	21	2	11	5		0
<i>Salix cinerea</i>	Grey willow	18	2	21	2	11	5		0
<i>Clematis vitalba</i>	Traveller's-joy	40	4	8	1		0	1	1
<i>Ulex europaeus</i>	Gorse	5	<1	31	3		0	2	2
<i>Malus sylvestris</i>	Crab apple	15	1	10	1	12	5		0
<i>Rhamnus cathartica</i>	Buckthorn	26	2	5	<1		0		0
<i>Quercus petraea</i>	Sessile Oak	3	<1	23	2	3	1		0
<i>Humulus lupulus</i>	Hop	17	2	9	1		0		0
<i>Prunus avium</i>	Wild cherry	4	<1	12	1	5	2	1	1
<i>Carpinus betulus</i>	Hornbeam	11	1	8	1		0		0
<i>Alnus glutinosa</i>	Alder	6	1	4	<1	7	3		0
<i>Ulex gallii</i>	Western gorse		0	13	1		0	2	2
<i>Viburnum lantana</i>	Wayfaring-tree	12	1	3	<1		0		0
<i>Viburnum opulus</i>	Guelder rose	3	<1	6	1	5	2		0
<i>Bryonia dioica</i>	White bryony	13	1		0		0		0
<i>Ribes uva-crispa</i>	Gooseberry	1	<1	6	1	2	1	4	3
<i>Rubus idaeus</i>	Raspberry		0	6	1		0	4	3
<i>Rosa rubiginosa</i>	Sweet-briar	5	<1	1	<1	2	1		0
<i>Rosa tomentosa</i>	Harsh downy-rose	2	<1		0	3	1	3	3
<i>Taxus baccata</i>	Yew	1	<1	7	1		0		0
<i>Solanum dulcamara</i>	Bittersweet	4	<1	3	<1		0		0
<i>Populus tremula</i>	Aspen	5	<1	1	<1		0		0
<i>Rosa caesia</i>	Hairy dog-rose		0		0	6	3		0
<i>Salix aurita</i>	Eared willow		0	3	<1		0	2	2
<i>Cytisus scoparius</i>	Broom	2	<1	2	<1		0		0
<i>Prunus padus</i>	Bird cherry		0	3	<1	1	<1		0
<i>Rubus caesius</i>	Dewberry	2	<1	2	<1		0		0
<i>Sorbus torminalis</i>	Wild service-tree	2	<1	2	<1		0		0
<i>Calystegia sepium</i>	Hedge bindweed	2	<1	1	<1		0		0
<i>Cornus suecica</i>	Dwarf cornel	2	<1		0		0		0
<i>Tilia platyphyllos</i>	Large-leaved lime		0	2	<1		0		0
<i>Frangula alnus</i>	Alder buckthorn		0		0		0	1	1
<i>Lavatera arborea</i>	Tree mallow		0	1	<1		0		0
<i>Ruscus aculeatus</i>	Butcher's-broom		0	1	<1		0		0
<i>Sorbus aria</i>	Whitebeam	1	<1		0		0		0
<i>Sorbus intermedia</i> agg.	Swedish whiteb.	1	<1		0		0		0
<i>Tilia cordata</i>	Small-leaved lime		0	1	<1		0		0
<i>Ulex minor</i>	Dwarf gorse		0	1	<1		0		0

Hedgerow trees

Hedgerow trees were identified in two ways:

- i) the surveyor used a 'hedgerow tree' code when describing a tree, or line of trees
- ii) trees which are recorded as being in a hedgerow, but where a surveyor omitted to use a hedgerow tree code, have been identified using GIS.

The estimated number of hedgerow trees in 1984, 1990, 1998 and changes between 1990 and 1998, by species and age class

Total estimated numbers of live trees associated with hedgerow (boundary features categorised as 'hedge', 'remnant hedge' or 'relict hedge') are presented in Table 7.

Table 7. Estimated number of hedgerow trees in 1984, 1990, 1998 and change between 1990 – 1998 by country and Environmental Zone. Coefficient of Variation (CV) in percent and probability on a scale of <0.01 to > 0.99. Shading with bold indicates probability of 0.01 or less, shading only indicates a probability of 0.02 to 0.05.

Country	EZ	1984 stock		1990 stock		1998 stock		1990-1998 change			% change from 1990
		No. x 1000	CV	No. x 1000	CV	No. x 1000	CV	No. x 1000	CV	2 sided p	
England & Wales	1	908	14	869	12	783	12	-66	39	<0.01	-8
	2	901	15	924	12	924	11	6	>100	0.85	1
	3	101	49	109	43	95	33	10	>100	0.46	10
England & Wales		1910	10	1902	8	1803	8	-50	88	0.22	-3
Scotland	4	16	38	29	27	30	27	-4	84	0.21	-14
	5	2	72	4	>100	3	>100	-1.0	>100	0.67	-22
	6	0	n/a	0	n/a	0	n/a	n/a	n/a	n/a	n/a
Scotland		18	35	33	27	34	27	-5	70	0.11	-27
Great Britain		1927	10	1935	8	1836	8	-55	80	0.18	-3

In 1998 there are an estimated 1.8 million hedgerow trees in Great Britain, of which 98% occur in England and Wales. This largely reflects the distribution of total length of all hedgerows in Great Britain where over 90% occur in England and Wales.

Environmental Zones 1 & 2 account for 95% of the stock of all hedgerow trees in England and Wales (roughly split evenly 44% and 51% respectively) and 93% of Great Britain. Few hedgerow trees were found in Environmental Zone 5 (3,000) and no hedgerow trees were found in Environmental Zone 6.

There has been a 3% net loss of hedgerow trees in Great Britain (-55,000) between 1990 and 1998, however this is not statistically significant (p=0.18). The net loss of hedgerow trees mostly occurred in England and Wales (-50,000) with the smaller loss in Scotland (-5,000) reflecting the lower number of hedgerow trees found there (Table 7 & Figure 1, Environmental Zones 4,5 & 6), again neither figures were statistically significant (p=0.22, p=0.11).

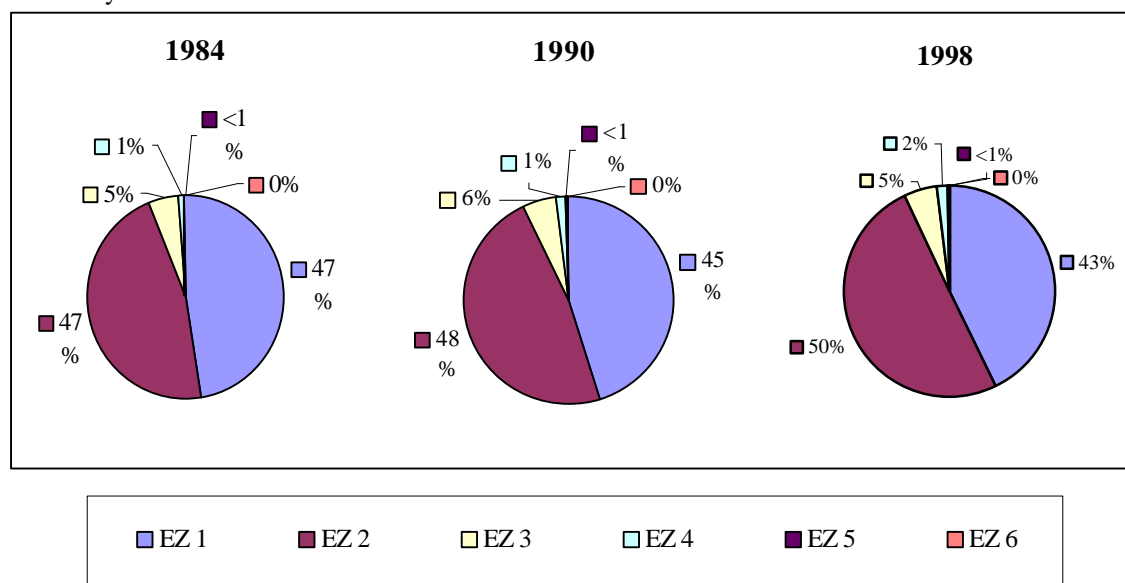
There has been a loss of 66,000 hedgerow trees (8%) in Environmental Zone 1 between 1990 and 1998 which is statistically significant (p=<0.01) and contrasts small, non significant gains of 6,000 for Environmental Zone 2 and 10,000 for Environmental Zone 3.

Hedgerow trees can be 'gained' by a number of reasons: lines of hedgerow trees degenerating into individual trees whilst still being associated with a hedgerow feature or management of hedgerows promoting individual trees. Losses may be caused by individual trees being

removed or becoming dead standing trees, becoming incorporated into a line of trees (canopies now touching) or an area of trees, or the associated hedgerow feature being removed or changing to another feature. Further analyses may reveal direct flows between live and dead standing trees.

The distribution of hedgerow trees in Great Britain for the periods 1984, 1990 and 1998 are shown in Figure 1 and have remained largely consistent. Environmental Zones 1 & 2 account for over 90% of the total stock with Environmental Zones 4 & 5 less than 2% and Environmental Zone 6 having no hedgerow trees.

Figure 1. Distribution of estimated number of hedgerow trees in 1984, 1990 and 1998 for Great Britain by Environmental Zone.



Estimated numbers of hedgerow trees in England and Wales, Scotland and Great Britain are presented by species in Table 8a,b & c.

Table 8 a, b & c. Estimated number of hedgerow trees in 1984, 1990, 1998 and change between 1990–1998, by country and species. Coefficient of Variation (CV) in percent and probability on a scale of <0.01 to > 0.99. Shading with bold indicates probability of 0.01 or less, shading only a probability of 0.02-0.05. Data by Environmental Zone are also available.

Species	1984 stock		1990 stock		1998 stock		1990-1998 change		% change from 1990	
	No. x 1000	CV	No. x 1000	CV	No. x 1000	CV	No. x 1000	CV		
a) England and Wales										
Not recorded	124	22	35	25	19	51	-15	91	0.23	-43
Ash	659	12	689	11	653	11	-4	>100	0.83	-1
Beech	22	59	25	24	23	24	-1	>100	0.65	-4
Elm	80	26	62	28	44	22	-17	69	0.07	-27
Feld maple	*	*	54	22	55	24	1	>100	0.82	2
Hawthorn	73	34	51	18	63	19	11	99	0.27	22
Oak	623	16	671	10	651	10	-22	74	0.18	-3
Sycamore	74	20	86	17	78	16	-2	>100	0.70	-2
Willow	71	22	54	17	50	16	-3	>100	0.54	-6
Other species	182	19	173	15	167	15	1	>100	0.92	0
TOTAL	1910	10	1902	8	1803	8	-50	88	0.22	-3

(Table 8 continues on next page)

b) Scotland

Not recorded	0	n/a	0	n/a	0	n/a	0	n/a	>0.99	n/a
Ash	4	65	8	38	7	39	-1	>100	0.56	-7
Beech	3	71	8	51	8	52	0	>100	0.68	-2
Elm	3	60	2	78	2	65	0	n/a	>0.99	0
Field maple	*	*	0	n/a	0	n/a	0	n/a	>0.99	n/a
Hawthorn	3	83	3	69	6	69	-1	>100	0.44	-18
Oak	1	73	4	47	4	46	0	n/a	>0.99	0
Sycamore	2	70	1	75	1	87	-1	72	0.24	-71
Willow	0	n/a	+	>100	+	>100	-	>100	0.70	-100
Other species	2	63	7	38	5	41	-3	80	0.21	-35
TOTAL	18	35	33	27	34	27	-5	70	0.11	-15

c) Great Britain

Not recorded	124	22	35	25	19	51	-15	91	0.27	-43
Ash	663	12	697	11	661	11	-4	>100	0.82	-1
Beech	25	52	34	22	31	22	-1	>100	0.67	-4
Elm	83	25	64	27	47	22	-17	69	0.09	-26
Field maple	*	*	54	22	55	24	1	>100	0.87	2
Hawthorn	76	33	54	17	69	18	11	>100	0.31	20
Oak	625	16	676	10	655	10	-22	74	0.13	-3
Sycamore	76	19	87	17	79	16	-3	>100	0.65	-3
Willow	71	22	55	17	51	16	-3	>100	0.48	-6
Other species	185	19	180	15	171	14	-2	>100	0.93	-1
TOTAL	1927	10	1935	8	1836	8	-55	80	0.18	-3

Notes: + indicates values between 0 and 1, - indicates values between 0 and -1,

* no category; included in "Other species"

Oak and ash are the most common hedgerow tree species making up over 65% of the total stock recorded in any year for England and Wales and Great Britain. In Scotland the most common species are ash and beech.

There were many gains and losses in numbers between 1990 and 1998 but none of these were statistically significant at the 95% level.

The age groups of hedgerow trees are shown in Tables 9a,b& c for England and Wales, Scotland and Great Britain.

The majority of hedgerow trees are aged over 20 yrs old for all countries and Environmental Zones. The majority of these fall into the '20-100yr' group with the second most common age group being 'over 100yrs'. These age grouping would reflect the most common hedgerow trees species found in the landscape, ash and oak.

There was a significant loss of 10,000 and 11,000 (40%) hedgerow trees in the 1-4 yr age class in both England and Wales and in Great Britain ($p < 0.01$, $p = 0.01$) between 1990 and 1998. A further loss of 42,000 hedgerow trees (55%) resulted from an age class being recorded in 1998. Further analyses may reveal flows between age classes.

In Scotland there was a small but significant loss ($p = 0.04$) of 3,000 (21%) 20-100 yr age class hedgerow trees. Again, further analyses may reveal flows between age classes.

Table 9 a, b & c. Estimated number of hedgerow trees in 1984, 1990, 1998 and change between 1990 – 1998 by country and age. Coefficient of Variation (CV) in percent and probability on a scale of <0.01 to > 0.99. . Shading with bold indicates probability of 0.01 or less, shading only a probability of 0.02-0.05. Data by Environmental Zone are also available.

Age	1984 stock		1990 stock		1998 stock		1990-1998 change			% change from 1990
	No. x 1000	CV	No. x 1000	CV	No. x 1000	CV	No. x 1000	CV	2 sided p	
a) England										
not recorded	23	36	76	21	33	34	-42	45	0.02	-55
1-4 yrs	32	40	26	29	16	40	-10	45	<0.01	-40
5-20yrs	345	19	280	16	290	15	16	>100	0.42	6
20-100yrs	978	11	950	9	959	8	24	>100	0.45	2
>100yrs	532	14	570	11	505	10	-38	60	0.07	-7
TOTAL	1910	10	1902	8	1803	8	-50	89	0.23	-3
b) Scotland										
not recorded	1	>100	0	n/a	0	n/a	0	n/a	>0.99	n/a
1-4 yrs	0	n/a	1	>100	+	>100	-	>100	0.73	-50
5-20yrs	1	68	3	59	5	66	-1	90	0.19	-37
20-100yrs	12	45	15	37	12	37	-3	55	0.04	-21
>100yrs	4	61	15	35	15	35	-	>100	0.83	-3
TOTAL	18	35	33	27	34	27	-5	70	0.10	-15
c) Great Britain										
not recorded	23	35	76	21	33	34	-42	45	0.03	-55
1-4 yrs	32	40	27	28	16	39	-11	44	0.01	-40
5-20yrs	346	18	282	16	295	15	15	>100	0.41	5
20-100yrs	990	10	965	9	971	8	21	>100	0.52	2
>100yrs	536	14	585	11	521	10	-38	60	0.07	-6
TOTAL	1927	10	1935	8	1836	8	-55	81	0.16	-3

Note: + indicates value between 0 and 1, - indicates value between 0 and -1

The estimated length of lines of hedgerow trees (tree-lines) in 1990 and 1998

The total estimated length of lines of hedgerow trees are presented in Table 10 for country and Environmental Zones and in Tables 11a,b & c for country and Environmental Zones by species.

There are nearly 80,000km of hedgerow trees in Great Britain in 1998, 74,000km of which occur in England and Wales. Environmental Zone 2&3 account for nearly 60,000km of hedgerow trees in England and Wales.

Environmental Zone 2 accounts for the greatest length of lines of hedgerow trees (37,000km) in 1998 in England and Wales and in Great Britain.

There has been a significant gain of lines of hedgerow trees ($p < 0.01$) in England and Wales (57%), Scotland (34%) and Great Britain (55%). The gains are also significant for Environmental Zone 1-4 with Environmental Zone 2 accounting for most of the gain (13,000km)

Table 10. Estimated length of lines of trees associated with hedgerows in 1990, 1998 and change between 1990-1998. Length presented in kilometres, Coefficient of Variation (CV) in percent and probability on a scale of <0.01 to > 0.99. Shading with bold indicates probability of 0.01 or less, shading only indicates a probability of 0.02 to 0.05.

		1990		1998		1990-1998			% change from 1990
		Length km	CV	Length km	CV	Length km	CV	2 sided p	
Country	EZ								
	1	14901.6	14.4	22293.7	11.9	7598.0	20	<0.01	51
	2	23066.7	14.6	37323.4	11.4	13539.8	17	<0.01	59
	3	4475.3	35.2	14855.2	23.7	2855.9	41	<0.01	64
England & Wales		42443.6	10.1	74472.3	8.2	23993.7	13	<0.01	57
	4	1365.5	36.5	2322.6	29.8	627.3	56	0.03	46
	5	1288.8	97.5	1208.1	91.5	286.5	770	.08	22
	6	0.0	n/a	0.0	n/a	0.0	n/a	n/a	0
Scotland		2654.3	50.9	3530.7	36.9	913.8	45	<0.01	34
Great Britain		45097.9	10.0	78003.0	8.0	24907.5	12	<0.01	55

Table 11a,b & c shows length of lines of hedgerow trees by species. In 1998 around 20% of lines of hedgerow trees were hawthorn in England and Wales and Great Britain and in Scotland over 50%.

Further analyses of lines of hedgerow trees will include age classes.

The large gains in lines of hedgerow trees, shown in Table 10, cannot necessarily be attributed to a shift from individual hedgerow trees to tree-lines (there has been no change in numbers of hedgerow trees in Table 7). Other reasons for gains in lines of trees will be explored.

Table 11 a, b & c. Estimated length of lines of trees associated with hedgerows in 1990, 1998 and change between 1990-1998 by species composition. Length presented in kilometres, Coefficient of Variation (CV) in percent and probability on a scale of <0.01 to > 0.99. Shading with bold indicates probability of 0.01 or less, shading only a probability of 0.02 to 0.05. Breakdowns by zones are also available.

a) Great Britain	1990		1998		1990-1998			% change from 1990
	Length km	CV	Length km	CV	Length km	CV	2 sided p	
Hawthorn	6353.4	26	15163.0	14	6856.8	19	<0.01	108
Oak	5049.1	22	7374.2	16	2057.7	35	0.01	41
Ash	3805.7	18	6398.2	15	2551.8	24	<0.01	67
Hawthorn+other	4225.1	23	6252.5	16	1248.7	50	0.03	30
Oak+other(except Hawthorn)	5631.8	30	6581.8	19	960.0	>100	0.58	17
Beech	815.6	43	1638.5	34	1138.7	41	<0.01	140
Other	19217.1	*	34594.9	*	10093.6	31	<0.01	53
TOTAL	45097.9	10	78003.0	8	24907.5	12	<0.01	55

(Table 11 continues on next page)

b) England and Wales

Hawthorn	4829.7	21	13306.7	14	6340.6	20	<0.01	131
Oak	4962.3	22	7269.2	16	2040.3	35	<0.01	41
Ash	3693.7	18	6235.3	16	2522.1	24	<0.01	68
Hawthorn+other	3612.3	25	5582.9	17	1263.4	47	0.01	35
Oak+other(except Hawthorn)	5612.2	30	6581.8	19	979.6	>100	0.62	17
Beech	704.1	47	1329.5	39	892.8	48	<0.01	127
Other	19029.5	*	34167.0	*	9954.9	31	<0.01	52
TOTAL	42443.6	10	74472.3	8	23993.7	13	<0.01	57

c) Scotland

Hawthorn	1523.8	84	1856.3	51	516.2	60	0.04	34
Oak	86.8	80	104.9	68	17.5	>100	0.07	20
Ash	112.1	56	162.9	45	29.7	95	0.24	27
Hawthorn+other	612.8	69	669.6	46	-14.6	>100	0.99	-2
Oak+other(except Hawthorn)	19.6	96	0.0	n/a	-19.6	96	0.26	-100
Beech	111.5	99	309.0	66	245.9	80	0.09	221
Other	187.7	*	427.2	*	138.7	>100	0.59	74
TOTAL	2654.3	51	3530	37	913.8	45	<0.01	34

* not available