

# Hedgerow Survey of Bedfordshire 1991

A report to Bedfordshire County Council

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## Introduction

A survey of hedgerow cover was carried out by Bedfordshire County Council Planning Department in 1978-79, and was published in 1980 as part of the Landscape and Wildlife Landscape Technical Volume. The purpose of this survey is to update this information in the Bedfordshire Environment Report No 3 to be published in spring 1993. Unfortunately because the original survey work was missing it was necessary to repeat the Hedgerow Sample Survey for 1976 using new sample data and the original aerial photographs.

## Methodology

This survey of Bedfordshire's hedges covered the whole of the county including the Greensand Ridge and Southern Chalk Hills excluded from the earlier study. The existing division of Bedfordshire into 9 natural regions was used as the foundation for the study and a 5% random sample of each of these regions excluding urban areas was taken giving a total of 49 one kilometre sample squares (Figure 1).

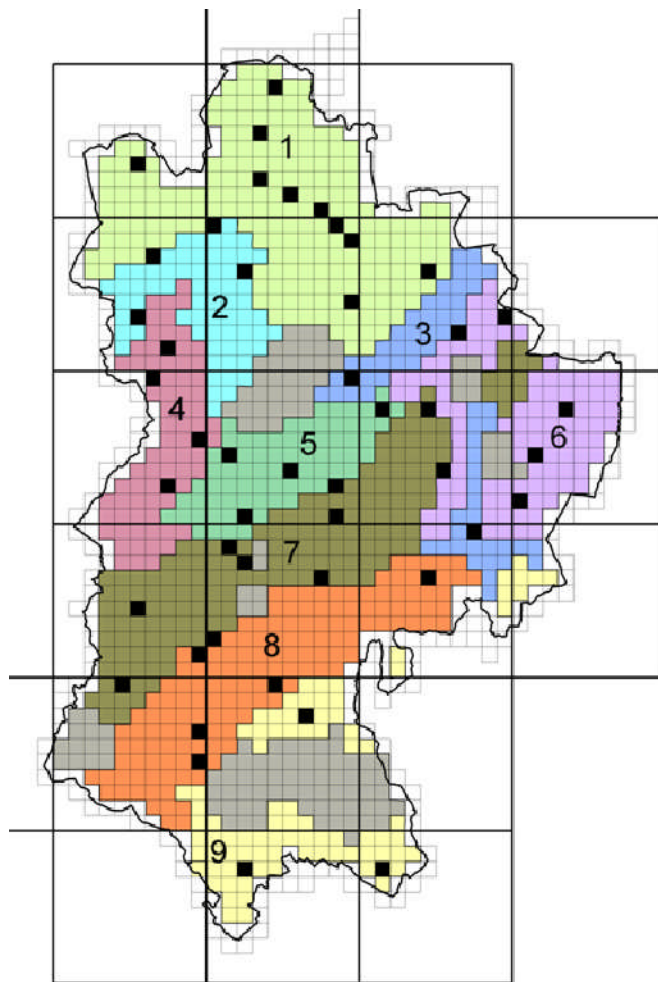


Figure 1 Bedfordshire Natural Regions and sample squares used in the 1991 county hedgerow survey. 1: North Bedfordshire, 2: Upper Ouse Valley, 3: Lower Ouse & Ivel Valleys, 4: West Bedfordshire Ridge, 5: Marston Vale, 6: East Bedfordshire, 7: Greensand Ridge, 8: Southern Clay Vale, 9: Southern Chalk Hills. Sample squares are indicated in black.

Monochrome aerial photographs were then used to plot the hedges in these areas in 1976, whereas full colour photographs were used for 1991. As monochromatic images contain less information than their colour counterparts the hedges surveyed from the 1976 images were simply classified into managed and unmanaged categories and used for a general comparison with the 1991 data.

The process for interpreting the colour images varied in that a more ambitious classification system that included pollarded (heavily/recently trimmed), clipped, overgrown and extremely overgrown (trees becoming dominant) hedges was used, after a training set for each of the categories was identified.

### Training set and discontinuity

The training set was derived from known examples of each hedge category located close to the Bedford Urban Area and subsequently identified in the aerial photographs. The training set was subsequently referred to when identifying hedgerows throughout the rest of the county.

Discontinuous (broken) lengths of hedge were also recorded as were hedge remnants when they were judged to be significant landscape

features. A hedge was judged to be discontinuous when breaks within the hedge were clearly identifiable in the aerial photographs, but the hedge continued to act as a boundary

despite being no longer stock proof. Remnants were judged on the basis that the amount of living hedge was significantly smaller than the amount of space between the hedgerow sections remaining along any boundary length.

#### Field validation

The data obtained were further supplemented by a series of 23 sample square site investigations covering a total of 72 hedges in all, to ascertain in general terms the species composition of the hedges in each of the natural regions, and to verify the results of the image interpretation.

The investigation process involved confirming hedge categorisation derived from the aerial photographs, then pacing off approximately a 100 m length of hedge, and recording the approximate proportions of the species within the hedge. The 100 m length was used to provide a representative length and to make an approximation of the constituent species simpler; the proportions being derived from the volume of the hedge taken up by each species. This avoided the need to identify each constituent plant, a classification system impractical in dense or overgrown hedges. Where 100 m lengths were unavailable the maximum length of available hedge was used. This produced a figure of 94% accuracy in identification made from the aerial photographs even with the survey being conducted one year after the images were taken.

Considering the small size of the supplementary sample (72 hedges with no more than 14 located in any one region) the results should not be considered as representative of species composition in any definitive sense, but should rather be regarded as indicative of regional variation countywide.

#### Results

Although the original sample site locations are unknown, it is still of interest to compare the data that do remain with the results of the revised 1976 survey as illustrated in Table 1. As can be expected using different sample squares, there is a noticeable regional variation; however, the county average for hedgerow length is precisely the same in both surveys at 4.0 km per km<sup>2</sup>.

Table 1 Changes in average hedgerow length in Bedfordshire per km<sup>2</sup>, between 1945 and 1991

Natural Region	1945	1976 (original)	1976 (revised)	1991
1. North Bedfordshire	5.8	3.7	3.5	3.8
2. Upper Ouse Valley	4.2	3.8	5.3	5.8
3. Lower Ouse & Ivel Valleys	4.0	3.1	4.0	3.7
4. West Bedfordshire	5.4	4.7	5.2	4.7
5. Marston Vale	4.1	3.5	4.1	3.6
6 East Bedfordshire	4.3	3.3	2.9	1.6
8. Southern Clay Vale	6.6	5.8	3.4	3.9
Survey area	4.9	4.0	4.0	3.8

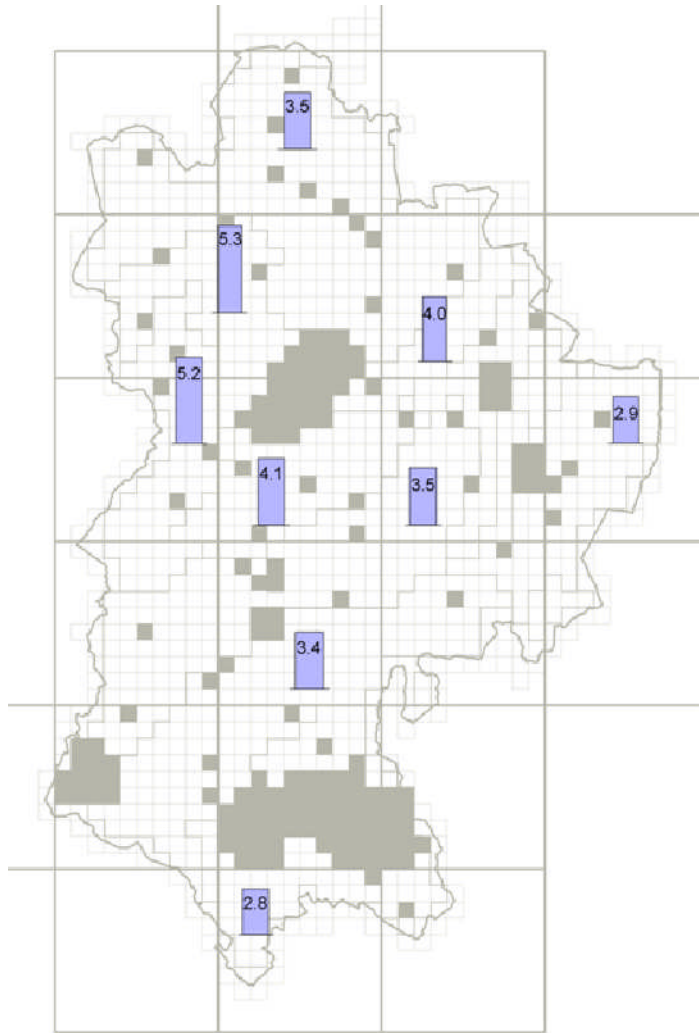


Figure 2 Average length of hedgerows per km<sup>2</sup> in each Natural Region, 1976

In 1976 the 491 km<sup>2</sup> sites contained a total hedgerow length of 182.8 km, of which 127.3 km was managed and 55.5 km unmanaged giving a county average of 3.7 km<sup>2</sup> (Figure 2 and Table 2). By 1991 the same sites contained 173.9 km (excluding remnants), categorised as follows: 41.6 km pollarded, 69.5 km clipped, 39.6 km overgrown, 23.4 km very overgrown or 3.5 km per km<sup>2</sup>, a loss of 8.9 km, 4.8% of the 1976 total (Figure 3). This figure is further reduced if the data are normalised to account for variations in sample and regional size. This produces a figure for loss of 1.8%, indicative that the rate at which hedgerows are being lost from the county is a fraction of its earlier level and/or is being balanced by the reintroduction of hedgerows into the landscape (Table 3). It should be noted that remnants have been excluded from the 1991 overall total as the 1976 figures do not contain figures for remnants either inclusively or separately.

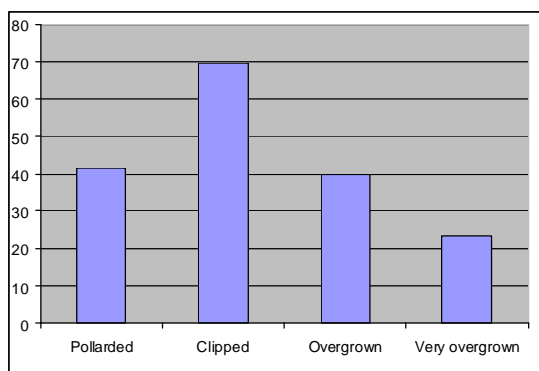


Figure 3 Hedgerow length in the 1976 sample squares in 1991, by type of management

Table 2 Change in hedgerow cover in Bedfordshire by Natural Region, 1976-1991

	Natural Region									
	1	2	3	4	5	6	7	8	9	
1976 managed (km)	28.0	13.7	9.7	16.7	11.6	10.9	17.6	13.8	5.3	
1976 unmanaged (km)	11.1	2.2	2.4	4.3	5.0	3.9	10.4	10.3	5.9	
1976 total (km)	39.1	15.9	12.1	21.0	16.6	14.8	28.0	24.1	11.2	182.8
1991 managed (km)	24.6	11.8	7.3	13.7	13.1	2.0	12.3	22.2	4.1	
1991 unmanaged (km)	18.2	5.7	3.9	5.2	1.4	6.1	10.1	5.3	6.9	
1991 total (km)	42.8	17.5	11.2	18.9	14.5	8.1	22.4	27.5	11.0	173.9
Change (km)	+3.7	+1.6	-0.9	-2.1	-2.1	-6.7	-5.6	+3.4	-0.2	-8.9
Change (%)	+9.4	+10.0	-7.4	-10.0	-12.6	-45.2	-20.0	+14.1	-1.7	-4.8

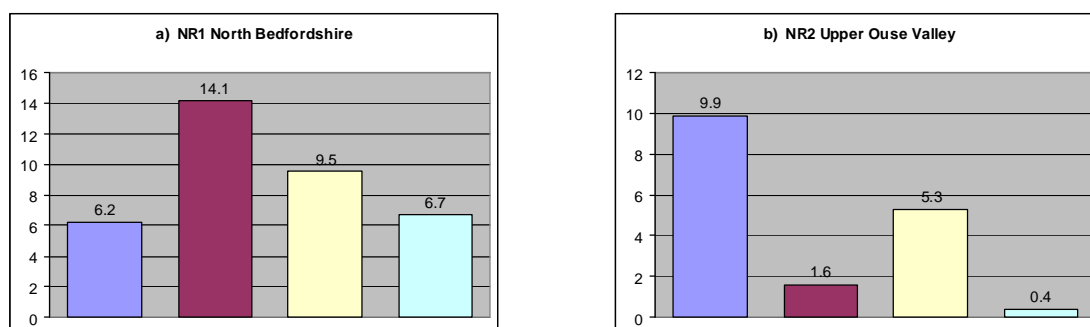
Table 3 Hedgerow loss in Bedfordshire Natural Areas between 1976 and 1991, taking account of sample size variation

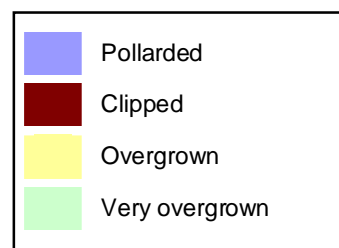
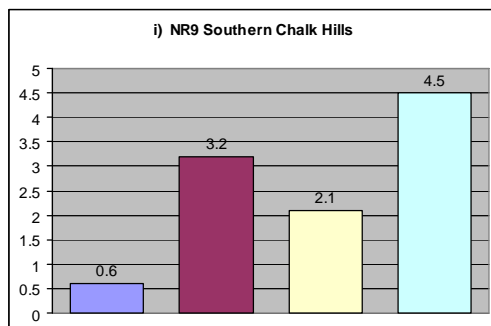
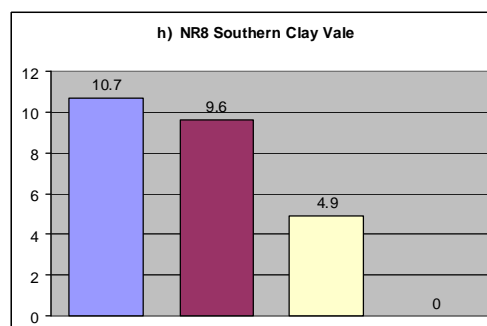
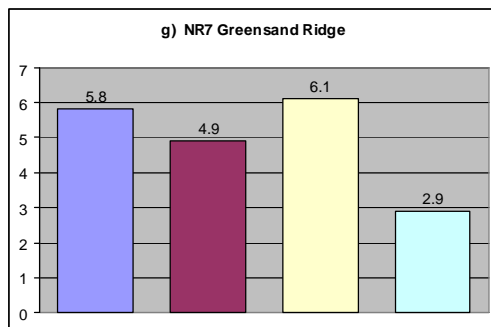
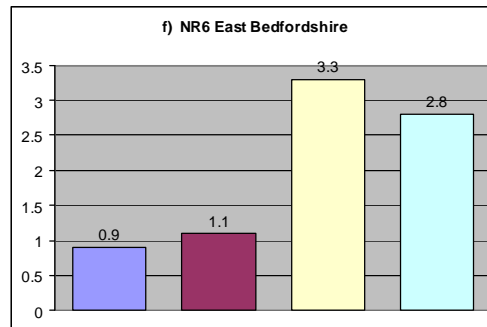
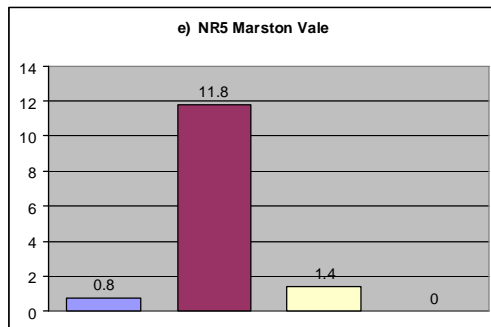
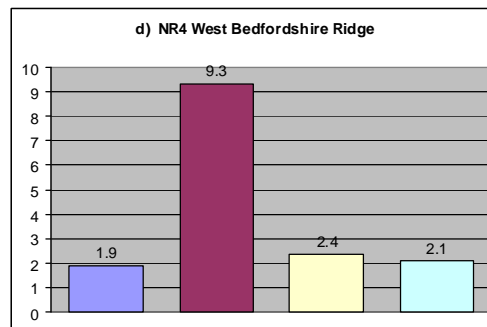
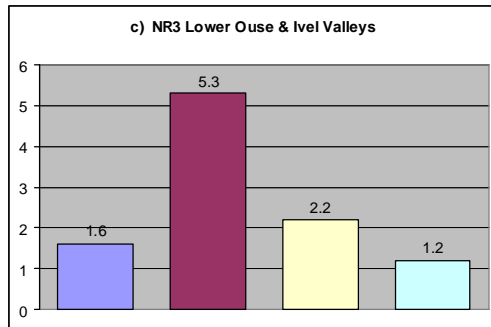
Region	Area (km <sup>2</sup> ) (A)	Sampled area (km <sup>2</sup> ) (B)	Estimated 1976 hedge length (km) (C <sub>1</sub> ) (km)	Total 1976 hedge loss (C <sub>1</sub> x A/B) (km)	Estimated 1991 hedge length (C <sub>2</sub> ) (km)	Total 1991 hedge loss (C <sub>2</sub> x A/B) (km)
1	216	11	39.1	767.7	42.8	840.4
2	68	3	15.9	360.4	17.5	396.4
3	64	3	12.1	258.1	11.2	238.9
4	75	4	21.0	393.7	18.2	354.3
5	74	5	16.6	245.6	14.5	214.6
6	103	5	14.8	304.8	8.1	190.5
7	172	8	28.0	602.0	22.9	492.3
8	151	7	24.1	519.8	28.9	623.4
9	87	3	11.2	324.8	12.3	356.7
			182.8	3776.9	177.1	3707.7

Countywide estimated change in total hedgerow length 1976-1991 = -1.8%

These figures are encouraging when compared to the previous loss of 24% of all hedgerows between 1945 and 1976, as they indicate a substantial reduction in the annual rate of loss. Concealed within this figure however are significant variations within the county's natural regions (Figure 4).

Figure 4 Hedgerow length (km) by management type and Natural Region in 1991





### Managed and unmanaged hedge

The loss of managed hedge, typically between 12% and 30% is a prominent characteristic of change since 1976 (Figure 5a). On average managed hedge is down 12.7% countywide, although regional variation exists with marked increases in the Marston Vale (+11.4%) and the Southern Clay Vale (+37.8%).

Corresponding changes had taken place in unmanaged hedgerows by 1991 (Figure 5b), with a countywide average increase of 11.6%. Again this figure conceals regional variation with the greatest increases in the Upper Ouse Valley of 61.4%, North Bedfordshire 39.0%, and the Lower Ouse and Ivel Valleys 38.4%. A notable exception is the Marston Vale where overgrown hedges have decreased by 72.0%. Coupled with the increase in total hedgerow

cover in North Bedfordshire this suggests that alongside some new planting there is still widespread neglect of existing hedges.

Figure 5 Change in average length of a) managed and b) unmanaged hedgerows per km<sup>2</sup> from 1976-1991, by Natural Region of Bedfordshire

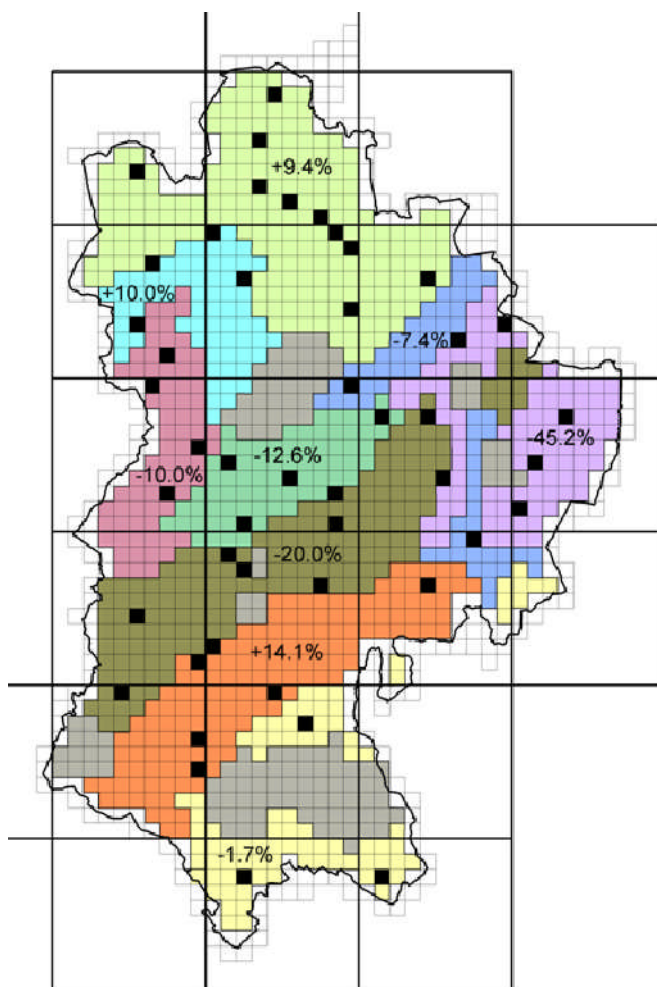
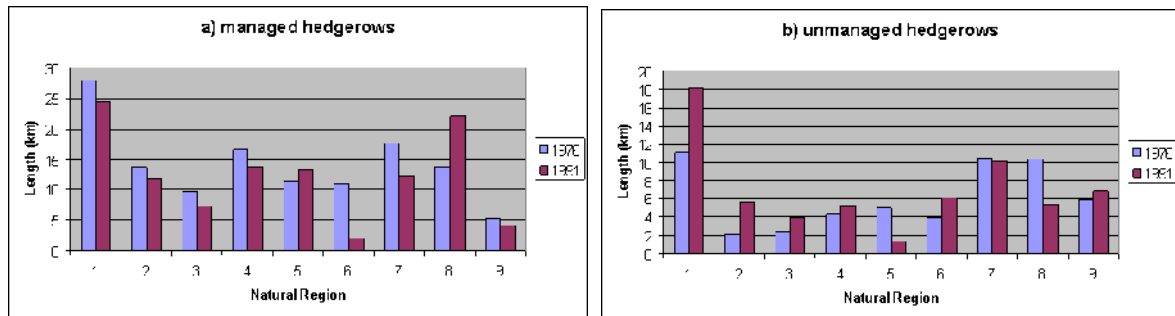


Figure 6 Change in overall hedgerow length from 1976 – 1991 in the nine Natural Regions of Bedfordshire

North Bedfordshire and the Upper Ouse Valley show increases in hedgerow cover of +9.4% and +10% respectively along with the Southern Clay Vale at +14.1%. The more central regions of Bedfordshire (Regions 3 to 7) and the Southern Chalk Hills have experienced a net loss in hedgerow cover of 17.6 km most especially noticeable in East Bedfordshire where 45.2% of the hedgerow has been lost since 1976, 81.6% of it in the form of managed hedge (Table 2 and Figure 6).

### Discontinuous hedge and remnants

Figures for clearly discontinuous hedge and hedge remnants are not available prior to this survey, however 1991 figures indicate that remnants and discontinuous hedges are of some importance in the overall framework of hedgerows within the county, remnants occupying

10.4% of the hedgerow total (Figure 7), with discontinuity in a range from 1.7% Upper Ouse Valley to 16.9% in the West Bedfordshire Ridge (Figure 8).

As would be expected the well managed hedges suffer less from discontinuity than their unmanaged counterparts (Table 7), with one major exception in the West Bedfordshire Ridge, where pollarded hedges surveyed suffer 84.2% discontinuity, indicating that although the hedges are managed, they are not maintained as stock proof boundaries, suggesting perhaps an increased awareness in the value of hedgerows as a landscape feature.

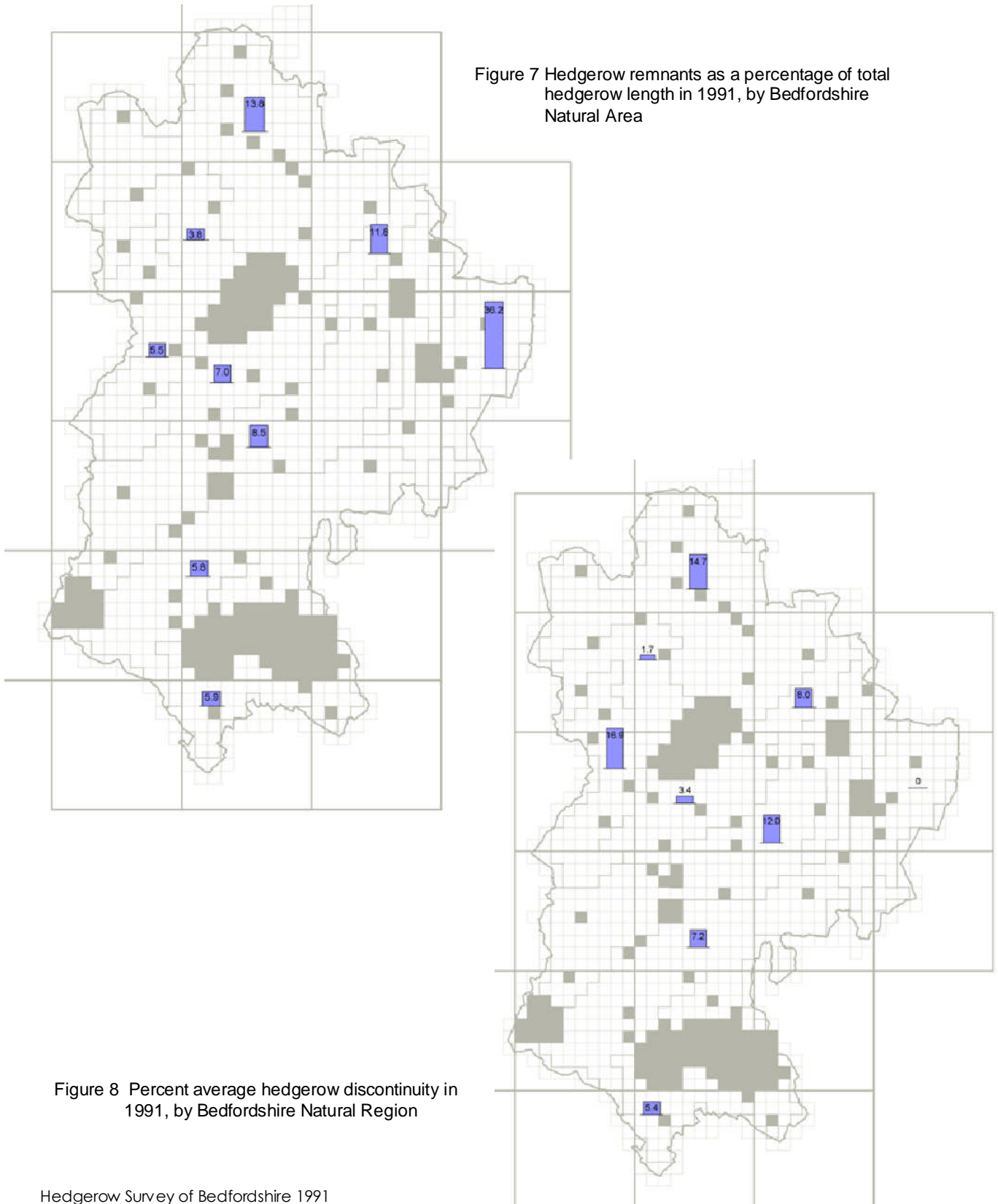


Table 7a Percent of clearly discontinuous hedgerow in Bedfordshire by Natural Region, 1991

Natural Region	Pollarded	Clipped	Overgrown	Very overgrown	Regional average
1	12.9	24.8	10.5	14.9	14.7%
2	3.0	-	-	-	1.7%
3	-	7.5	22.7	-	8.0%
4	84.2	9.6	-	33.3	16.9%
5	-	4.2	-	-	3.4%
6	-	-	-	-	-
7	3.4	28.5	8.1	20.6	12.0%
8	2.8	16.6	2.0	-	7.2%
9	-	9.3	14.2	-	5.4%
Category average	8.3	14.1	6.4	11.9	

Table 7b Hedgerow remnants as a percentage of total hedgerow length, 1991

	Natural Region									County
	1	2	3	4	5	6	7	8	9	
Remnants as % of total hedge length	13.8	3.8	11.8	5.5	7.0	36.2	8.5	5.8	5.9	10.4
Total remnant length (km)	6.8	0.7	1.5	1.1	1.1	4.6	2.1	1.7	0.7	20.3

### Supplementary species survey

The supplementary hedge composition survey identified a total of 25 species within the sampled sites, with Ash, Blackthorn, Elm, Hawthorn and Oak occurring in all of the nine regions. Secondary to these species in frequency are Elder, Field Maple and Rose, which occurred in 80% of the sample sites. The relative proportion of each species in each region can be seen in Table 8 and countywide in Table 9.

Table 8 Hedgerow species percent occurrence in Bedfordshire by Natural Region, 1991

Species	Natural Area									County
	1	2	3	4	5	6	7	8	9	
Alder	0.08	-	-	-	-	-	-	-	-	0.008
Ash	3.04	5.0	5.6	3.0	0.5	8.75	1.25	3.0	4.7	3.8
Beech	0.2	-	-	-	-	-	-	-	2.0	0.2
Blackthorn	11.7	20.0	5.6	9.4	3.3	46.2	12.1	8.8	7.5	13.8
Buckthorn	-	-	3.7	-	-	-	-	-	-	0.4
Crab apple	-	-	-	1.2	-	-	-	-	-	0.1
Elder	2.6	2.5	3.1	0.5	-	1.0	5.0	5.0	5.8	2.8
Elm	0.75	5.6	20.2	32.5	16.6	36.7	48.7	33.8	6.6	22.4
Field maple	0.8	1.7	-	3.1	3.0	3.1	1.2	1.1	1.2	1.7
Hawthorn	79.4	39.5	58.1	46.2	70.5	0.2	18.7	41.1	65.0	46.5
Hazel	-	12.5	-	-	-	-	-	-	4.6	1.9
Holly	-	-	-	-	-	-	-	-	0.4	0.04

Species	Natural Area									County
	1	2	3	4	5	6	7	8	9	
Hornbeam	0.2	5.6	-	-	-	-	-	-	-	0.6
Horse chestnut	-	-	-	-	0.3	-	-	-	-	0.04
Lime	-	-	0.6	-	-	-	-	3.3	-	0.4
Norway maple	-	-	0.6	-	-	-	-	0.4	-	0.1
Oak	0.6	1.1	1.2	0.6	3.3	0.6	4.1	1.9	0.4	1.5
Osier	-	-	-	-	-	-	1.25	-	-	0.1
Privet	-	-	0.2	1.2	-	-	-	-	-	0.1
Plum	0.08	0.2	-	-	-	-	-	-	-	0.04
Rose	0.3	3.2	-	1.5	0.3	0.5	-	1.1	0.7	0.8
Sycamore	-	-	-	-	-	2.7	-	-	-	0.3
Sallow	-	2.5	0.6	-	-	7.5	-	-	0.4	1.2
Whitebeam	-	0.3	-	0.6	-	-	-	-	-	0.1
Yew	-	-	-	-	-	-	-	0.5	-	0.06

Table 9 Bedfordshire hedgerow constituent species in order of occurrence

Rank	Species	Percent occurrence	Rank	Species	Percent occurrence
1	Hawthorn	46.50	14	Sycamore	0.30
2	Elm	22.40	15	Beech	0.24
3	Blackthorn	13.86	16	Privet	0.16
4	Ash	3.87	17	Crab apple	0.14
5	Elder	2.84	17	Osier	0.14
6	Hazel	1.90	18	Norway maple	0.11
7	Field maple	1.71	18	Whitebeam	0.11
8	Oak	1.56	19	Yew	0.06
9	Sallow	1.23	20	Plum	0.04
10	Rose	0.85	20	Holly	0.04
11	Hornbeam	0.65	20	Horse chestnut	0.04
12	Lime	0.44	21	Alder	0.008
13	Buckthorn	0.40			

### Single species hedges

Single species hedges (defined as those comprised of 90%+ single species) occur throughout the county (Figure 9), most notably in North Bedfordshire where 71.4% of the hedges sampled were Hawthorn hedges. This figure is much lower elsewhere in the county where single species hedges vary in occurrence from 14.2% in the Upper Ouse Valley to 40% in East Bedfordshire and the Marston Vale. Neither are all single species dominated by Hawthorn: the Greensand Ridge contains 28.5% single species hedges, all of them Elm. This compares to an average of 22.2% of single species elm hedges elsewhere in the county.

Regenerating Elm also features highly as a hedgerow constituent, occurring as the second most common plant species after Hawthorn outside the North Bedfordshire region.

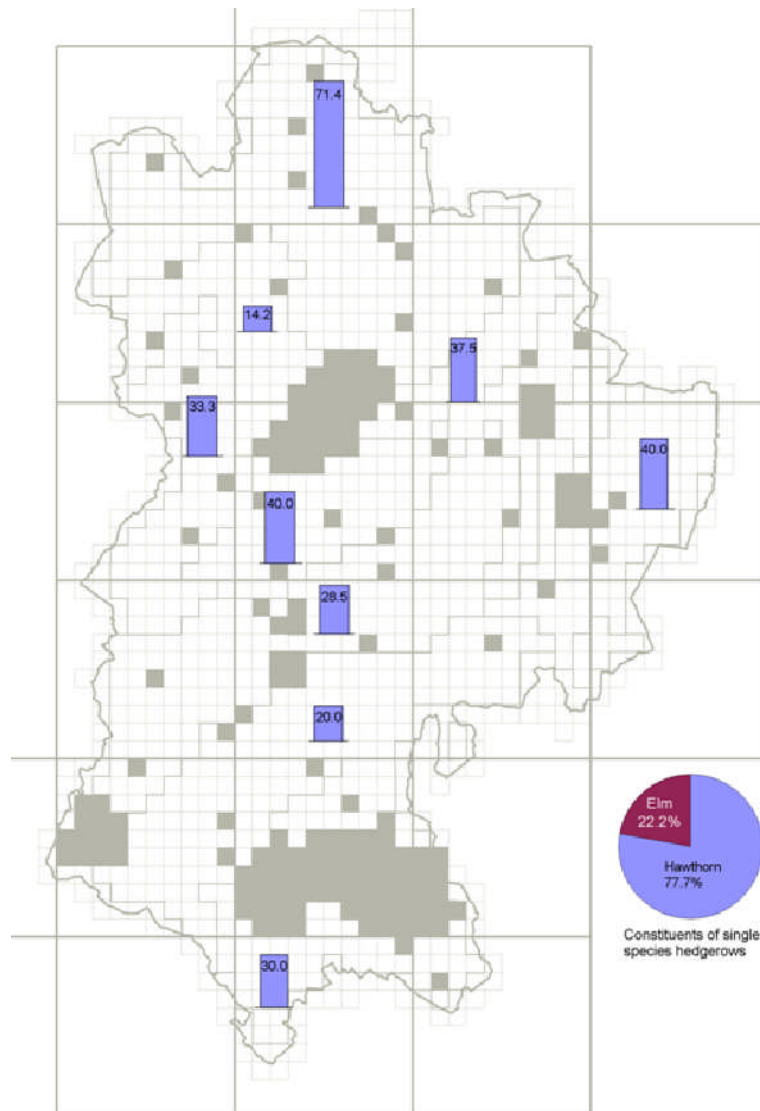
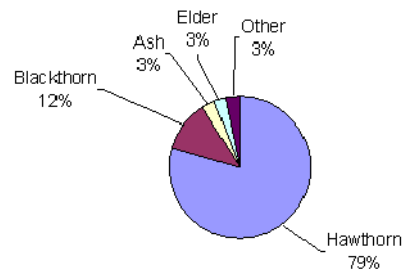


Figure 9 Percentage of Bedfordshire hedgerows with >90% single species in 1991, by Natural Region

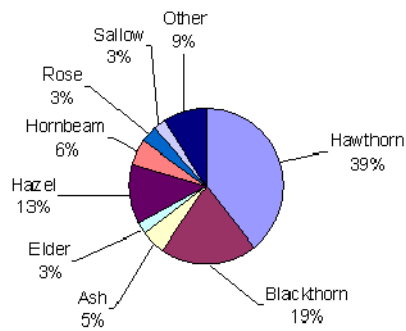
An interesting variation on the regional species mix occurs in East Bedfordshire (Figure 10), where Blackthorn at 46.25% replaces entirely Hawthorn as the dominant hedgerow species in the sampled sites. Hawthorn being recorded at 0.25%, its lowest level in the survey. This coincides with the high level of hedgerow loss especially in managed hedge where Hawthorn is commonly the primary species.

Figure 10 Species composition of Bedfordshire hedgerows 1991, by Natural Region

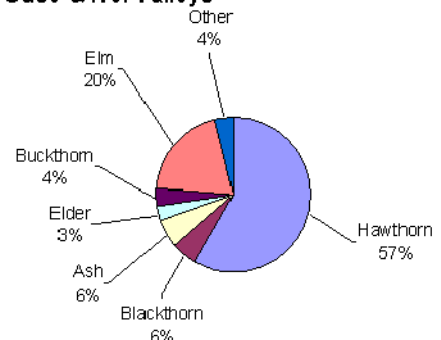
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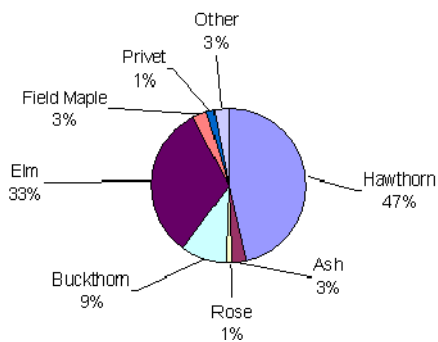
b) NR2 Upper Ouse Valley



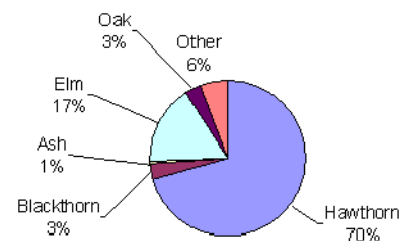
c) NR3 Lower Ouse & Ivel Valleys



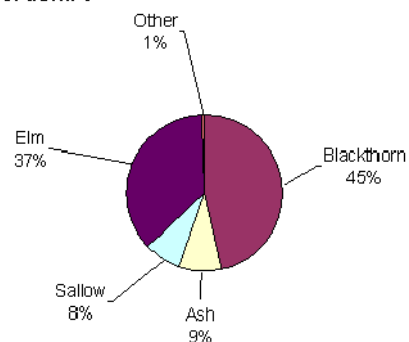
d) NR4 West Bedfordshire Ridge



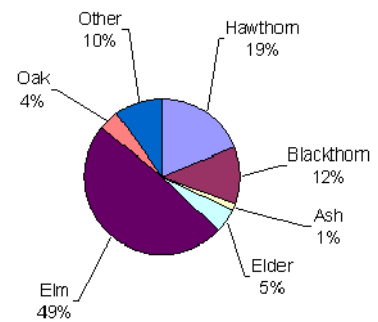
e) NR5 Marston Vale



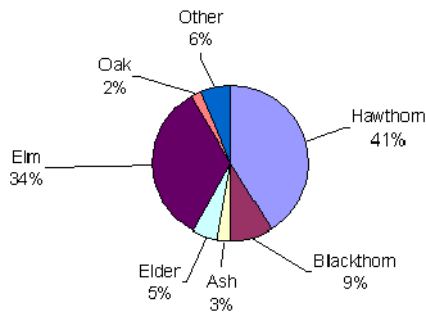
f) NR6 East Bedfordshire



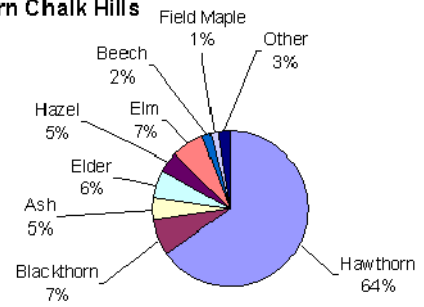
g) NR7 Greensand Ridge



**h) NR8 Southern Clay Vale**



**i) NR9 Southern Chalk Hills**



Overall, between 8 and 13 species were recorded for each of the natural regions with fewer variations than might be expected considering the differences in underlying geology and relief that exist across the county. Variation is more apparent on an individual hedge basis where age plays a greater role in determining the number of species within a hedge. Species type also tends to follow localised landscape practices, with crab apple and plum occurring close to orchards, and Alder, Sallow and Osier beside drainage ditches and ponds. Exceptions to this however are evident when the hedgerow can be seen to be close to or derived from woodland areas, where the woodland itself in combination with the soil and geology influence the species composition as is the case on the Southern Chalk Hills.

## Hedgerow Survey 1992 – Observations

The 1991 Hedgerow Survey also provided ancillary non-quantifiable information beyond the survey data in terms of general impressions from the study of over 49 aerial images, site investigation and contact with landowners and tenants.

**Aerial photography:** The quality of the 1976 monochrome images is good in terms of resolution and delineation of features within the image, however lack of further information in the visible colour spectrum required hedgerow identification be based primarily on shape and texture and tone rather than colour variations. This proved to be the primary restriction on hedgerow categorisation. Also the scale of the photographs did not allow for completely accurate identification of spaces and gaps within any one hedge; figures for discontinuity were therefore not included in the 1976 data.

**Elms:** In the 1976 images it is possible to see a large number of dead mature hedgerow trees. Inferring from their overall form and location suggests that they are Elms suffering from the ravages of Dutch Elm Disease, and in some locations trees can be seen to have been removed leaving gaps in hedgerow length, effectively reducing their length.

The introduction of 'gappiness' into a hedge through the removal or death of hedgerow trees could be viewed as one of the initial stages in the degradation of a hedge. Once the hedgerow has been broken, it is no longer present as a complete physical barrier or a perceived one; and in some circumstances may be viewed as either without use or even a hindrance. If in such cases repair is delayed or not forthcoming the hedge may be neglected with detrimental results.

The effects of this are identifiable in 1992 through the presence of regenerating Elm often close or next to gaps in hedgerow length, often filling the gaps created by the removal of the original earlier tree.

Similarly avenues of Elm and lines of Elm that have been felled have regenerated to produce Elm hedges where previously a stand of trees existed. The effect of Elm removal may also have further localised effects. Reduced immediate competition for light, nutrients and space may encourage the growth of other opportunistic hedgerow species.

**Trimming:** The effects of some of the mechanical methods used to trim and maintain hedges are noticeably to the detriment of the hedge as a whole. Hedgerows that had been mechanically clipped tended to be cut back further than is perhaps necessary, hindering regeneration. The hedge looks untidy and contains naked splinters, in some extreme cases hedgerow components can be seen to have died directly as a result of overtrimming.

**Two sides to a hedge:** Identification of hedge category sometimes proved difficult when one side was clipped and maintained while the other side remained untended. In such situations other boundary features were used such as paths, tracks, ditches and fences to determine on which side the hedge should be sampled. If the hedge was clearly planted on land on which the side of the hedge was maintained, it was considered a managed hedge and vice versa.

**Form:** The most difficult type of hedge to identify in the aerial photographs proved to be the pollarded hedge. Represented on the images as pale, very narrow linear features, they resemble closely drainage channels also located on field boundaries, and to the naked eye the colouration is similar.

Most misidentification of hedgerows took place with clipped hedge initially recorded as overgrown. In some cases clipped hedge has been allowed to grow extremely tall, beyond the reach of the mechanical arm used to do the trimming. In consequence, although the hedge is managed in its lower sections the crown is unmanaged and overhangs the clipped section beneath. From the air the hedgerow looks to be extremely overgrown whilst in fact it is under active management.

**Constituents:** The species survey is by no means definitive of Bedfordshire's hedgerow constituents. The species list only reflects the species present in the surveyed hedges. Notable by their exception from the survey, especially in the south of the county, were Dogwood and Spindle. Both species were seen to be present within hedgerows around Luton but did not occur in the sampled hedges.

**Ad hoc:** Finally, in some locations the data recorded do not perhaps represent the region in the best possible manner. For example in the Marston Vale, one of the sites sampled (22) includes the boundary hedgerows of Bedfordshire's first Link Farm (Wood End Farm), and the level of management and condition of the hedgerows is over and above that in the surrounding landscape.