CENTRE FOR ECOLOGY AND HYDROLOGY

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Trends in Broad Habitats:

England 1990-1998

L R Norton, J W Watkins, S M Smart,
R C Stuart, D C Howard

Centre for Ecology & Hydrology
Merlewood Research Station
Grange over Sands
Cumbria LA11 6JU

C O N T E N T S

SUMMARY

BACKGROUND

In order to set 'priority' habitats and species requiring conservation action in context, a classification of 'Broad Habitat' types was developed as part of the UK Biodiversity Action Plan, of which results from 15 terrestrial habitats are reported in Countryside Survey 2000 (CS2000). Two indicators from a suite of 'Quality of Life Counts' (landscape features and plant diversity) were derived from Countryside Survey data, and these are also reported. CS2000 and its predecessors provide baseline data for future surveys of countryside change in England.

The Countryside Survey was first carried out in 1978, with additional surveys in 1984, 1990 and 1998 (for CS2000). The main terrestrial components of the field survey included; habitat/land cover mapping and the recording of species composition in permanently marked plots. The survey estimated the 'stock' (or amount) of each terrestrial Broad Habitat in Great Britain and the change in stock by comparing areas visited in both 1990 and 1998. It was recognised that the methodology could not provide reliable information on all Broad Habitats, especially those with a limited distribution. A suite of condition indices for plant species based on Ellenberg indicator values of soil fertility, soil pH and light, and the three established plant strategies, *viz*. ruderals, stress-tolerators and competitive plants, were used to express fine scale vegetation change. Changes in these indices can be used to assess changes in vegetation quality and to infer possible drivers of change.

The results of the CS2000 for England and Wales and Scotland were published in late 2000 (Haines-Young *et al.* 2000). This report presents the findings from an analysis of results from the 302 1km squares which were surveyed in England.

MAIN FINDINGS

- There was a significant decrease in the stock of *Acid Grassland* in England with large losses to *Improved Grassland* and a slight but significant increase in competitive plant species within the Broad Habitat itself.
- There was also a marginally significant decrease in the already limited stock of *Calcareous Grassland* in England, again with losses mainly to *Improved Grassland.*
- The stock of *Neutral grassland* remained largely unchanged but a significant decrease in species richness and increase in the number of competitive plant species indicates a decline in the quality of the Broad Habitat.
- There was a significant increase in the stock of *Fen, Marsh and Swamp* in England. This may result from a decline in grassland management and an increase in the cover of rushes on grassland, as gains were from the grassland Broad Habitats.
- There was a significant increase in the stock of *Broadleaf, Mixed and Yew Woodland* with gains both from *Arable and Horticultural* and from *Coniferous Woodland.*
- In contrast, *Coniferous Woodland* showed a significant decline in stock, which may indicate that policies seeking to increase the proportion of broadleaf trees in plantations are proving successful.
- A significant increase in the stock of *Built-Up and Gardens* at the expense of *Arable and Horticultural, Broadleaf Woodland* and *Improved* and *Neutral Grassland* reflects the increasing pressure for development on rural land in England.
- For some Broad Habitats, no significant net change in stock was detected by the survey, although there were interchanges between habitats. Changes in the botanical composition of some Broad Habitats also occurred.

- There were significant decreases in species richness in [1]boundary and [2]roadside verge plots within the *Linear (transport) Features* Broad Habitat, together with a slight increase in the nitrogen score and a slight decrease in the light score indicative of increasing rankness of vegetation.
- The same kind of patterns (significant decreases in species richness and light score, together with increases in the nitrogen score and numbers of competitive species) were recorded in the *Rivers and Streams* Broad Habitat indicating possible eutrophication of streamside vegetation.

Quality of Life Counts[1]

Landscape features

- There was no significant change in the lengths of managed hedges and walls. However, the length of relict hedges, including lines of trees and shrubs, increased significantly. whilst length of remnant hedge decreased significantly. Both of these imply a progressive deterioration in the management of hedgerows.
- There was an increase in the length of post and wire fences in England of around 6%.
- Increases in the nitrogen score in boundary plots associated with landscape features which form boundaries (including fences and hedges), together with decreases in species richness and the light score, accord with similar patterns found in a number of plot types (including, boundary, roadside and verge and all plots excluding [3]targeted) within the linear features Broad Habitat.
- Boundary plots associated with *Neutral* and *Improved Grassland*, showed significant decreases in species richness whereas boundary plots in *Arable and Horticultural* showed no significant change in species richness.

Plant diversity

- An overall analysis of the data for all plot types (excluding targeted plots in order to avoid bias) showed that species richness was significantly lower in 1998 than in 1990.
- Whilst [4]main plots did not show a decline in species richness, linear plot types (boundary, roadside and verge and [5]streamside and riverside) and targeted plots had a lower species richness in 1998 than in 1990.
- This was confirmed within Broad Habitat types where decreased species richness appeared to be mainly associated with linear plot types.
- Overall, losses in species richness were generally associated with agricultural grasslands, field boundaries and verges, some gains occurred on arable land.

[1] Boundary plots are linear plots 10x1m plots placed along field boundaries
[2] Roadside verge plots are linear plots 10x1m placed along roadside verges
[3] Targeted habitat plots are 2x2m plots non-randomly placed in areas of habitat interest
4 Main plots are random plots of 14 x 14m placed in fields and unenclosed land away from field boundaries
[5] Streamside and riverside plots are 10x1m linear plots placed along stream and riversides

1. COUNTRYSIDE SURVEY

1.1 Background

The Convention on Biological Biodiversity was agreed at the Earth Summit in Rio de Janeiro, 1992. The Convention, which was signed by 150 countries (including the United Kingdom and the European Union), placed an onus on each signatory to –

'…develop national strategies, plans or programmes for the conservation and sustainable use of biodiversity….'

The UK Biodiversity Action Plan (1994) set out a programme of action to conserve and enhance biological diversity throughout the UK. It outlined the effects of land management on the rural environment, including –

- the loss and fragmentation of habitats due to intensified farming practices (including grazing), land drainage and road building
- the loss of habitats, linear features and species due to habitat neglect or abandonment and the decline of traditional forms of management
- damage to soils, water and ecosystems due to inappropriate use of fertilisers and pesticides

In order to set priority habitats and species requiring conservation action in context, a classification of Broad Habitat groups has been developed (UK Steering Group, 1995). In the most recent classification (Jackson, 2000) there are 37 Broad Habitat types. This report presents the results of CS2000 for England only for the first time including the fifteen terrestrial habitats which occur in England.

Sustainable development (integrating environmental, social and economic dimensions) aims to ensure that our present quality of life can be maintained. In 1999, a suite of indicators, known as 'Quality of Life Counts' were published (Government Statistical Service, 1999). They were intended to assess progress towards sustainability in the UK. Two of these indicators (landscape features and plant diversity) were derived from Countryside Survey data. These are reported for England in the chapters 2 and 3.

1.2 Methodology

The Countryside Survey (CS) methodology has developed since the first survey in 1978, with additional surveys carried out in 1984, 1990 and 1998 (for CS2000). In 1978, 126 1km squares were visited in England, but by 1990, the number had been increased to 264 1km squares and in CS2000 302 squares in England were surveyed.

The objectives of CS2000 were to-

- Record the stock of features associated with the wider countryside, including information on land cover, landscape features, terrestrial and freshwater habitats and species
- Determine change by comparison with earlier surveys
- Maintain and refine the baseline set down in 1990 to ensure that survey data continue to be relevant to current policy needs

Precision of land cover estimates

In CS1990 country estimates for England, Scotland and Wales were based on the frequency of Land Classes in the country multiplied by the mean class values in the whole of Great Britain for the feature being reported. Therefore, estimates for a land class in England might have been based on a mean that included sample squares, not only in England, but also in Scotland and Wales. In CS2000, in order to enable separate reporting for Scotland and 'England and Wales' land classes did not cross the Scottish border.

The changes to the sampling design needed to accommodate country-level reporting depended on 1) the level of precision of the estimates, and 2) the framework used to report the results. The standard errors attached to the reporting categories are affected by –

- the statistical properties of the basic field survey classes
- the level of aggregation used to create reporting classes. In general, merging the basic survey elements to create larger classes reduces standard errors

Following consultation with user groups, a reporting framework for Biodiversity Action Plan (BAP) Broad Habitats was adopted as a way of extending the policy relevance of CS2000. Area estimates were made for the main terrestrial Broad Habitats with standard errors that are less than, or close to, 25% of the mean. To reduce the errors from 25% to 12.5% would require at least four times as many samples for many of the Broad Habitats, and it was recognised that the CS could not provide reliable information on all Broad Habitats, especially coastal habitats or those with a limited distribution.

Reporting change

Change in England was estimated at two scales: large scale changes between Broad Habitats and fine scale changes in vegetation composition and condition within sample plots. In 1999, a suite of indicators, known as 'Quality of Life Counts', were published by DETR (Government Statistical Service, 1999). These were intended to assess progress towards sustainability in the UK. Two of these indicators (landscape features and plant diversity) were derived from the Countryside Survey data and trends in them were determined in the 1998 survey.

Differences in the survey methodology between 1990 and 1998 account for some of the apparent anomalies between stock of Broad Habitats in 1990 and 1998, as well as estimates of change of stock. CS1990 stock and estimates of change in stock between 1990 and 1998, were calculated using the 262 squares common to both surveys. The 1998 improved stock estimate was based on the 302 squares surveyed for England in CS2000. CS20000 provides a baseline for future surveys of countryside change in England.

A suite of condition measures was used to express fine-scale vegetation change, describing the location of vegetation characteristics along major environmental gradients. These gradients included substrate fertility, substrate pH and shade for which condition measures were based on Ellenberg indicator values (Bunce *et al*. 1999, Hill *et al.* 1999). These are values attributed to species, which define their ecological range in terms of fertility, acidity, light and moisture (Ellenberg, 1974). Other condition measures were based on changes in the proportional contribution of Grimes' (1979) three established plant strategies: ruderals, stress-tolerators and

competitors. 'Ruderals' have high demands for nutrients and/or are intolerant of competition. They are species that frequently colonise waste ground. 'Stress-tolerators' are species that are tolerant of environmental stress (such as severe drought, or lack of nutrients). They are usually slow-growing perennials. 'Competitors' are plants that survive by 'out-growing' other species and usually require good climate or soil conditions to maintain their fast growth. Changes in these indices can be used to assess changes in vegetation quality and to infer possible drivers of change.

The Field Survey

The underlying principles of the field survey are that-

- the methods should be objective and repeatable
- the statistical precision of the data can be quantified
- the data can be linked at a variety of scales
- outputs from any part of the project can be modified by reference to data from other components to allow the development of predictive models.

All the National Grid 1km squares in Great Britain (c.240 000, of which 34% were in Scotland) were classified into 40 environmental land-class strata. The land classes were derived from broad environmental data on climate, geology, topography and anthropogenic features, but independently of land use or vegetation types. Thus, for any 1km square, the land-class does not change over time, but squares in the same class can look different because of regional differences in land management. From these land classes, a stratified random sample was generated to ensure that the ecological variability of the whole country was covered, as well as the principal land cover types. In order to accommodate 'country' reporting the land classes were sub-divided by country and extra squares were surveyed in those classes that did not have adequate representation. For England, it was decided that confidence in the estimates for the uplands would be increased if the numbers of squares in the English uplands were increased. Therefore, of the increase in squares from 1990 -1998 a number (23) were in English upland areas.

Land cover was mapped under five headings –

- physiography – covering the underlying structure of the land and including details of coastal features, rivers, cliffs and rock outcrops
- agriculture and semi-natural vegetation – including crops, grasslands, moorland and bog
- forestry, woodland and trees – including information on species, age and management
- urban, built-up and recreation – including all man-made features in rural and urban areas (e.g. roads, factories, farmhouses and recreational facilities)
- boundaries – including hedges, fences, bank and walls, together with details of height, management, and the species comprising hedges.

Each land cover parcel and landscape element (greater than 20m x 20m – the minimum mappable unit) was described using a pre-determined list of coded attributes. These attributes included details of species and percentage cover, land use and management. When used in combination, these allowed each feature to be described in great detail.

In CS1990 surveyors mapped the land cover in the square and then the 1984 and 1990 maps were overlaid in a Geographic Information System (GIS) and the change computed. In the unenclosed uplands, detecting small-scale changes by overlaying maps could be difficult. Reasonable estimates for changes in area (or stock) can be recorded, but not for spatial changes between vegetation types (where observer differences are probably greater than 'real' change). To overcome this in CS2000, in unenclosed habitats, major land cover change (e.g. new forestry blocks in upland areas) was mapped at the Broad Habitat level but additional random vegetation plots, to monitor changes in vegetation or composition or type, were also recorded. In enclosed areas, features such as fences provide sufficient geographical reference to allow mapping to be undertaken in detail as previously.

Vegetation composition was recorded in up to 47 plots in each 1km square. Some plots were placed at random throughout the square and others located in areas of semi-natural vegetation (targeted plots), which was not adequately represented by the random plots. Linear plots were placed on boundaries, along hedgerows, and on streamsides and roadside verges. The vegetation plots were permanently marked to ease relocation. In each of the plots, species of flowering plants and grasses, lichens and bryophytes from a selected list were recorded, together with visual estimates of their cover (>5%).

Other aspects of the field survey, not reported here, were as follows.

- A survey of freshwater biota was carried out. Integrating data on the occurrence of freshwater animals and plants, and relating these to local land use and environmental factors, provides useful indices of pollution, particularly in the context of eutrophication and acidification.
- Soil samples were collected from a limited number of sites selected at random from the 1978 squares. There were two types of sample: 1) to assess the macro-invertebrates present and 2) for chemical and physical analyses.
- Heather samples were collected from all 1km squares where heather occurred in any of the main plots. Total nitrogen content of the heather was analysed.
- Bird counts were made in 336 of the CS2000 squares in the spring and summer of 2000 using the Breeding Bird Survey methodology as used by the BTO/JNCC/RSPB.

The mapped land cover data entered into the GIS, allowed automatic calculations of areas, lengths and numbers of features in the sample squares. By overlaying maps from previous surveys, changes were computed. Analyses of the plant data will enable changes to be determined in comparison with records from previous surveys, and also detailed comparisons of linear features with adjacent open countryside.

2. THE NATIONAL PICTURE

2.1 Trends in Broad Habitats

The Countryside Survey 2000 sample survey and the Northern Ireland Countryside Survey 2000 (NICS2000) estimated the 'stock' (or extent) of each terrestrial Broad Habitat in the UK (Haines-Young *et al.*, 2000). This report presents both the estimated stock for England in 1990 and 1998 (Table 2.1 and Fig 2.1) and changes in stock for England by comparing areas visited in both 1990 and 1998 (Table 2.2).

For many Broad Habitats, no significant net change in stock was detected between 1990 and 1998. Change was judged to be statistically significant at the 5% confidence level. Findings are summarised in Table 2.4 and Fig 2.2.

Fig 2.1. Proportions (%) of major Broad Habitats found in England (1998)

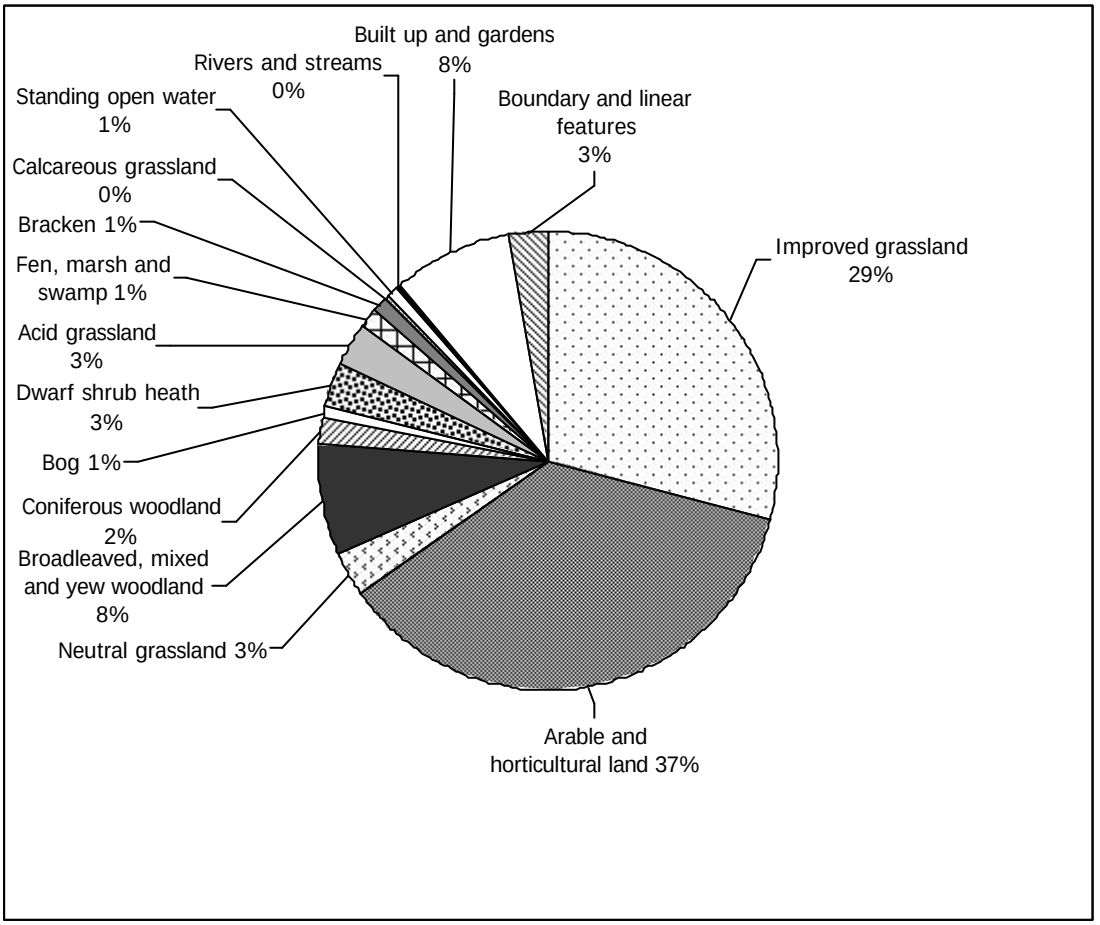


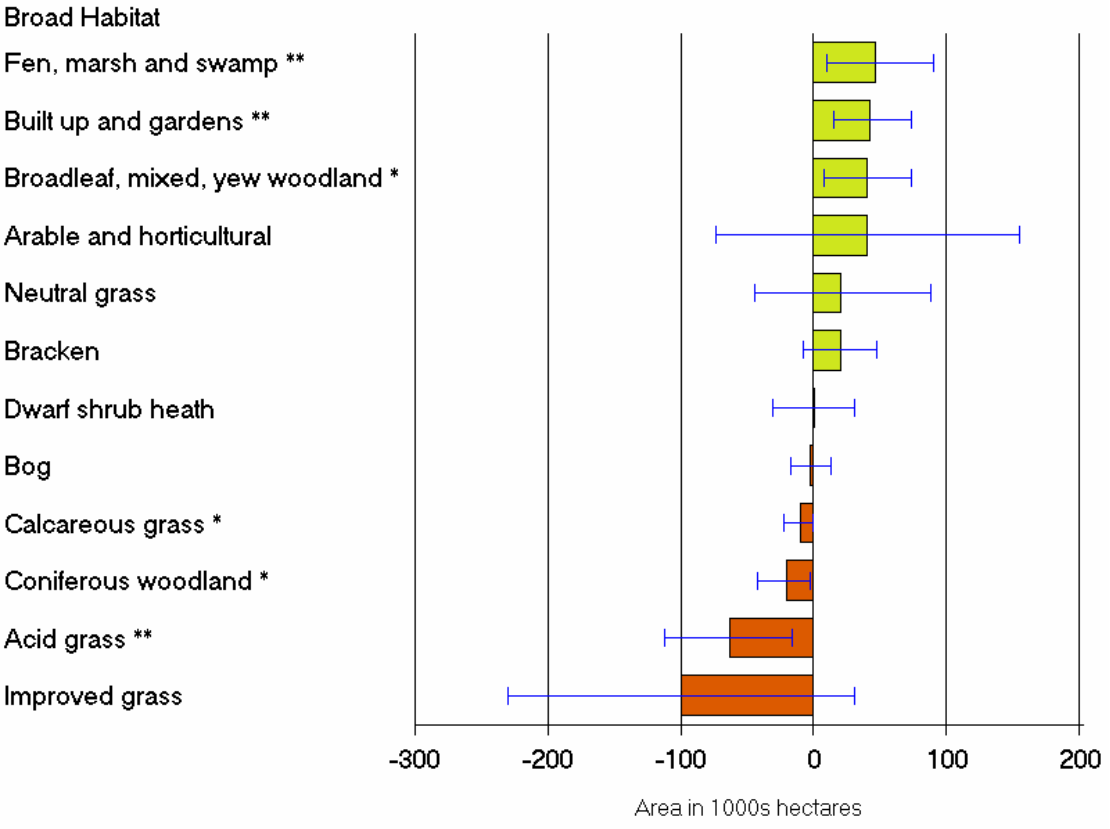
Table 2.1. Estimated Broad Habitat extent 1990 and 1998 (with 95% confidence limits). CS 1990 stock was calculated using the 264 1km squares common to both surveys. 1998 stock was based on the 302 squares surveyed for CS2000. (N.B. due to differences in sample size between surveys a direct comparison of stock figures does not provide an accurate estimate of change, e.g. apparent decreases in stock of 'Bog' habitat '90-'98 reflect increased upland sampling and improved accuracy in the 1998 sample).

Broad Habitat	'90 area ('000 ha)	Lower 95% CL	Upper 95% CL	'98 area ('000 ha)	Lower 95% CL	Upper 95% CL
Improved Grassland	3668	3355	4006	3642	3336	3960
Arable and Horticultural	4606	4222	4973	4521	4145	4889
Neutral Grassland	313	249	384	376	296	471
Broadleaved, Mixed and Yew woodland	914	773	1072	971	830	1123
Coniferous Woodland	320	183	462	273	173	384
Bog	144	70	240	103	54	159
Dwarf Shrub Heath	360	204	552	377	252	510
Acid Grassland	419	274	581	388	286	494
Fen, Marsh and Swamp	94	58	135	145	95	209
Bracken	158	82	253	167	105	240
Calcareous Grassland	48	14	92	36	9	73
Standing Open Water	103	22	246	86	25	185
Rivers and Streams	32	23	41	32	23	41
Built-Up and Gardens	975	811	1163	1042	856	1242
Boundary and Linear Features	358	323	394	353	319	390
Unsurveyed core urban area	5	n/a	n/a	5	n/a	n/a

Table 2.2. Estimated change in the extent of Broad Habitats 1990-1998 (with 95% confidence limits and significance). Change in stock was calculated from measures of stock based on sample sizes in Table 2.1. The % change in area was based on changes from the 1990 estimates.

Broad Habitat	Change in area ('000 ha)	Lower 95% CL	Upper 95% CL	%	Sig	p
Improved Grassland	-100	31	-230	-3	ns	0.13
Arable and Horticultural	40	155	-73	1	ns	0.49
Neutral Grassland	21	88	-45	7	ns	0.54
Broadleaved, Mixed and Yew Woodland	**40**	74	8	4	*	0.01
Coniferous Woodland	**-21**	-3	-42	-7	*	0.02
Bog	-2	14	-17	-2	ns	0.77
Dwarf Shrub Heath	1	31	-30	0	ns	0.94
Acid Grassland	**-63**	-17	-112	-15	**	0.01
Fen, Marsh and Swamp	**46**	90	10	49	**	0.01
Bracken	20	48	-8	13	ns	0.15
Calcareous Grassland	**-10**	0	-22	-20	*	0.05
Standing Open Water	1	3	-1	1	ns	0.45
Rivers and Streams	**-1**	-1	-2	-4	***	0.00
Built-Up and Gardens	**43**	74	15	4	**	0.00
Boundary and Linear Features	**-8**	-1	-16	-2	*	0.04

Fig 2.2. Net change (gross) in Broad Habitats in England between 1990 and 1998.



Enclosed Farmland

Arable and Horticultural

The amount of *Arable and Horticultural* habitat in England remained largely unchanged with transfers in land between *Improved Grassland* and *Arable and Horticultural* largely balancing out, and probably due to rotational use. Losses to *Broadleaf, Mixed and Yew Woodland* and *Built-Up and Gardens* are consistent with similar losses to *Improved Grassland* (see below). The large error bars for both *Arable and Horticultural* and *Improved Grassland* indicate the high variability in levels of change across the sample.

Improved Grassland

The stock of Improved *Grassland* in England did not change significantly between 1990 and 1998. However, there were losses and gains between *Improved Grassland* and *Arable and Horticultural* which are likely to be due to the normal arable rotation including ploughing and re-sowing of short-term grassland. Small losses to *Broadleaf, Mixed and Yew Woodland* and *Built-Up and Gardens* are consistent with development in certain areas and policies which encourage woodland planting ([1]Forestry Commission 1998, DETR 1999). Losses to *Neutral Grassland* were higher than gains which is somewhat different from the picture in Scotland where *Neutral Grassland*

[1]Forestry Commission (1998) *UK Forestry Standard*, Forestry Commission, Edinburgh; HMSO (1994) *Sustainable Forestry*: The UK Programme. HMSO London; DETR (1999) *A better quality of life*: *A sustainable development strategy for the UK*. The Stationary Office, London, Cm 4345. Forestry Commission (1998) *The England Forestry Strategy*, Forestry Commission, Edinburgh;

was lost to *Improved Grassland* (Mc Gowan *et al.*2002). *Improved Grasslands* in England showed a net gain from *Acid Grasslands.*

Neutral Grassland

The stock of *Neutral Grassland* in England did not change between 1990 and 1998 although there were some shifts between *Neutral Grassland* and other Broad Habitats. There were reductions in stock to *Fen, Marsh and Swamp*, *Bracken* and *Bog* possibly due to reduced management of the particular habitat type. Reductions in stock to *Broadleaf, Mixed and Yew Woodland*, *Built-Up and Gardens* are consistent with similar losses to both *Improved Grassland* and *Arable and Horticultural* (above). Small gains in *Neutral Grassland* from *Acid* and *Calcareous Grasslands* and from *Coniferous Woodlands* were dwarfed by a much larger gain from *Improved Grasslands*. Changes in Neutral Grassland are being investigated further in the [1]FOCUS (Finding out Causes and Understanding Significance) project.

Woodlands

Broadleaf, Mixed and Yew Woodland

There was a significant net gain of 5% in the stock of this habitat type between 1990 and 1998. There were several transfers between Broad Habitats, many of which balanced out. However, the largest gains were from *Arable and Horticultural* (perhaps as a result of agri-environment schemes) and *Coniferous Woodland*. Other gains were from *Built-Up and Gardens* and *Neutral Grassland*.

Coniferous Woodland

There was a significant net loss of *Coniferous Woodland* of -6.5% between 1990 and 1998. Gains from other Broad Habitats were largely balanced out by losses in other areas with the exceptions of small net gains from *Bracken*, *Arable and Horticultural* and *Improved Grassland*. Losses of *Coniferous Woodland* were largely to *Broadleaf, Mixed and Yew Woodland* with smaller losses to *Fen, Marsh and Swamp*, *Bogs* and *Acid* and *Neutral Grassland*. The losses of *Coniferous Woodland* to *Broadleaved Woodland* reflect changes across GB as a whole and may indicate that policies for restocking plantation with broadleaved trees are starting to take effect. Losses of (albeit small) areas to *Fen, Marsh and Swamp*, *Bogs* and *Acid* and *Neutral Grassland* do not reflect patterns at the GB level where losses to *Bog*, in particular, were outweighed by gains from *Bog*.

Mountain, Moor, Heath and Down

Bog

There was no significant overall change in the area of *Bog* habitat in England during the period 1990-1998. Transfers to *Bog* habitat were from several Broad Habitats including *Acid Grassland* and *Coniferous Woodland*. Losses were to *Dwarf Shrub Heath* and *Fen, Marsh and Swamp*.

[1] FOCUS is a research project which follows on from CS2000 currently being carried out by CEH for a DEFRA led consortium of funders. For information see: http://www.cs2000.org.uk/FOCUS_home.htm

Dwarf Shrub Heath

There was no significant change in the stock of *Dwarf Shrub Heath* in England between 1990 and 1998. Small gains from *Bogs* and *Fen, Marsh and Swamp* were countered by losses to *Acid Grassland*.

Acid Grassland

There was a significant decrease of around 63,000ha in the area of *Acid Grassland* in the period 1990 to 1998. Small gains from *Dwarf Shrub Heath* and both woodland Broad Habitats were outweighed by losses to *Improved Grassland*, in particular, as well as to *Bracken*, *Bog* and *Fen, Marsh and Swamp*. This is in line with the overall results in the main CS2000 report (Haines-Young *et al.* 2000) which showed a loss of *Acid Grassland* to *Improved Grassland* particularly in the English and Welsh uplands. Further work under [1]FOCUS has investigated these changes in the *Acid Grassland* Broad Habitat and tend to support the losses to *Improved Grassland* whilst losses to other Broad Habitats are less well supported.

Fen, Marsh and Swamp

As in Scotland, the stock of *Fen, Marsh and Swamp* increased significantly in England in the period 1990 to 1998. Gains from almost all Broad Habitats, with which there was a transfer of land to and from *Fen, Marsh and Swamp*, exceeded losses. The biggest gains were from *Neutral*, *Improved* and *Acid Grassland* indicating a possible decline in land management leading to increased wetness and associated species. There were also net gains from *Bog* and both types of woodland.

Bracken

There was no significant change in the stock of *Bracken* in the period 1990 to 1998. Small gains were from *Acid* and *Neutral Grassland*. Shifts between other Broad Habitats may have reflected either natural control (by shading) or local land management.

Calcareous grassland

The area of *Calcareous Grassland* in England is limited and there was a small but significant decrease in that area between 1990 and 1998. Losses were mainly to *Improved Grassland.*

Rivers, Streams and Standing Waters

Standing Open Water

The stock of *Standing Open Water* did not change significantly in the period 1990 to 1998. Minor losses to *Built-up Areas and Gardens* and *Improved Grassland* and gains in a number of Broad Habitats including Arable *and Horticultural*, *Neutral Grassland* and *Broadleaf, Mixed and Yew* Woodland were probably due to the creation or filling in of ponds, or to the re-mapping of standing water boundaries.

Rivers and Streams

The results show that there was a significant decrease in the area of *Rivers and Streams* in England during the period 1990 to 1998. However, areas of these habitats are not necessarily the best guide to their stock as the area which they cover is

[1] FOCUS is a research project which follows on from CS2000 currently being carried out by CEH for a DEFRA led consortium of funders. For information see: http://www.cs2000.org.uk/FOCUS_home.htm

comparatively small. The biggest loss was to *Standing Open Water* perhaps reflecting different coding of the habitats in the two surveys.

Developed Land in Rural Areas

Built-Up and Gardens

There was a significant increase of around 43,000ha in the stock of *Built-Up and Gardens* in the period 1990 to 1998. The net gains were from the *Improved* and *Neutral Grassland, Broadleaf, Mixed and Yew Woodland* and *Arable and Horticultural* reflecting an increase in urban development in England.

Linear features

Linear Features (transport features)

There was a small marginally significant decrease in the extent of *Boundary and Linear Features* in England in the period 1990 to 1998. Whilst roads, railways and tracks make up the majority of the area of *Linear Features,* old railway tracks, farm tracks and disused roads are also included. As with *Rivers and Streams* the areas of these habitats are not the ideal measure of their stock.

Aggregated Broad Habitats

If Broad Habitats are aggregated into a smaller number of general habitat types representing; intensive agriculture (*Arable and Horticultural*, *Improved Grassland*), unimproved grassland (*Neutral, Calcareous* and *Acid Grassland*), semi-natural habitats (*Bracken, Bog, Fen, Marsh* and *Swamp, Montane Habitats, Dwarf shrub heath*), developed land (*Boundary and Linear Features, Built-up areas and gardens, Inland rock*), woodland (*Broadleaf, mixed and yew woodland, Coniferous woodland*), freshwater (*Standing open water, Rivers and streams*) and coastal it is possible to examine larger scale shifts in the landscape. A matrix of change (Table 2.3) shows increases in areas of semi-natural habitats, woodland and developed land over the period 1990 to 1998 and decreases in the areas of intensive agriculture and unimproved grassland. The matrix shows no net change in the extent of coastal and freshwater habitats.

It is possible that gains in woodland and semi-natural habitats at the expense of intensive agriculture may correspond with changes in agriculture including the agri-environment schemes which have encouraged farmers to adopt less intensive land management practices. Increases in developed land are in line with continuing pressure for development across England. Decreases in the area of unimproved grassland (*Acid, Calcareous* and *Neutral Grassland*) may point towards increased intensity of management of these habitats.

Table 2.3. Matrix of change for aggregate Broad Habitats in England 1990-1998 (areas are in '000Ha). This analysis of change uses only repeat squares, i.e. squares surveyed in both 1990 and 1998 (n = 262).

		Countryside Survey 2000							
Countryside Survey 1990	Aggregate	Intensive agriculture	Unimproved grassland	Semi-natural habitats	Developed land	Woodland	Freshwater	Coastal	**Total stock 1990**
	Intensive agriculture	**8010**	153	22	54	44	1	0	**8284**
	Unimproved grassland	157	**501**	83	17	17	0	1	**777**
	Semi-natural habitats	12	39	**694**	1	11	0	0	**758**
	Developed land	23	14	6	**1305**	13	0	0	**1362**
	Woodland	20	17	18	11	**1149**	1	0	**1216**
	Freshwater	1	0	0	1	0	**132**	0	**134**
	Coastal	1	0	0	0	0	0	**147**	**148**
Total Stock 1998		**8224**	**724**	**823**	**1389**	**1216**	**134**	**148**	
Net Change 1990-1998		**-60**	**-53**	**65**	**27**	**0**	**0**	**0**	
Net % Change 1990-1998		**-0.1**	**-6.8**	**8.6**	**2.0**	**0**	**0**	**0**	

Table 2.4. Estimates of stock and change in the areas of Broad Habitats for England in 1990-1998. (N.B. Due to differences in sample size between surveys, % change in stock is not a direct measure of the % change between the areas given, see footnotes on sample sizes for stock and change)

Broad habitat	Key trends 1990-1998 significant change, P<0.05, in **bold**	[1]Area in 1990 ('000Ha)	[2]Area in 1998 ('000Ha)	[1]% change 1990-1998
1. *Improved grassland*	• No significant change in stock • Interchange with *Arable and Horticultural* consistent with rotational management, with a net conversion to arable • Small losses to *Broadleaf Woodland*, *Built-Up and Garden* and *Neutral Grassland* were countered by gains from *Acid Grassland*	3668.2	3641.9	-3
2. *Arable and Horticultural*	• No significant change in stock • Interchange with consistent with rotational management, with a net conversion to arable • Small losses to *Broadleaf, Mixed and Yew Woodland* and *Built-Up and Gardens*	4606.1	4520.6	1
3. *Neutral Grassland*	• No significant change in stock • Net reductions to *Fen, Marsh and Swamp*, *Bracken* and *Bogs* as well as small losses to *Broadleaf, Mixed and Yew Woodland* and *Built-Up and Gardens* • Net gain from improved grasslands	312.9	376.3	7
4. *Broadleaf, Mixed and Yew Woodland*	• **Significant net gain in stock between 1990 and 1998** • Largest gains from *Arable and Horticultural* and *Coniferous Woodland*, smaller gains from *Built-up and Gardens* and *Neutral Grassland*	913.1	970.5	4
5. *Coniferous Woodland*	• **Significant net loss in stock between 1990 and 1998** • Largest net loss was *to Broadleaf, Mixed and Yew Woodland* • Small gains from *Bracken* and *Improved Grassland* were countered by losses to *Fen, Marsh and Swamp*, *Bogs* and *Acid* and *Neutral Grassland*	319.5	272.9	-7
6. *Bog*	• No significant change in the stock • Some gains from *Acid Grassland* and *Coniferous Woodland* and losses *to Dwarf Shrub Heath* and *Fen, Marsh and Swamp*	143.9	102.6	-2

Broad habitat	Key trends 1990-1998 significant change, P<0.05, in **bold**	[1]Area in 1990 ('000Ha)	[2]Area in 1998 ('000Ha)	[1]% change 1990-1998
7. *Dwarf shrub heath*	• No significant change in stock • Small gains from habitats including *Bogs* and *Fen, Marsh and Swamp* were countered by losses to *Acid Grassland*	360.4	377.4	0
8. *Acid Grassland*	• **Significant decrease in stock between 1990 and 1998** • Large loss to *Improved Grassland* and smaller losses to *Bracken, Bog and Fen, Marsh and Swamp*.	418.7	387.6	-15
9. *Fen, Marsh and Swamp*	• **Significant increase in stock between 1990 and 1998** • Largest gains were from *Neutral, Improved* and *Acid Grassland*	94.1	144.9	49
10. *Bracken*	• No significant change in stock • Gains from *Acid* and *Neutral Grassland* were relatively small as were losses to both *Coniferous* and *Broadleaf Woodland*	157.6	167.4	13
11. *Calcareous Grassland*	• **Marginally significant decrease in stock between 1990 and 1998** • Losses mainly to *Improved Grassland*	48.1	36.3	-20
12. *Standing Open Water and Canals*	• No significant change in stock	102.6	85.7	1
13. *Rivers and Streams*	• **Significant decrease in stock between 1990 and 1998**	31.6	31.6	-4
14. *Built-Up and Gardens*	• **Significant increase in stock between 1990 and 1998** • Net gains from *Improved and Neutral Grassland, Broadleaf, Mixed and Yew Woodland* and *Arable and Horticultural* reflect an increase in urban development in England	975.4	1042.4	4
15. *Linear Features* (transport features)	• **Small marginally significant decrease in the area of boundary and linear features in England (but see *Rivers and Streams* above)**	358.3	353.2	-2

N.B.[1] CS 1990 stock and estimates of change between 1990 and 1998 were calculated using the 262 1km squares common to both surveys. [2] 1998 stock was based on the 302 squares surveyed for CS2000.

2.2 Quality of Life Counts

Landscape features (boundaries)

There were significant increases in the lengths of fences and lines of trees/shrubs and relict hedge between 1990 and 1998 and a decrease in the length of remnant hedge (Fig 2.3). There were no significant changes in the lengths of managed hedges or walls.

Decreases in the length of remnant hedge together with increases in the length of relict hedge suggest a decline in the management of hedgerows. Remnant hedge remains recognisable as hedge whereas relict hedge is a further stage of abandonment. Increases in the length of fences may be at the expense of walls which showed a non-significant decrease in length during the period, or may in some cases have replaced remnant hedges.

Plant species richness

Analysis of plot data show that overall species richness in England in all random plots was significantly lower in 1998 than in 1990. When different types of plots are looked at separately, species richness in the main plots was not significantly different between 1990 and 1998, whilst linear (boundary, roadside and verge, streamside and riverside) and targeted plots show a significant decrease in richness.

The Government's *Quality of Life Counts* indicator of plant diversity is based on the analysis of changes in species richness in eight major vegetation classes. In a number of these classes (infertile grass, tall grass, lowland and upland woods) species richness was significantly lower in many plot types in 1998 than in 1990 (Fig 2.4). However, for crop/weeds, the moorland grass mosaic and for main and target plots in fertile grasslands, species richness increased over the same period. There were no significant changes in the species richness in the heath/bog aggregate class.

Fig 2.3. Quality of Life Counts indicator for landscape features. Estimated stock ('000km) of linear features in 1990 and 1998 in England (as with QOLC for CS2000 estimates of stock have been revised to take account of the better quality data available from CS2000).

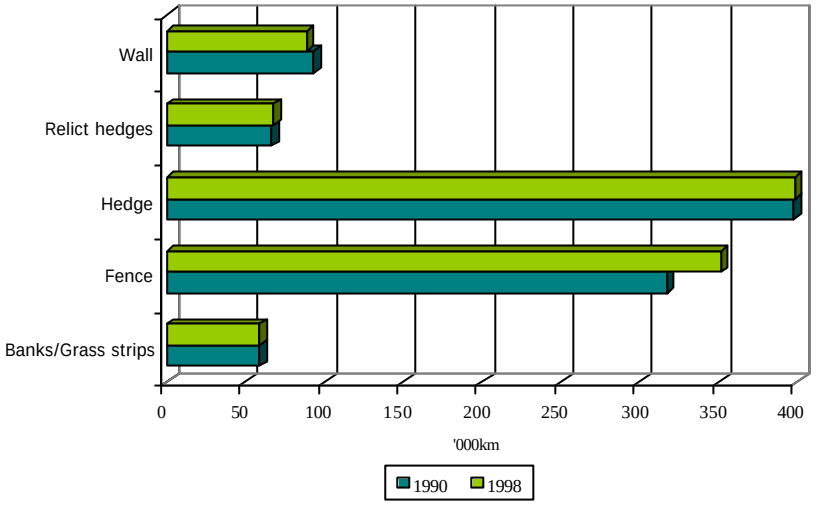
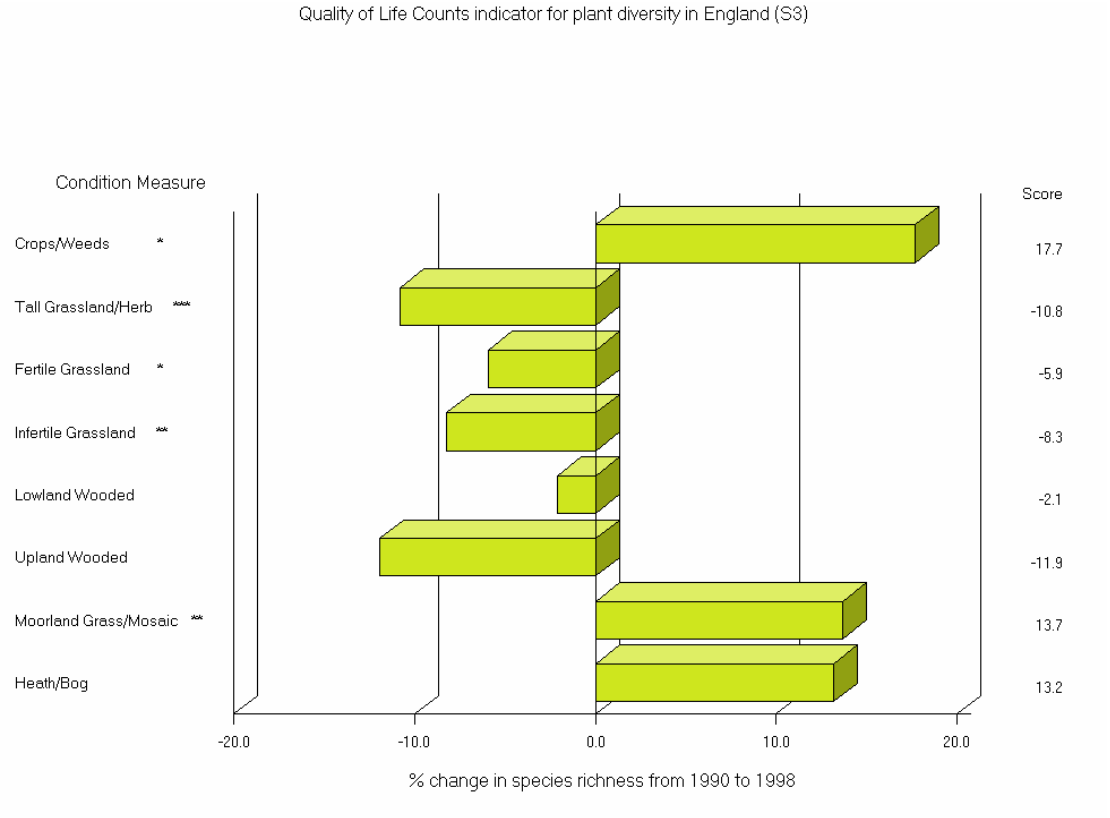


Fig 2.4. Quality of Life Counts indicator for plant diversity showing percent change in species-richness in the major vegetation types for 1990-1998. Scores to the right represent % changes in species richness for each of the aggregate classes.



3. LANDSCAPE FEATURES

Landscape features are one of the two government *Quality of Life Counts* indicators published in 1999 (Government Statistical Service, 1999) derived from Countryside Survey data.

Main Findings

- There was no significant change in the lengths of managed hedges and walls.
- Lengths of relict hedges, including lines of trees and shrubs, increased significantly whilst length of remnant hedge decreased significantly. Both of these imply possible deterioration in the management of hedgerows.
- There was an increase in the length of post and wire fences in England of around 6%.
- Increases in the nitrogen score in boundary plots associated with landscape features which form boundaries (including fences and hedges), together with decreases in species richness and the light score, accord with similar patterns found in a number of linear plot types (including, boundary, roadside and verge and all plots excluding targeted) within the *Boundary and Linear Features* Broad Habitat.

3.1 Introduction

Landscape features are features whose stock is best assessed in terms of length, i.e. hedges, walls, banks, lines of trees and grass strips. In England hedges form an important part of the English landscape and constituted around 38% of all linear landscape features recorded in CS2000, more than any other type of feature. They are important both in terms of their ecological value for plants and animals as well as providing corridors for movement and dispersal of some species. Together with other linear landscape features (in particular, walls and lines of trees/shrubs associated with fences and relict hedge) they contribute to the character of the landscape and provide a record of its historical use.

Post and wire fences are the second most common boundary type in England, constituting around 33% of linear landscape features. Other landscape features measured in CS2000 include; remnant hedges, walls, lines of trees/shrubs and relict hedge (either with or without fence) and banks/grass strips (Table 3.1 provides a definition of Linear Landscape features used within CS2000).

Remnant hedges, 'lines of trees/shrubs and relict hedge and fence' and 'lines of trees/shrubs and relict hedge' constituted approximately 15% of all linear landscape features in England. Walls are locally very important parts of the landscape but are of restricted occurrence. Because they only occur in certain regions they make up only around 8% of all linear landscape features in England. Banks/grass strips constitute around 5% of linear landscape features.

Table 3.1: Definition of Linear Landscape features used within CS2000

Feature	Description
Hedge	A more or less continuous line of woody vegetation that has been subject to a regime of cutting in order to maintain a regular shape. This category includes both recently-managed and other hedges including hedges with walls or fences.
Remnant hedge	A woody field boundary feature with a residual hedge structure but without evidence of recent hedge management, with or without a fence.
Wall	A built structure of natural stone or manufactured blocks, mostly of traditional dry stone wall construction but including mortared walls. Includes walls with fences and lines of trees or shrubs.
Line of trees/shrubs and relict hedge and fence	Line of trees or shrubs, including those originally planted as hedges but lacking any significant hedge structure and with a fence forming a field boundary.
Line of trees/shrubs and relict hedge	Line of trees or shrubs, including those originally planted as hedges but lacking any significant hedge structure or a fence. Includes avenues of trees. Not an effective stockproof field boundary.
Bank/grass strip	An earth or stone-faced bank with or without a fence. A grass strip without a fence.
Fence	A permanent post and wire or rail structure, including wooden, concrete or metal posts without any other associated feature other than a grass strip, ditch or stream.

3.2 Trends

The estimated total length of linear landscape features in England in 1998 was 1.05 million km. The stock of the various features recorded for CS2000 is given above and in Table 3.2.

There was a significant increase in the total length of these features during the period 1990 to 1998 of approximately 3%. No significant difference between the stock of hedges, walls and grass strips/banks in 1990 and 1998 in England was detected. However, there were significant declines in the lengths of remnant hedge in England by around 18%. The net losses to remnant hedges result from either degeneration of hedgerows or removal and replacement by fences or other boundaries.

There were net gains of around 25,000km in the lengths of line of trees/shrubs and relict hedge including fence and line of trees/shrubs and relict hedge without fence. This gain was at the expense of some deterioration in the condition of managed and remnant hedges recorded in 1990 but was largely due to reclassification of existing features.

There were significant increases in the length of fences of around 6% across England.

Table 3.2. Estimates of the stock in 1998 and change 1990 to 1998 of linear landscape features in England. Standard Error (SE) terms for the estimates are provided. Changes which are statistically significant ($p<0.05$) are indicated in **bold**

	Stock in 1998			Change in stock 1990-1998		
Feature	Length ('000km)	SE ('000km)	% of 1998 stock	Length ('000km)	SE ('000km)	% change from 1990
Hedge	398.8	18.6	38.0	1.2	4.5	0.3
Remnant Hedge	43.5	4.0	4.0	**-9.1**	2.6	17.5
Wall	89.5	11.4	8.5	-2.3	1.5	2.4
Line of trees/shrubs and relict hedge and fence	49.0	3.7	4.6	**10.6**	1.8	29.0
Line of trees/shrubs and relict hedge	66.8	4.6	6.3	**14.4**	2.6	27.0
Bank/grass strip	50.8	6.3	4.8	-1.2	1.9	0.4
Fence	351.6	14.9	33.5	**19.0**	9.1	6.0
Total	1050.0	28.1	100.0	**32.6**	8.4	3.2

3.3 Change in Condition

The figures of net change given above provide no information on the relative ecological value of the features recorded. For example, the age of a hedge and the way it has been managed will have a large bearing on its ecological and landscape value. It is therefore important to look at the ecological condition of hedgerow stock. Two hedge plots of 10 x 1m were located in each survey square in which hedges were found. They record the vegetation growing along the bottom of hedges as well as the shrubs in the hedge itself. The same plots were surveyed in both 1990 and 1998. The majority of hedgerow plots were dominated by two of the eight main vegetation types or aggregate classes (see Chapter 4) 'lowland wooded' and 'tall, grass and herb' vegetation, with fewer comprising of 'infertile grassland' vegetation.

Results for changes in vegetation condition for hedges characterised by the two dominant vegetation types are given in Fig 3.1a and b. Overall hedge plots showed no significant change in species richness. Hedge plots comprising lowland wooded vegetation in 1990 showed a marginally significant decrease in competitive species aligned with a more significant increase in the numbers of ruderal species typically associated with disturbed ground.

Fig. 3.1a. Vegetation condition measures in hedge plots in lowland wooded vegetation (aggregate class 5) (n = 248).

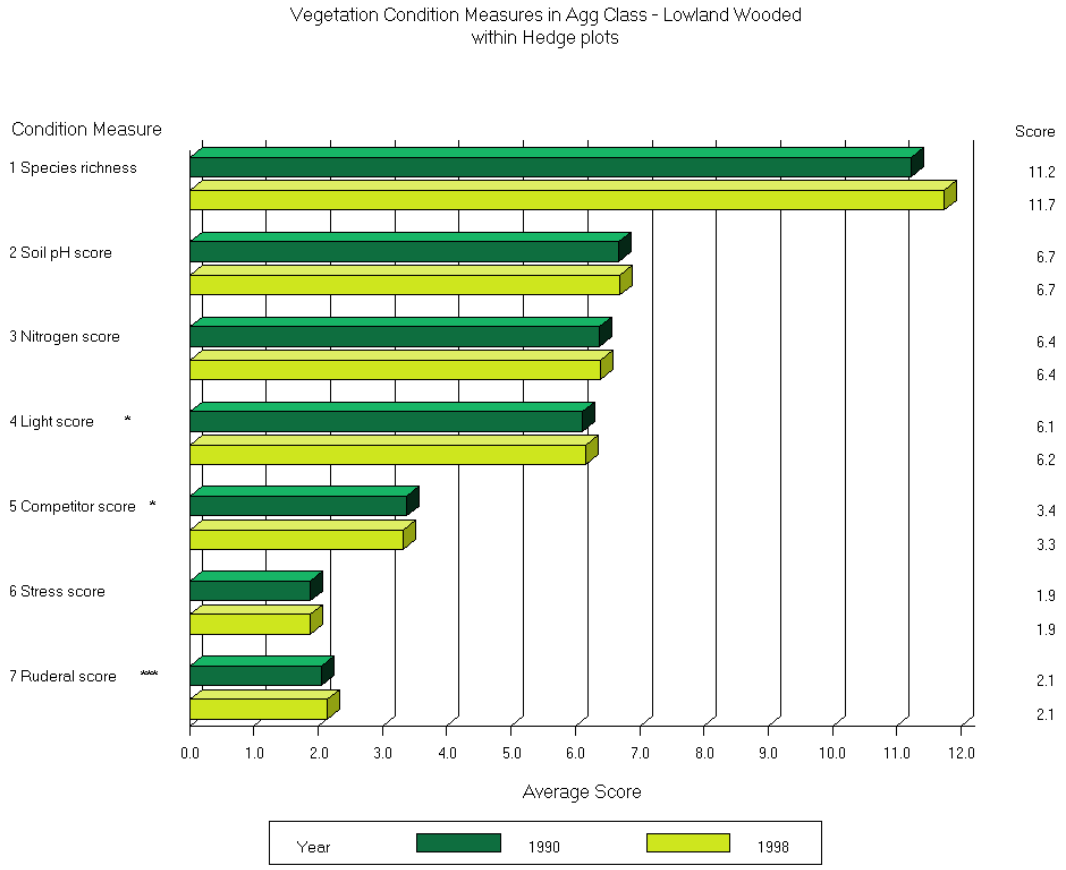
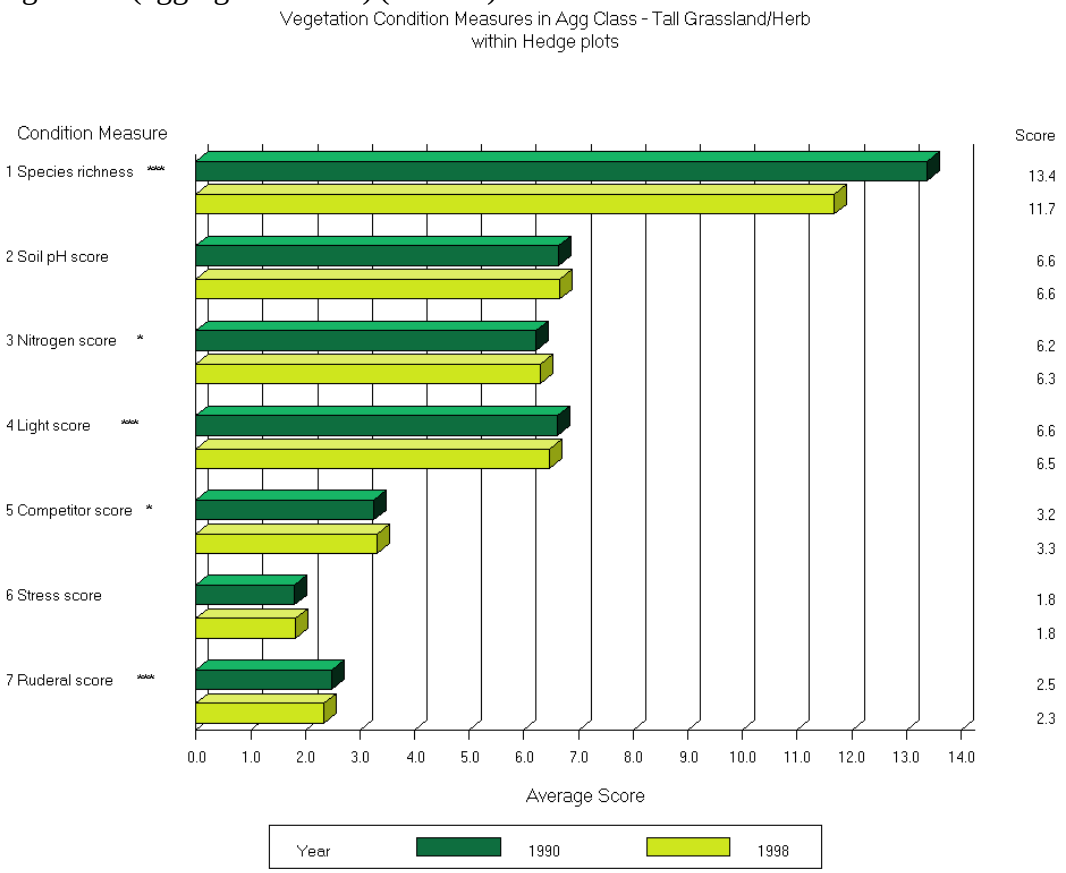


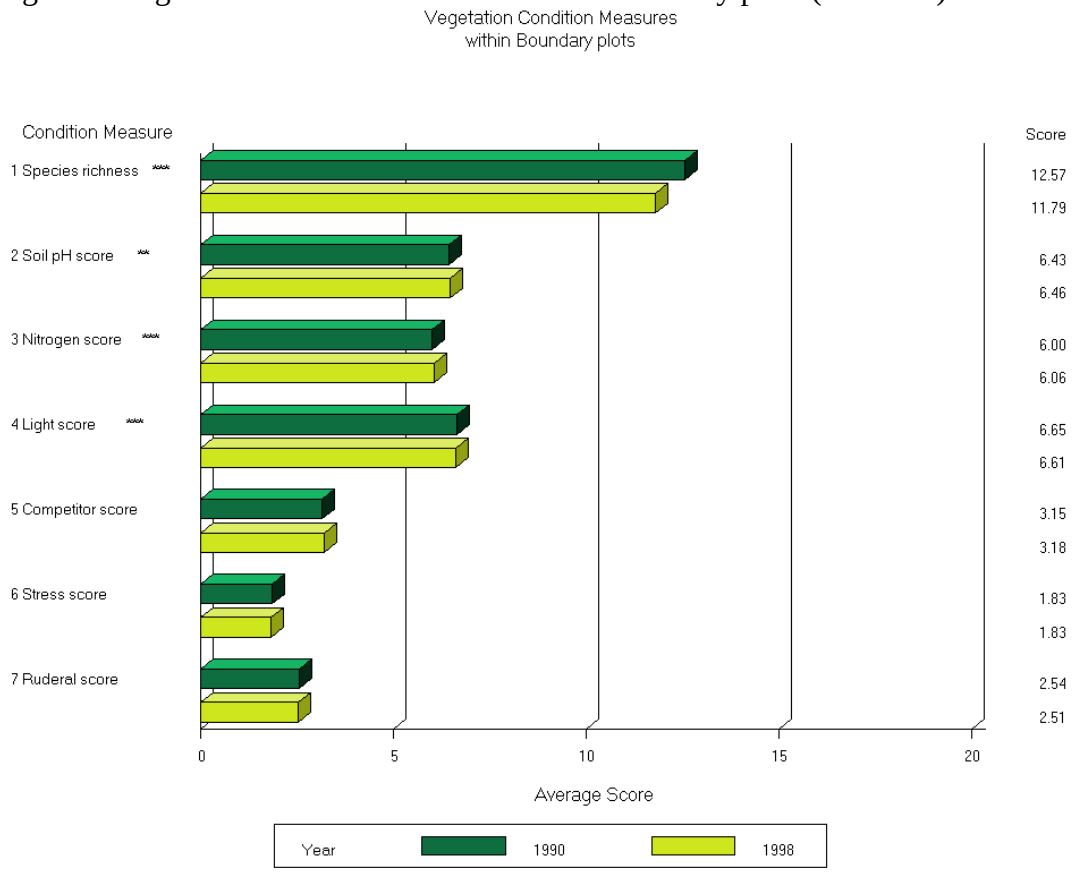
Fig. 3.1b. Vegetation condition measures in hedge plots in tall grassland/herb vegetation (aggregate class 2) (n = 107).



Hedge plots characterised by tall grass and herb vegetation showed a significant decline in species richness of around 13%, with declines in the number of ruderal species aligned to an increase in the number of competitive species. These changes may indicate decreased hedgerow management and subsequent increases in hedgerow size. A marginally significant increase in the nitrogen score (nutrient status) and a significant decrease in the light score (resulting in increased frequency of shade tolerant species) also point towards a general increase in the size of hedge canopies and undergrowth.

Boundary plots are 10 x 1m plots which run alongside physical features at field boundaries and therefore provide information on the ecological condition of the field margins and associated linear features. There were 5 boundary plots recorded in each sample square. Boundary plots showed a significant decrease in species richness between 1990 and 1998 of around 6% (Fig 3.2). Nutrient and soil pH levels showed significant increases in this plot type and there was a significant increase in the numbers of shade tolerant species found. These changes are in line with changes recorded in the hedgerow plots and may results from decreased management of hedgerows.

Fig. 3.2. Vegetation condition measures within boundary plots (n = 1007).



Boundary plots associated with *Neutral* and *Improved Grassland* in particular, showed decreases in species richness whereas boundary plots in *Arable and Horticultural* showed no significant change in species richness. The general trend across boundary plots dominated by a variety of different types of vegetation from crop/weeds, fertile, infertile and tall/herb rich grassland to lowland wood vegetation was for an increase in competitive and light tolerant species often (but not always) accompanied by a decrease in species richness.

4. PLANT DIVERSITY

Plant diversity is one of the two Government *Quality of Life Counts* indicators published in 1999 for GB (Government Statistical Service, 1999) derived from Countryside Survey data. The results presented here are for England only, although they mirror the changes found for GB as a whole.

Main findings

- Analysis of the data for all random plot types showed that species richness was significantly lower in 1998 than in 1990.
- Whilst main plots did not show a decline in species richness, linear plot types (boundary, roadside and verge and streamside and riverside) and targeted plots had a lower species richness in 1998 than in 1990.
- Overall losses in species richness were generally associated with agricultural grasslands, field boundaries and verges, gains occurred on arable land.

4.1 Introduction

The balance between plant species and their habitats fluctuates temporally and spatially, influenced both by natural forces (e.g. climate) and by changes in environmental management. A simple measure of the numbers of plant species in sample plots (species richness or plant diversity) provides information on this balance between plant species and the changing quality of the habitats in which they exist. The Government's *Quality of Life Counts* indicator of plant diversity is based on the analysis of changes in eight main vegetation types or aggregate classes (1) crop/weeds, 2) tall grass and herb, 3) fertile grassland, 4) infertile grassland, 5) lowland wooded, 6) upland wooded, 7) moorland grass mosaics, and 8) heath/bog). The use of species richness as a condition measure in CS2000, meant that it is possible to look at plant diversity within *Broad Habitats* as well as across the eight major vegetation types.

4.2 Trends

An overall analysis of the data for all random plot types showed that species richness was significantly lower in 1998 than in 1990 (Fig 3.1). The species richness scores for 1990 and 1998 for the various plot types are presented in Table 3.1. Several linear plot types showed significant declines in species diversity with streamside and riverside plots showing the largest decline. Targeted plots (2x2m plots non-randomly placed in areas of habitat interest)also showed a significant decrease in species richness, however, there was no significant change in species richness in hedge and main plots.

Fig. 4.1 Vegetation condition measures within all random plots in England. N.B. plots vary in size (see table 4.1) (n = 4389).

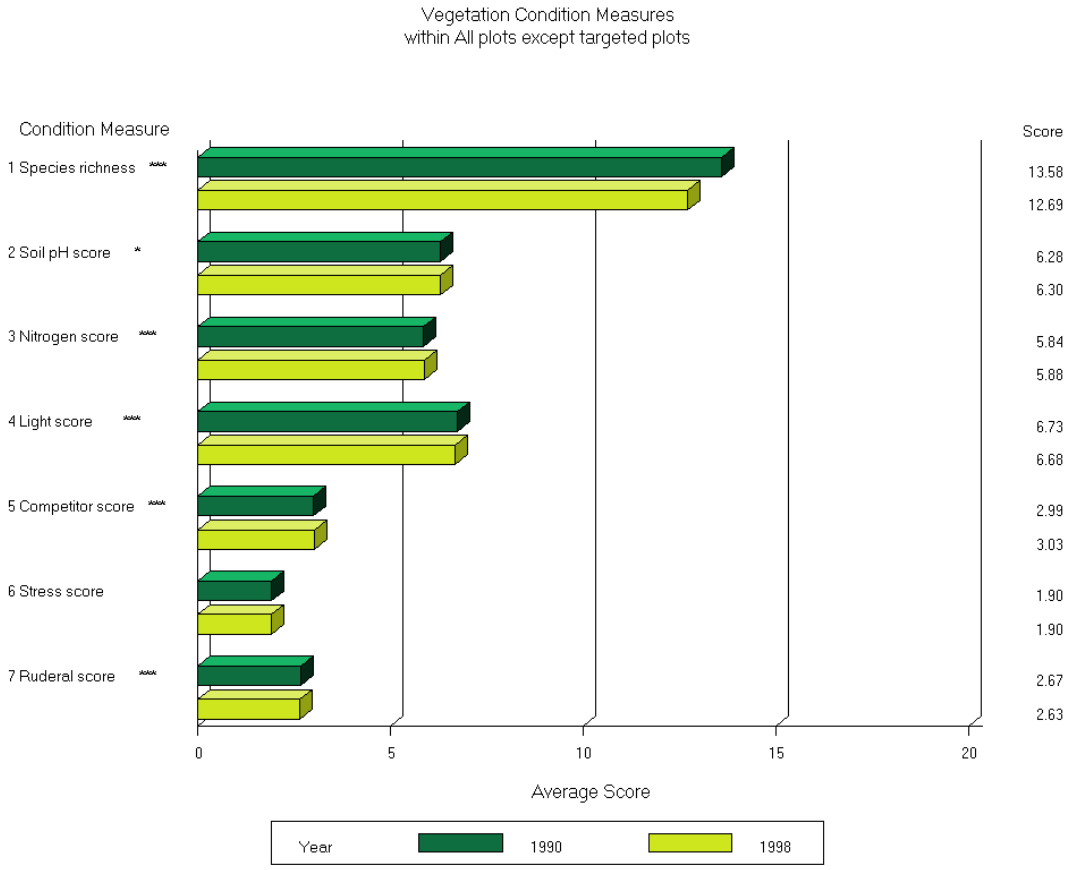


Table 4.1 Species richness scores (numbers of species per plot) in plot types in 1990 and 1998. Significant differences are indicated thus;* p< 0.05, ** p<0.01, *** p<0.001.

Plot type	Plot size	Species richness score 1990	Species richness score 1998	No. of plots	% change in species richness
Boundary	1 x 10m	12.6	11.8***	1007	-6%
Hedge	1 x 10m	12.2	12.0	386	-2%
Main	14 x 14m	11.4	11.4	980	0%
Roadside and verge	1 x 10m	15.7	14.6***	1124	-7%
Streamside and riverside	1 x 10m	15.0	13.0***	892	-13%
Target (non-random)	2 x 2m	11.6	10.0***	1033	-14%

Trends in Aggregate Classes

There were significant increases in species richness in a number of plot types within the Crop/Weeds aggregate class 1. The largest decreases in species richness occurred in streamside and riverside plots in upland woods (17%) and in target plots in tall grass and herb where there was an 18% decrease in species richness. Significant results for all aggregate classes are presented in Table 4.2.

Table 4.2 Species richness scores in 1990 and 1998 for all plot types and aggregate classes. Significance of differences are indicated thus;* $p< 0.05$, ** $p<0.01$, *** $p<0.001$.

Aggregate Class/Plot type	Species richness score 1990	Species richness score 1998	No. of plots	% change in species richness
Crop/Weeds				
Boundary	8.3	10.7*	29	28%
Main	5.2	6.2*	297	19%
Roadside and verge	8.1	10.8**	36	33%
Targeted	10.7	7.5	21	-30%
Tall Grass and Herb				
Boundary	12.8	11.4***	453	-11%
Hedge	13.4	11.7***	107	-13%
Main	13.0	13.6	45	5%
Roadside and verge	16.2	14.6***	515	-15%
Streamside and riverside	13.7	11.6***	395	-15%
Targeted	10.2	8.4***	243	-18%
Fertile Grassland				
Boundary	12.4	12.2	140	-2%
Main	11.4	11.1	268	-3%
Roadside and verge	14.7	13.7**	413	-7%
Streamside and riverside	16.8	13.9**	75	-17%
Targeted	11.3	9.9**	115	-12%
Infertile Grassland				
Boundary	17.2	15.4*	104	-10%
Hedge	18.7	17.6	18	-6%
Main	20.7	19.1**	184	-8%
Roadside and verge	20.0	19.0	112	-5%
Streamside and riverside	20.3	18.1**	132	-11%
Targeted	15.9	13.7***	300	-14%
Lowland Wood				
Boundary	10.6	10.7	235	-1%
Hedge	11.2	11.7	248	-4%
Main	13.1	11.4	61	-13%
Roadside and verge	15.3	13.8	27	-10%
Streamside and riverside	12.7	10.9**	117	-14%
Targeted	8.2	7.0***	162	-15%

Aggregate Class/Plot type	Species richness score 1990	Species richness score 1998	No. of plots	% change in species richness
Upland Wood				
Boundary	14.1	12.5	24	-11%
Main	10.7	11.0	37	3%
Roadside and verge	19.7	17.8	11	-10%
Streamside and riverside	16.3	13.5***	87	-17%
Targeted	10.1	8.5**	65	-16%
Moorland Mosaic				
Boundary	11.0	13.1	20	19%
Main	14.8	17.0*	46	15%
Streamside and riverside	14.8	16.0	63	8%
Targeted	12.1	12.1	67	0%
Heath and Bog				
Main	7.1	7.1	42	0%
Streamside and riverside	6.4	6.7	22	5%
Targeted	7.2	6.6	60	-8%

5. ENCLOSED FARMLAND – Improved and Neutral grasslands, Arable and Horticultural

Main Findings

Arable and Horticultural and *Improved Grassland* are the most extensive Broad Habitats in England. The net stock of these habitats has changed little between 1990 and 1998, although there have been shifts between the various Broad Habitats which make up enclosed farmland. There was evidence for both increases and decreases in species richness within certain plot types in the *Arable* Broad Habitat. In *Improved Grassland* plant diversity declined and nutrient levels increased in a number of plot types. There were net losses of *Improved* to *Neutral Grassland* which covers around 3% of England and showed non-significant gains in area during the period 1990-1998. Whilst there were gains in the area of *Neutral Grassland* in England the condition of plots within the Broad Habitat showed significant declines in species richness, significant increases in fertility and a change in species composition.

5.1 Introduction

Agriculture plays a major role in shaping the English countryside. The majority of the farmed landscape in England is enclosed farmland, made up of *Arable and Horticultural* and *Improved* and *Neutral Grassland* Broad Habitats, which together account for almost 70% of the rural land area of England.

The *Arable and Horticultural* Broad Habitat includes the different types of cereal and vegetable crops, together with orchards, market gardening and commercial flower growing. Newly ploughed land, fallow areas, set-aside and annual grass leys are also included in this category.

Most permanent agricultural grasslands in this category are of either the *Neutral* or *Improved Grassland* Broad Habitat. *Improved Grassland* occurs on fertile soils and is characterised by swards dominated by species such as rye grass (*Lolium perenne*) and white clover (*Trifolium repens*). Theses grasslands are mainly used for grazing or silage and sometimes for recreational purposes. They tend to be intensively managed and may be ploughed as part of the normal arable rotation, although they will be more than 1 year old if included in this Broad Habitat.

Neutral Grasslands include unimproved or semi-improved grasslands on soils that are neither acid nor lime. Traditionally they are managed as hay meadows and pastures. They are less fertile than *Improved Grassland* and thus contain more species and a lower proportion of rye grass. *Neutral Grasslands* are often the less actively managed corners or strips of land in the intensively farmed lowlands, including set aside land

5.2 Trends

The *Arable and Horticultural* and *Improved Grassland* Broad Habitats between them cover around 65% of rural land in England. There were no significant net changes in the stock of either Broad Habitat over the period 1990-1998. However, there has been considerable turnover of land within each habitat type Figs 5.2a and b.

Fig. 5.2a Interchanges in gross area (1000's hectares) of Broad Habitat between the *Arable and Horticultural* and other Broad Habitat types.

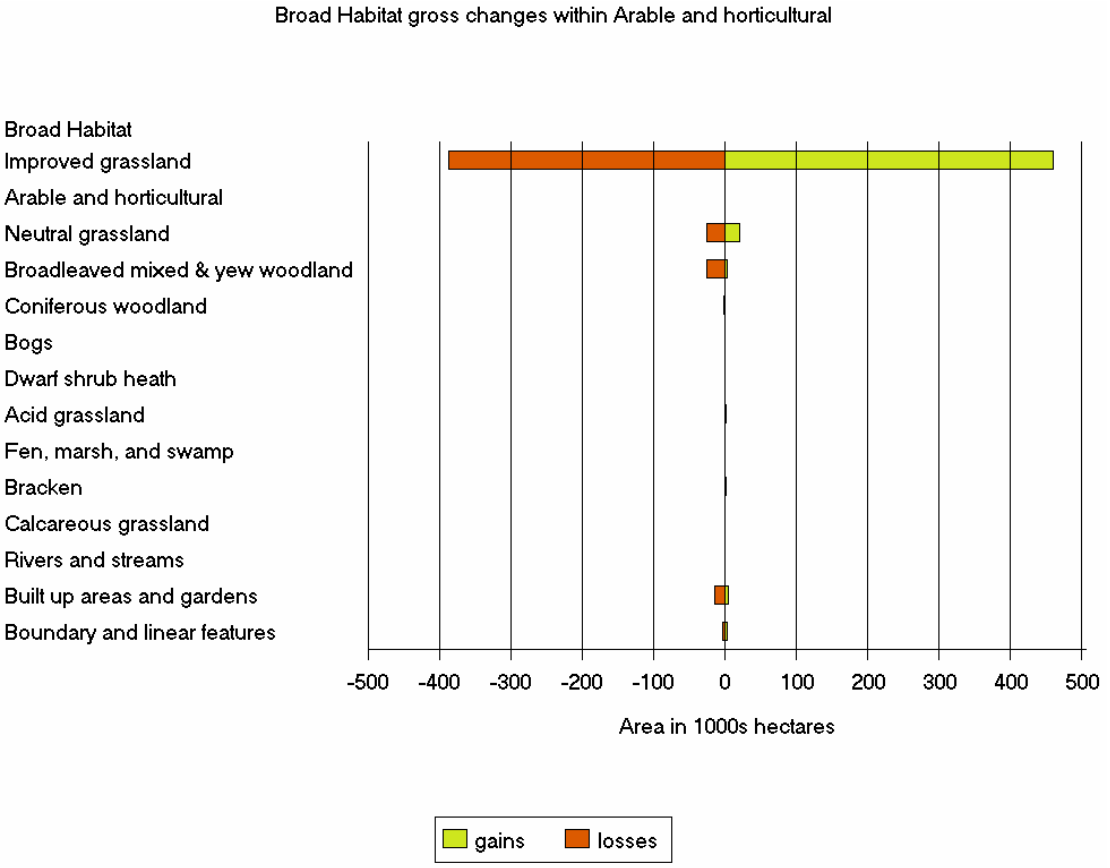
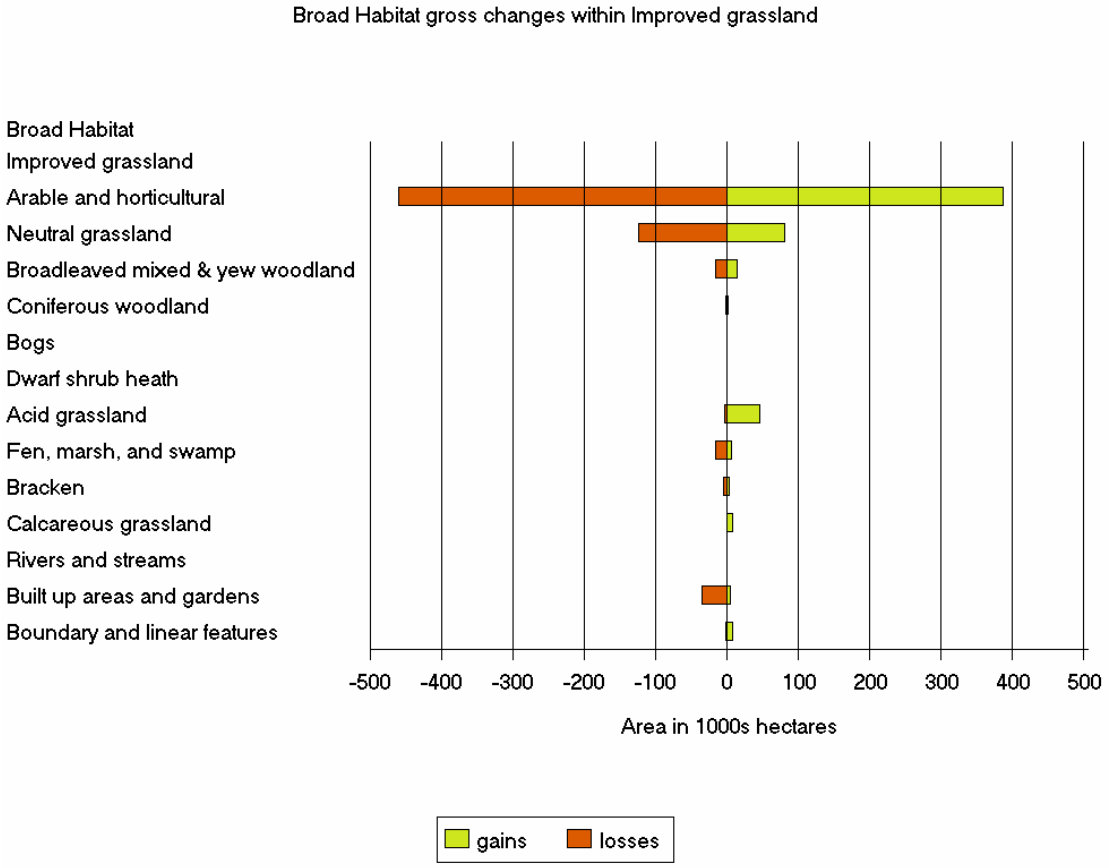


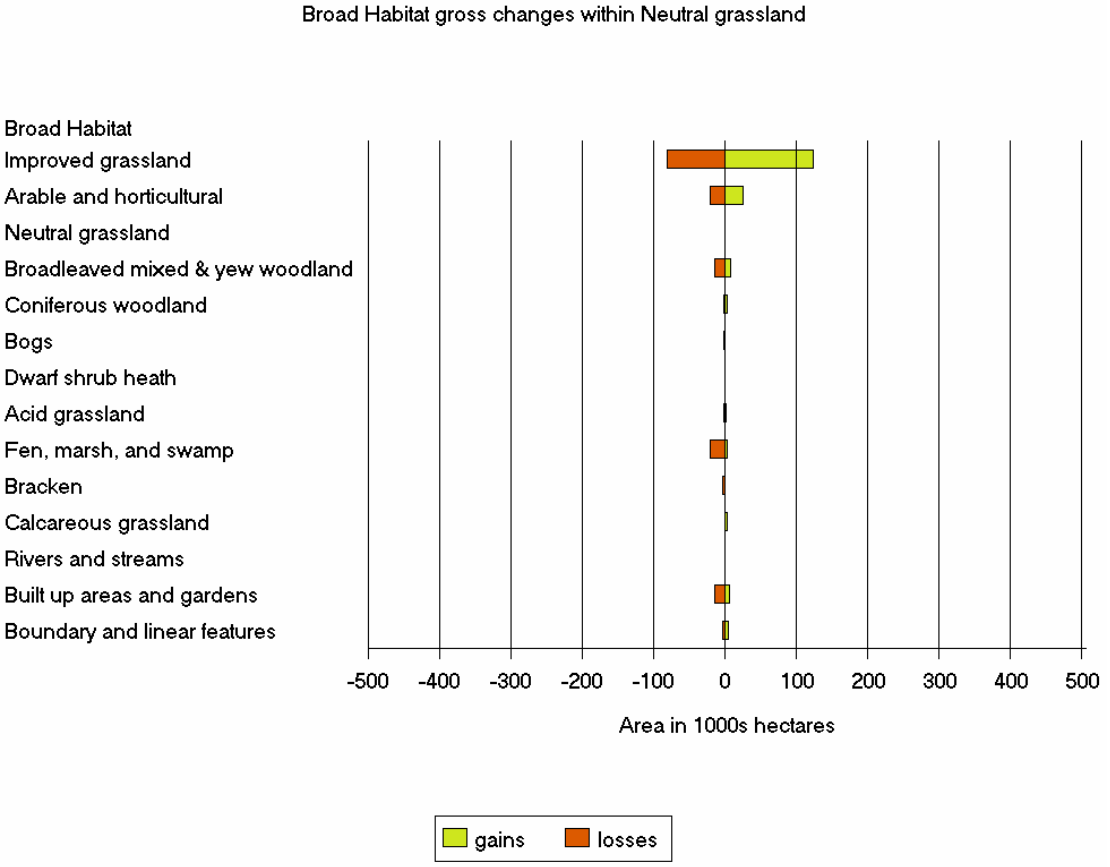
Fig. 5.2b Interchanges in gross area (‘1000’s hectares) of Broad Habitat between *Improved Grassland* and other Broad Habitat types.



This interchange between the two most dominant Broad Habitats is to be expected since ploughing and re-sowing of grassland is part of the normal arable rotation. Losses of the *Arable* and *Improved Grassland* to *Broadleaved Woodland* and *Built-up* Broad Habitats reflect patterns at the GB level and are to be expected given policies to encourage woodland planting (see Chapter 1) and development pressures in England. As with the GB picture, more *Improved Grassland* than *Arable* land is being lost to development in England.

Neutral Grassland has also shown considerable turnover with other Broad Habitats during the period 1990-1998 (Fig 5.1c).Changes in Neutral Grassland are being investigated further in the FOCUS (Finding out Causes and Understanding Significance) project. Overall, losses to a number of Broad Habitats were outweighed by net (non-significant) gains in the habitat type largely at the expense of Improved Grassland.

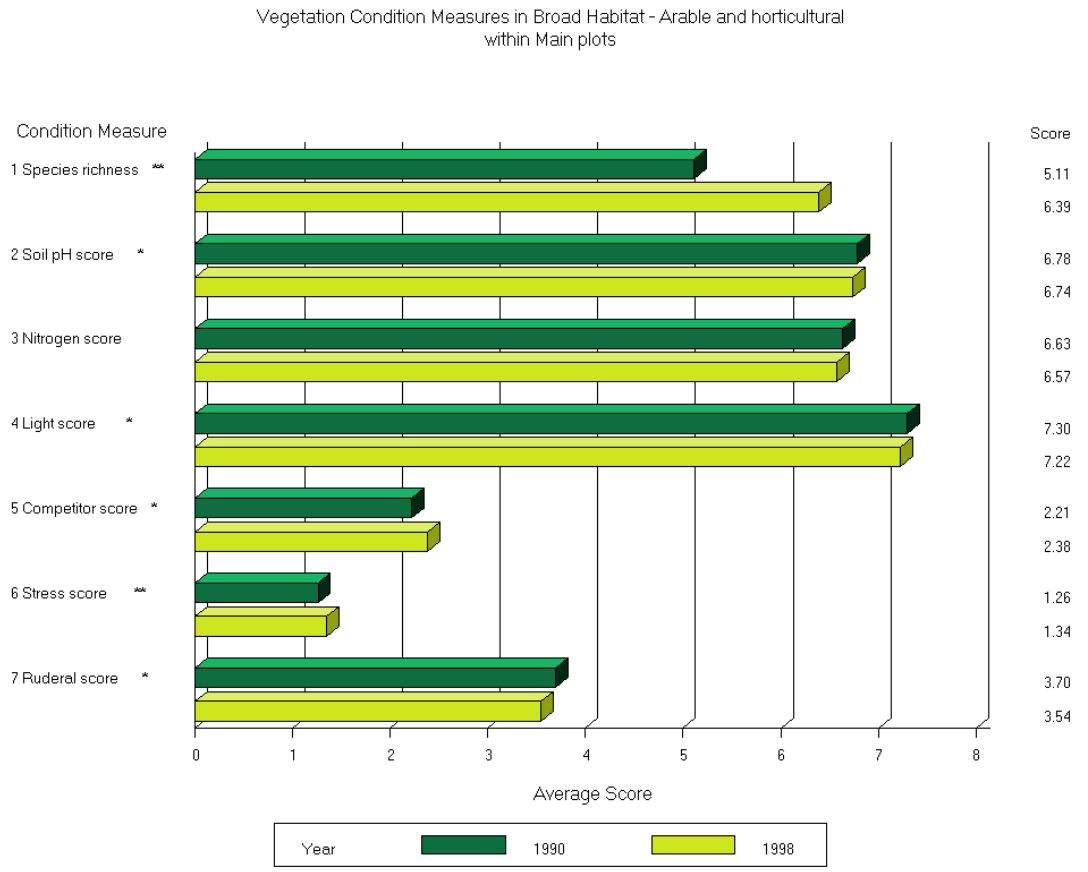
Fig 5.2c Interchanges in gross area (1000's hectares) of Broad Habitat between *Neutral Grassland* and other Broad Habitat types.



5.3 Changes in Condition

The ecological condition of the Broad Habitats which comprise enclosed farmland are of key interest given the proportion of land area which they cover in England. Whereas the 1990 Countryside Survey concluded that there had been a decline in weed diversity on arable fields the results of CS2000 show increased species richness in main plots on *Arable and Horticultural* (Fig 5.3).

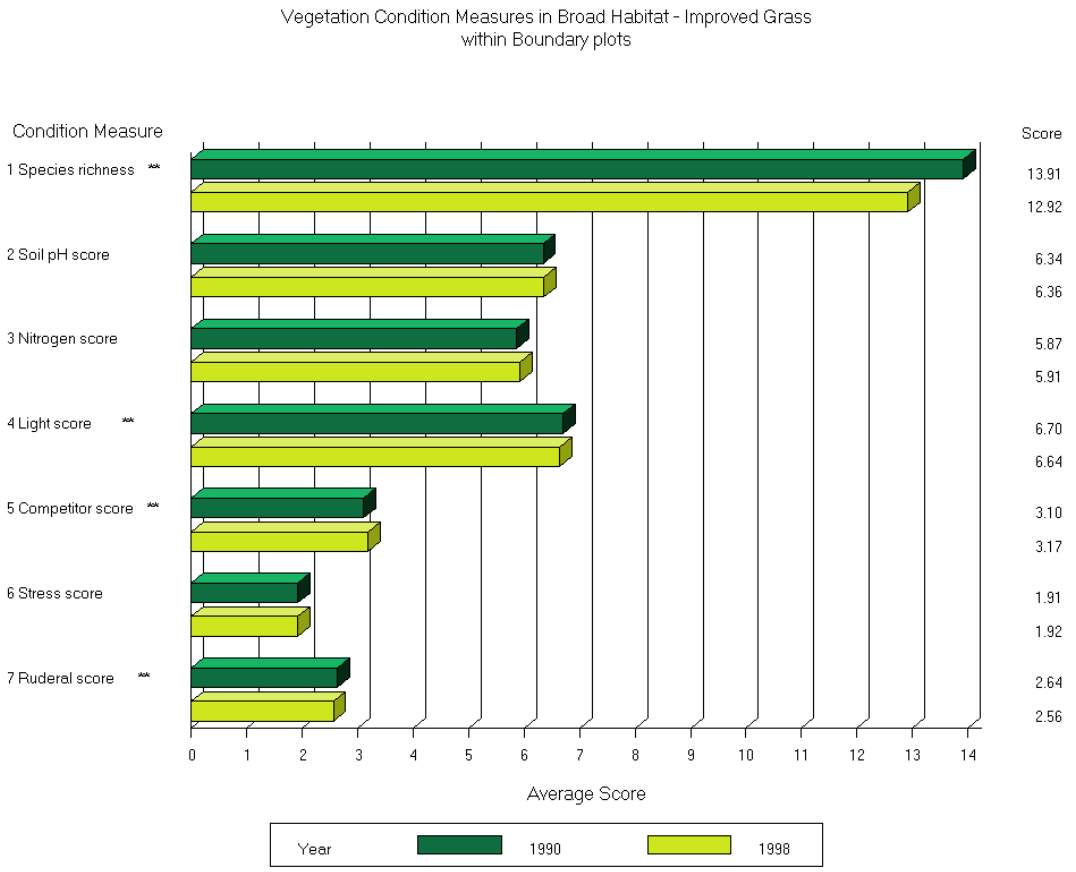
Fig 5.3 Vegetation condition measures in *Arable and Horticultural* Main (X) plots (n varies according to condition measure with max n = 286 and min n = 214).



These changes in species richness appear to be associated with shifts in the balance between competitive, ruderal and stress tolerant species and may reflect shifts in cropping patterns. In contrast to increases in species richness in main plots on *Arable and Horticultural* there were significant decreases in targeted plots. Similar results were found for boundary (Fig 5.4) and targeted plots on *Improved Grassland* in England.

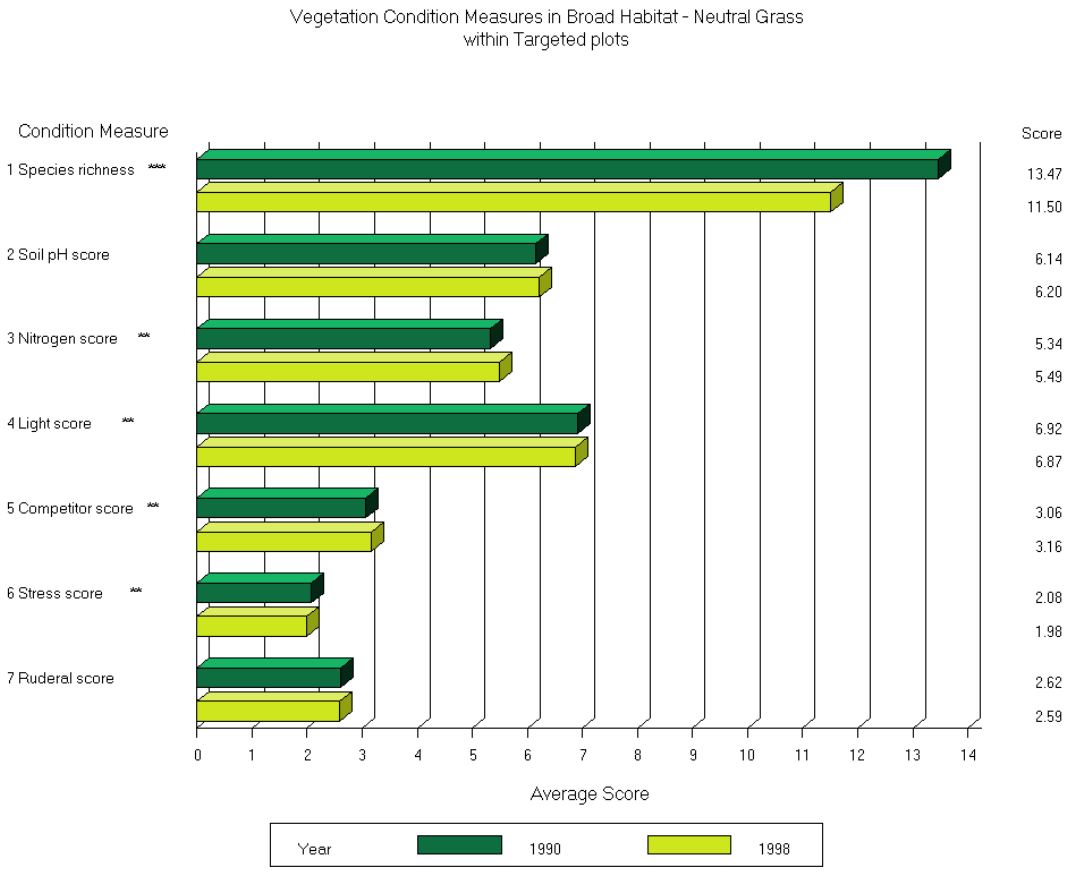
Aligned with this decrease in species richness are marginal, but significant, increases in nutrient levels and the proportion of competitive plant species present. These results are in agreement with results for GB as a whole. It should be noted that analyses of vegetation condition are 1990 based, which means that changes in condition may also reflect the movement of plots from one Broad Habitat to another, e.g. *Arable and Horticultural* to *Grassland*.

Fig 5.4 Vegetation condition measures in *Improved Grassland* in boundary plots (n = 381).



The results for *Neutral Grassland* for England also reflect the results for GB as a whole. The targeted plots which record smaller fragments of the Broad Habitat found in the countryside showed significant increases in fertility and numbers of competitive species aligned with significant decreases in species richness and numbers of stress tolerant species (Fig. 5.5).

Fig 5.5 Vegetation condition measures in *Neutral Grassland* in Targeted plots (n = 167).



6. WOODLANDS – Broadleaf, Mixed and Yew Woodlands, Coniferous Woodlands

Main Findings

Woodland covers approximately 10% of rural land in England. There was a significant net gain in stock of *Broadleaf, Mixed and Yew Woodland* between 1990 and 1998 and a significant net loss in the stock of *Coniferous Woodland*. Much of the increase in *Broadleaf Woodland* is at the expense of losses in *Coniferous Woodland* suggesting that policies encouraging the planting of *Broadleaf* over *Coniferous Woodland* are working. Little change was detected in the condition of *Coniferous Woodland*. However, the condition of *Broadleaf Woodland* appeared to show a successional change, with a decrease in species richness and the numbers of ruderal species and increases in the numbers of shade loving competitive species.

6.1 Introduction

Woodlands form an integral part of the pattern of the English countryside. They have been the focus of a number of environmental policies during the period between the last two Countryside Surveys including the 1998 UK Forestry Standard and the UK Strategy for Sustainable Development[1]. The aim of such policies has been to enhance and improve the quality and area of woodlands, thereby enhancing their role in the wider countryside.

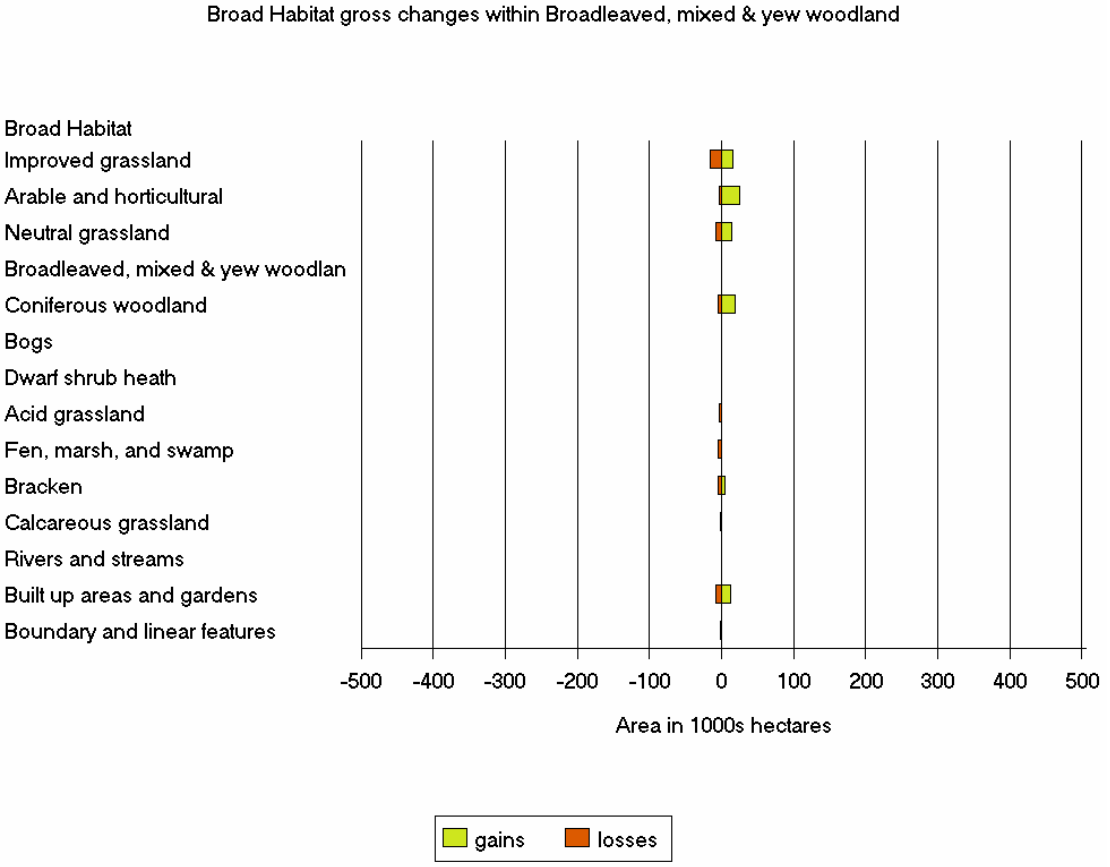
Broadleaved Woodland includes stands of native and non-native trees such as oak (*Quercus sp*), ash, (*Fraxinus excelsior*), beech (*Fagus sylvatica*), sycamore (*Acer pseudoplantanus*) and yew (*Taxus baccata*) in which the proportional cover of broadleaved species is more than 20% of the tree cover present. *Coniferous Woodland* is dominated by native and non-native conifers such as Scots pine (*Pinus sylvestris*), Sitka spruce (*Picea sitchensis*) and larch (*Larix spp*.). Recently felled woodland is included in this habitat type where there is a probable intention to return the area to woodland.

6.2 Trends

The stock of *Broadleaf Woodland* in England increased by around 4% on stock recorded in 1990 to over 0.9 million hectares, compared to a gain of 9% in Scotland. These changes reflect the policies for expansion of native woodland referred to above. Planting incentives have been particularly targeted at *Arable and Horticultural* as well as intensively managed grassland. Fig 6.2a shows that the main gains in *Broadleaf Woodland* were at the expense of *Arable and Horticultural* and *Coniferous Woodland*, although there were smaller gains from *Built-up and Gardens* and *Neutral Grassland.* Gains from *Coniferous Woodland* may be as a result of replanting after felling, or of thinning conifers in mixed woodland.

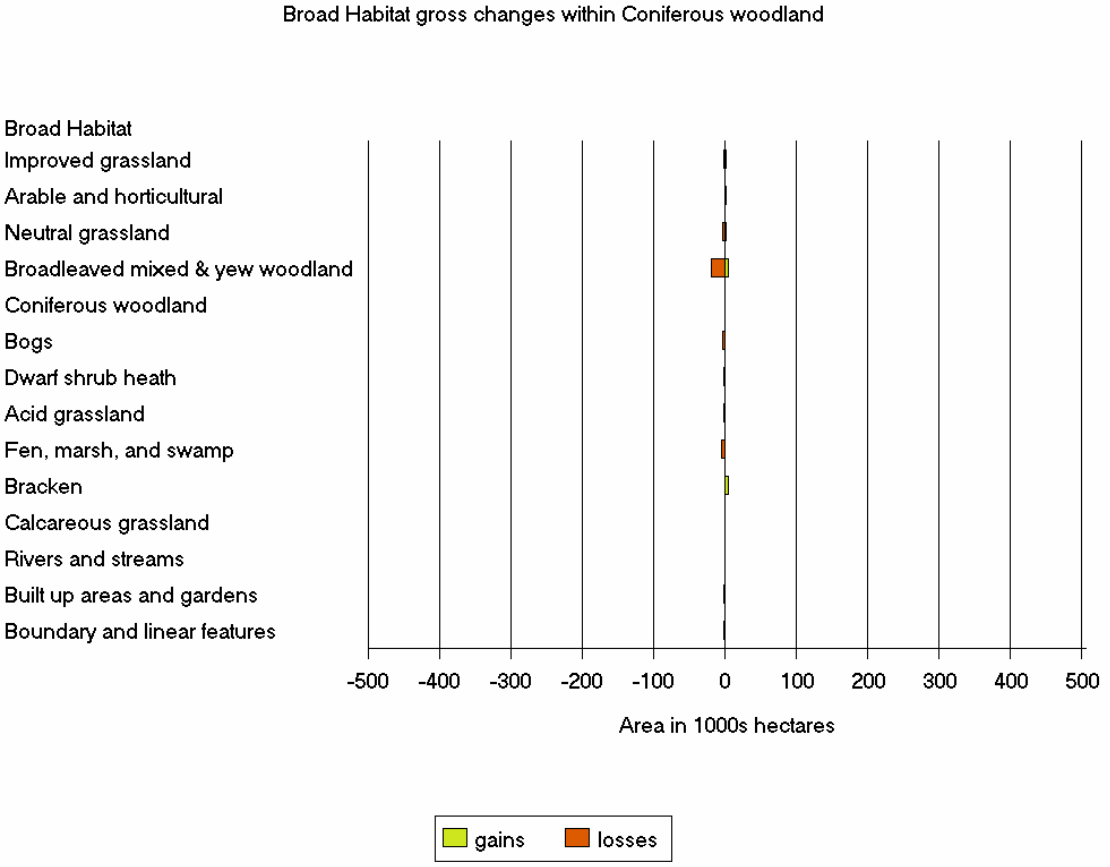
[1] Forestry Commission (1998) *UK Forestry Standard*, Forestry Commission, Edinburgh; HMSO (1994) *Sustainable Forestry*: The UK Programme. HMSO London; DETR (1999) *A better quality of life*: *A sustainable development strategy for the UK*. The Stationary Office, London, Cm 4345. Forestry Commission (1998*) The England Forestry Strategy*, Forestry Commission, Edinburgh;

Fig 6.2a Interchanges in gross area (100's hectares) of Broad Habitat between *Broadleaf, Mixed and Yew Woodland* and other Broad Habitat types.



As may be expected, gains to *Broadleaf Woodland* due in part to losses from *Coniferous Woodland* have resulted in decreased stock of the *Coniferous Woodland* Broad Habitat. There was a significant loss in the stock of *Coniferous Woodland* in England of 6.5%. This contrasts with results from Scotland which showed no significant change in stock between 1990 and 1998. In England the largest net loss was to *Broadleaf, Mixed and Yew Woodland* (Fig 6.2b). Other losses and gains between a range of Broad Habitats were on a smaller scale.

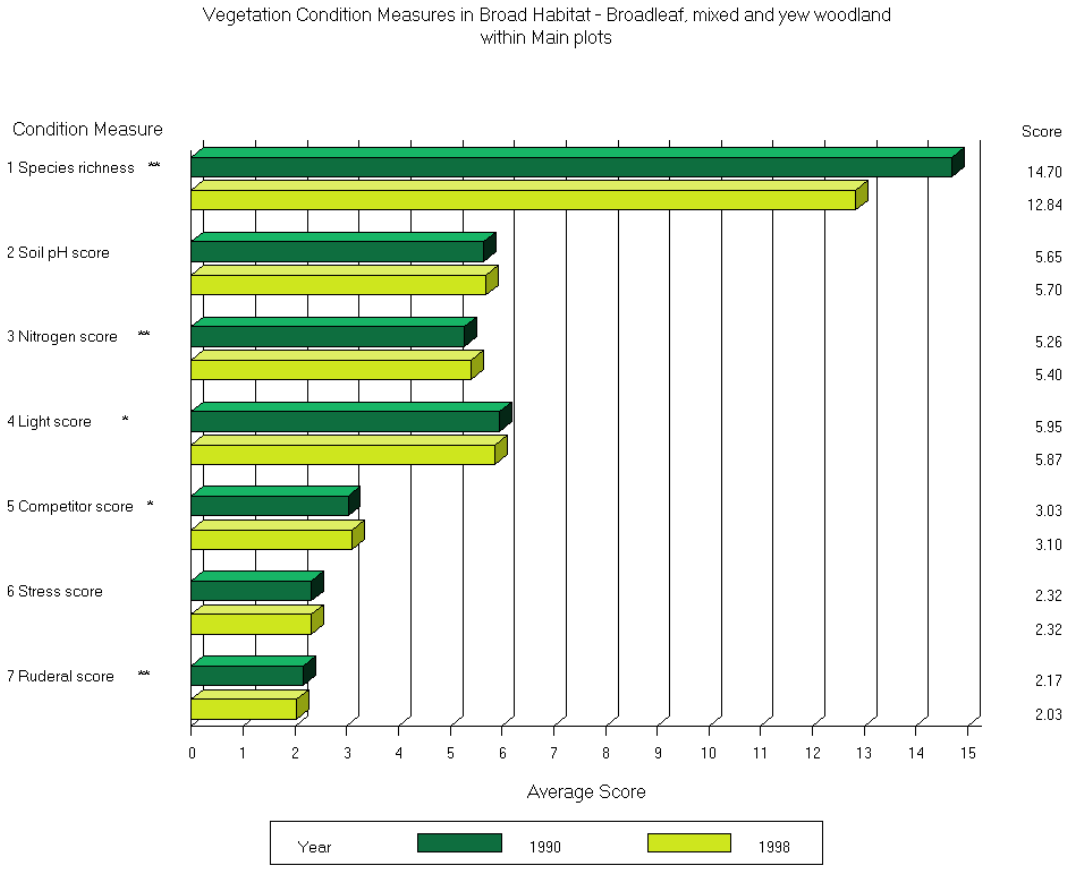
Fig 6.2b Interchanges in gross area (100's hectares) of Broad Habitat between *Coniferous Woodland* and other Broad Habitat types.



6.3 Changes in Condition

As for Great Britain as a whole, there was a decline in species richness in *Broadleaf Woodland* in England. Fig 6.3 shows the decrease in species richness detected in Main (X) plots (random plots of 14 x 14m placed in fields and unenclosed land away from field boundaries) between 1990 and 1998. Associated with the decline in species richness are changes in the proportions of ruderal and competitive species, an increase in fertility and a decrease in the light score indicating more shaded, perhaps later successional, conditions. These results are very similar to those found for England and Wales, but not for Scotland

Fig 6.3 Vegetation condition measures in *Broadleaf, Mixed and Yew Woodland* in Main (X) plots (n = 99).



There were no significant changes in the condition of the *Coniferous Woodland* Broad Habitat between 1990 and 1998.

7. MOUNTAIN, MOOR, HEATH AND DOWN – Acid Grassland, Dwarf Shrub Heath, Fen, Marsh, Swamp, Bog, Bracken and Calcareous Grasslands

Main Findings

The semi-natural habitats which comprise areas of mountain, moor, heath and down cover around 10% of rural land in England. There were no significant changes in the stock of *Bog, Dwarf Shrub Heath* or *Bracken* Broad Habitats between 1990 and 1998. There was a significant increase in the stock of *Fen, Marsh and Swamp*, with largest gains from *Neutral*, *Improved* and *Acid Grassland.* There were significant decreases in stock of both the *Acid Grassland* and *Calcareous Grassland* Broad Habitats with losses chiefly to *Improved Grassland*. There was some evidence of changes in species composition in the *Bracken* and *Acid Grassland* Broad Habitats.

7.1 Introduction

The English uplands, which are the areas where the Broad Habitats covered in this chapter are largely concentrated, are important resources for biodiversity as well as supporting both outdoor recreation, tourism and less intensive agriculture. Most of the Broad Habitats are covered by their own 'habitat statements' as part of the *UK Biodiversity Action Plan* and policy initiatives have been directed at encouraging appropriate agricultural practices in areas designated as having high environmental value (e.g. Environmentally Sensitive Areas and other agri-environment schemes).

Acid Grassland Broad Habitats are dominated by grasses and herbs on lime-deficient or acidic soils. They include a range of habitats from open dry grasslands which often include many annuals to damp moorland grasslands on shallow peats. *Dwarf, Shrub Heath* occurs on generally well drained, nutrient poor acid soils and is distinguished from *Acid Grassland* by the cover of plant species from the heath family or dwarf gorse species exceeding 25%. *Calcareous Grassland* contrasts with the two previous Broad Habitats in that it is dominated by grasses and herbs on shallow, well drained soils which are alkaline as a result of the weathering of chalk, limestone or other types of base-rich rock.

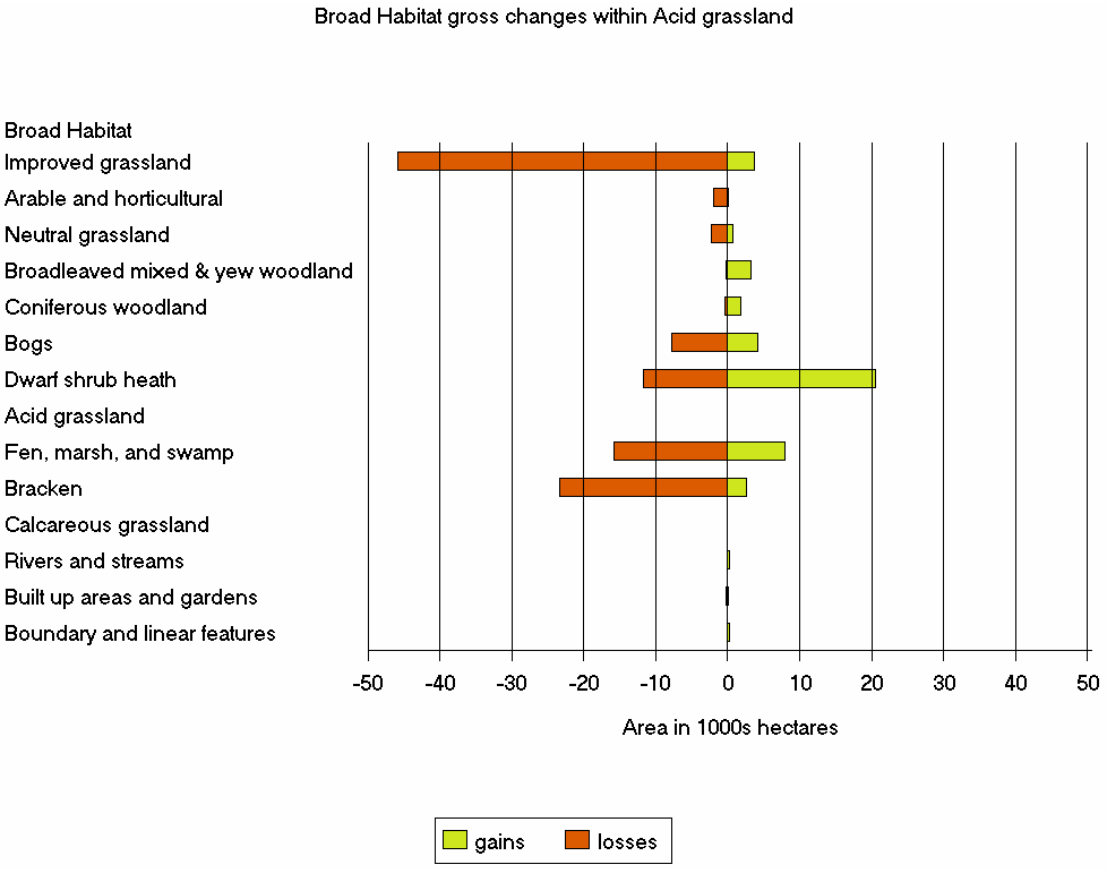
Fen, Marsh and Swamp includes a wide range of plant communities (including fens, flushes, marshy grasslands, rush-pastures, swamps and reedbeds) found on either peat, peaty soils or mineral soils. It is characterised by being permanently, seasonally or periodically waterlogged as a result of ground water or surface run-off. This contrasts with *Bog* habitats which receive mineral nutrients from precipitation. The *Bog* Broad Habitat generally comprises of wetlands formed only on deep wet acid peat where (without interference) vegetation is dominated by plants tolerant of acid conditions. The *Bracken* Broad Habitat is easily identified by stands of vegetation greater than 0.25 ha in area dominated by continuous canopies of *Bracken* (*Pteridium aquilinum*).

7.2 Trends

It should be noted at this stage, that all the Broad Habitats covered in this chapter are of limited extent when compared to other Broad Habitats (see Fig 2.1). For this reason, in order to present the interchanges in gross area effectively for these habitats the scale used is different to that used for Broad Habitat flows in other chapters. For

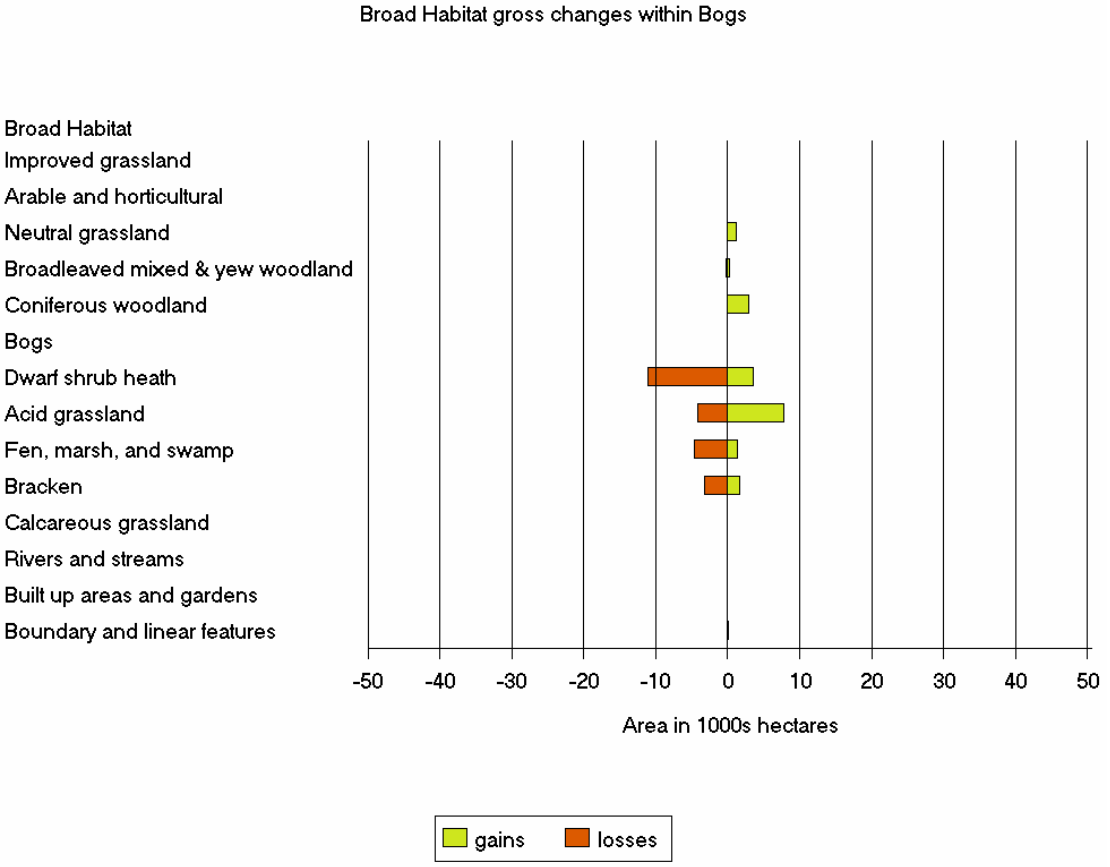
GB as a whole the only Broad Habitat within the Mountain, Moor, Heath and Down habitats to show a significant decline in area was *Acid Grassland* although the stocks of both *Bog* and *Dwarf Shrub Heath* showed non-significant declines in area. For England only, *Acid Grassland* still showed a significant decline in extent with a loss of approximately 15% of the stock in 1990. As reported in the main CS2000 report (Haines-Young *et al.* 2000) loss of *Acid Grassland* in both England and Wales was concentrated in the Uplands where it was lost to *Improved Grassland* and other semi-natural habitats such as *Bracken, Fen Marsh and Swamp* and *Dwarf Shrub Heath* (Fig 7.2a). Losses of *Acid Grassland* to *Improved Grassland* and *Bracken* are contrary to BAP objectives for this habitat and are therefore of concern.

Fig 7.2a Interchanges in gross area (100's hectares) of Broad Habitat between *Acid Grassland* and other Broad Habitat types. (N.B. Due to the limited extent of this Broad Habitat the scale is x10 the scale for Broad Habitat flows in other chapters).



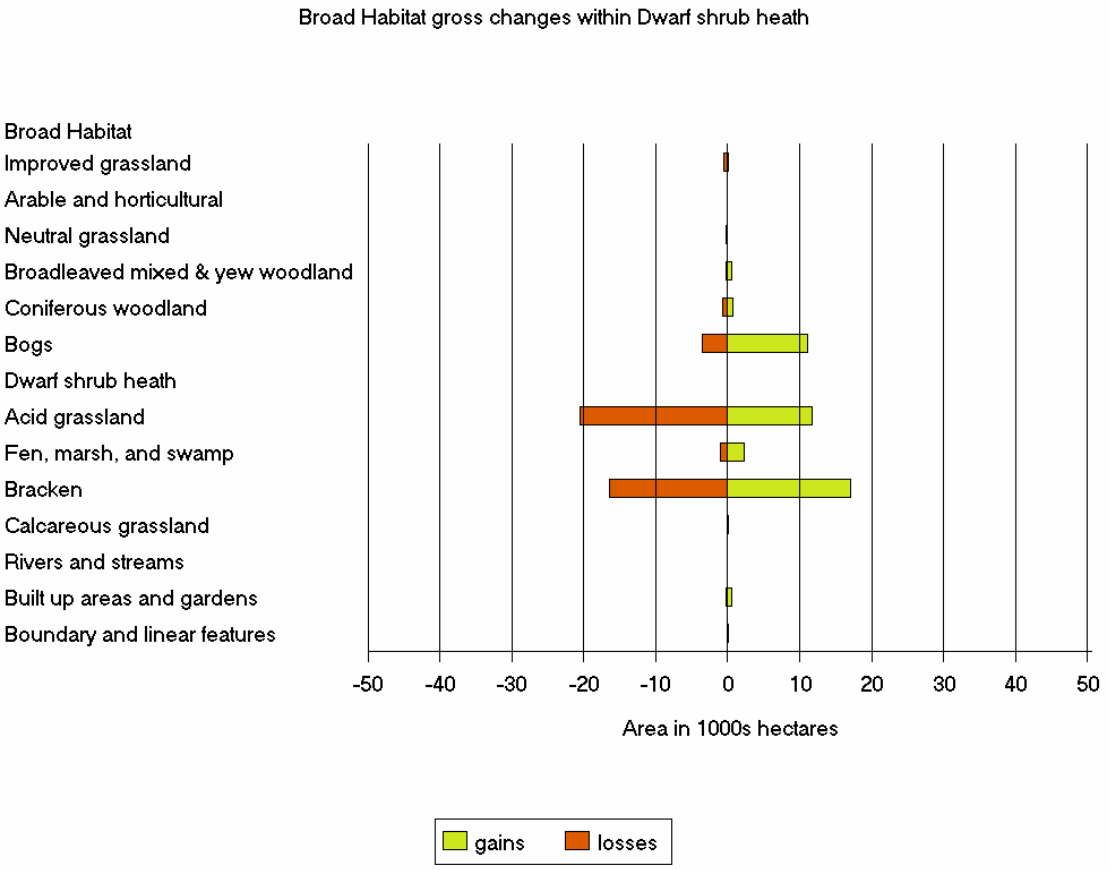
The declines in the *Bog* Broad Habitat at the GB level are not reflected in the results for England. This is not surprising given the fact that GB results for *Bog* are dominated by the results for Scotland where *Bog* is the most extensive Broad Habitat in Scotland. Fig 7.2b shows the picture of change in the relatively small stock of *Bog* in England between 1990 and 1998. It shows that the majority of interchange between the *Bog* Broad Habitat and other Broad Habitats was between semi-natural habitats covered in the chapter, although there was some gain from *Coniferous Woodland*. Changes to *Bog* may reflect different interpretations by field surveyors of this complex habitat.

Fig 7.2b Interchanges in gross area (100's hectares) of Broad Habitat between *Bog* and other Broad Habitat types. (N.B. Due to the limited extent of this Broad Habitat the scale is x10 the scale for Broad Habitat flows in other chapters).



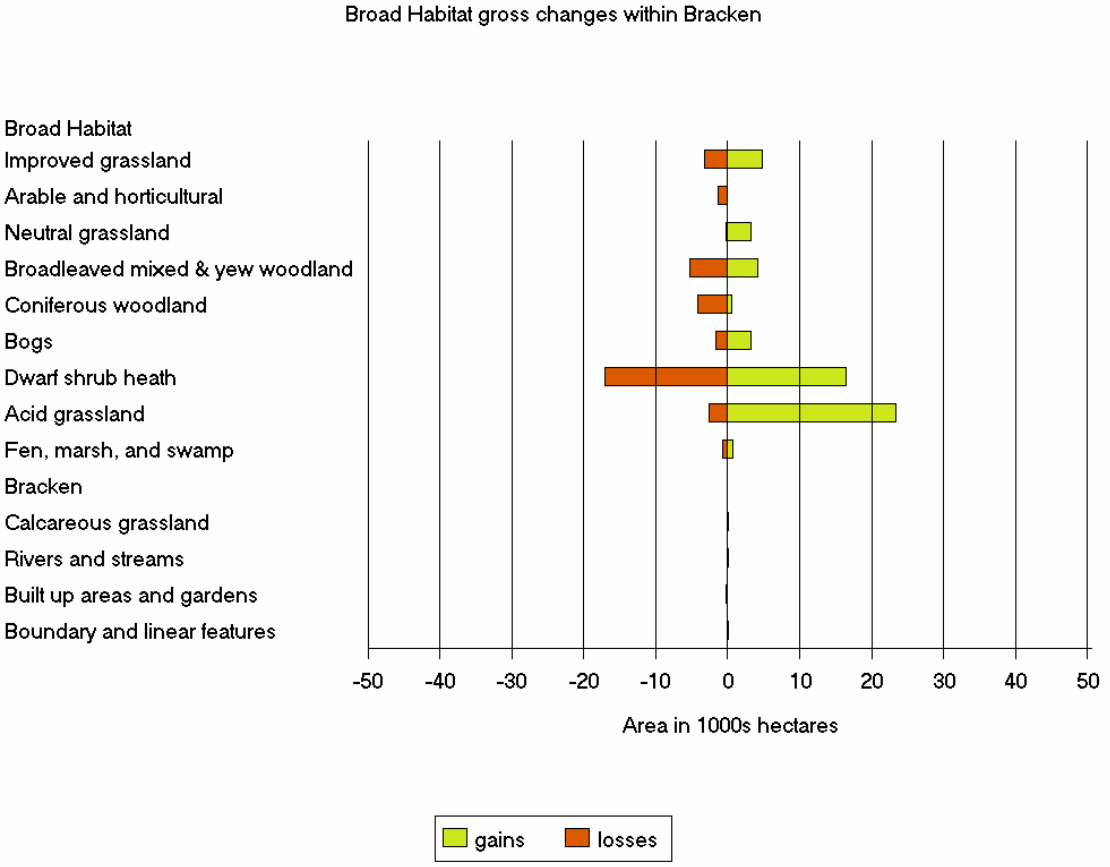
As for the *Bog* Broad Habitat, the change in the *Dwarf Shrub Heath* Broad Habitat in GB and England was different. *Dwarf Shrub Heath* (Fig 7.2c) showed non-significant increases across England reflecting net gains from *Bog* and *Fen, Marsh and Swamp.* The gain in *Dwarf Shrub Heath* may result from conservation efforts in particular areas but would require further investigation to confirm that. It may also be due to the difficulty of interpreting complex habitats by field surveyors, or to bog drainage.

Fig 7.2c Interchanges in gross area (100's hectares) of Broad Habitat between *Dwarf Shrub Heath* and other Broad Habitat types. (N.B. Due to the limited extent of this Broad Habitat the scale is x10 the scale for Broad Habitat flows in other chapters).



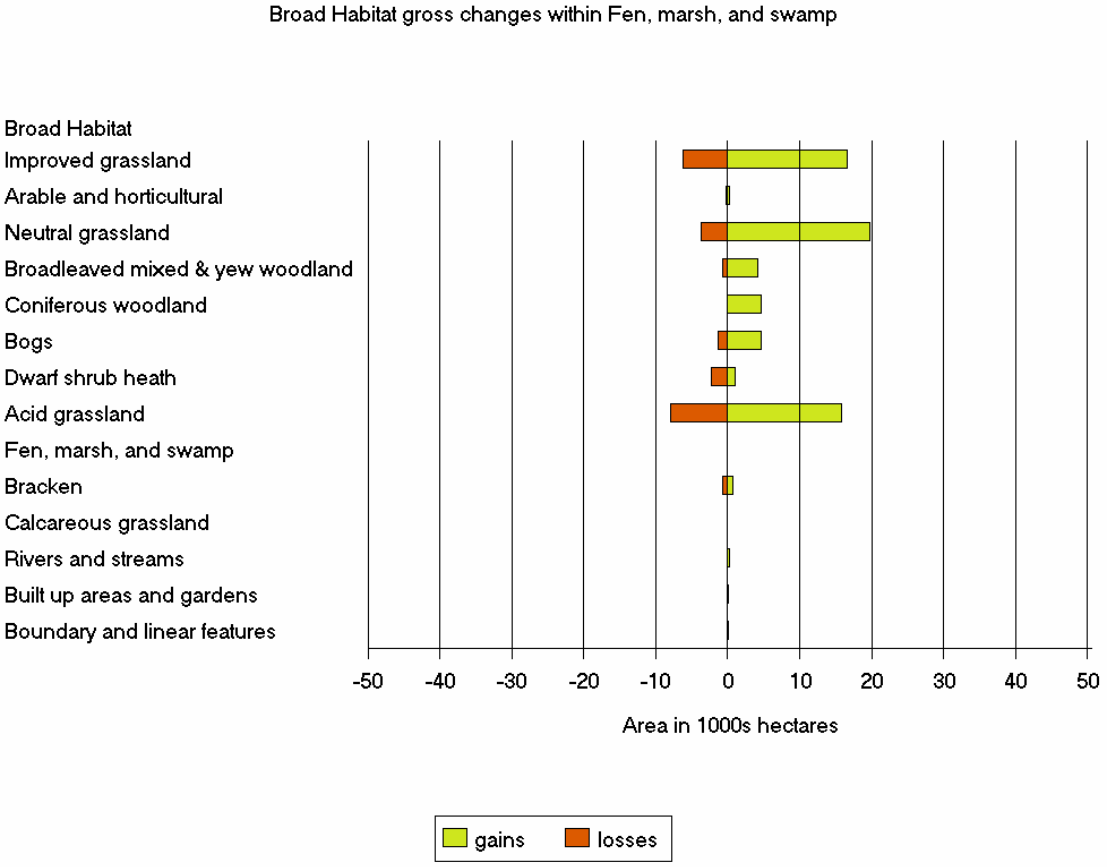
The area of *Bracken* did not change significantly between 1990 and 1998, previously it had shown a marked decline between 1984 and 1990. Whilst there was no significant change, the trend was towards an increase rather than a decline in the Broad Habitat, which appears to have been at the expense of *Acid* and *Neutral Grassland* in particular (Fig 7.2d).

Fig 7.2d Interchanges in gross area (100's hectares) of Broad Habitat between *Bracken* and other Broad Habitat types. (N.B. Due to the limited extent of this Broad Habitat the scale is x10 the scale for Broad Habitat flows in other chapters).



The *Fen, Marsh and Swamp* Broad Habitat is one of the most limited terrestrial Broad Habitats in extent in England. Between 1990 and 1998 it showed a significant increase in area in GB, England and Wales, Scotland and England only. The increase in area in England and Wales equated to a 27% increase in stock on the 1990 figure. For England only the percentage change in stock was almost 50% with largest gains from *Acid*, *Neutral* and *Improved Grassland* (Fig 7.2e).

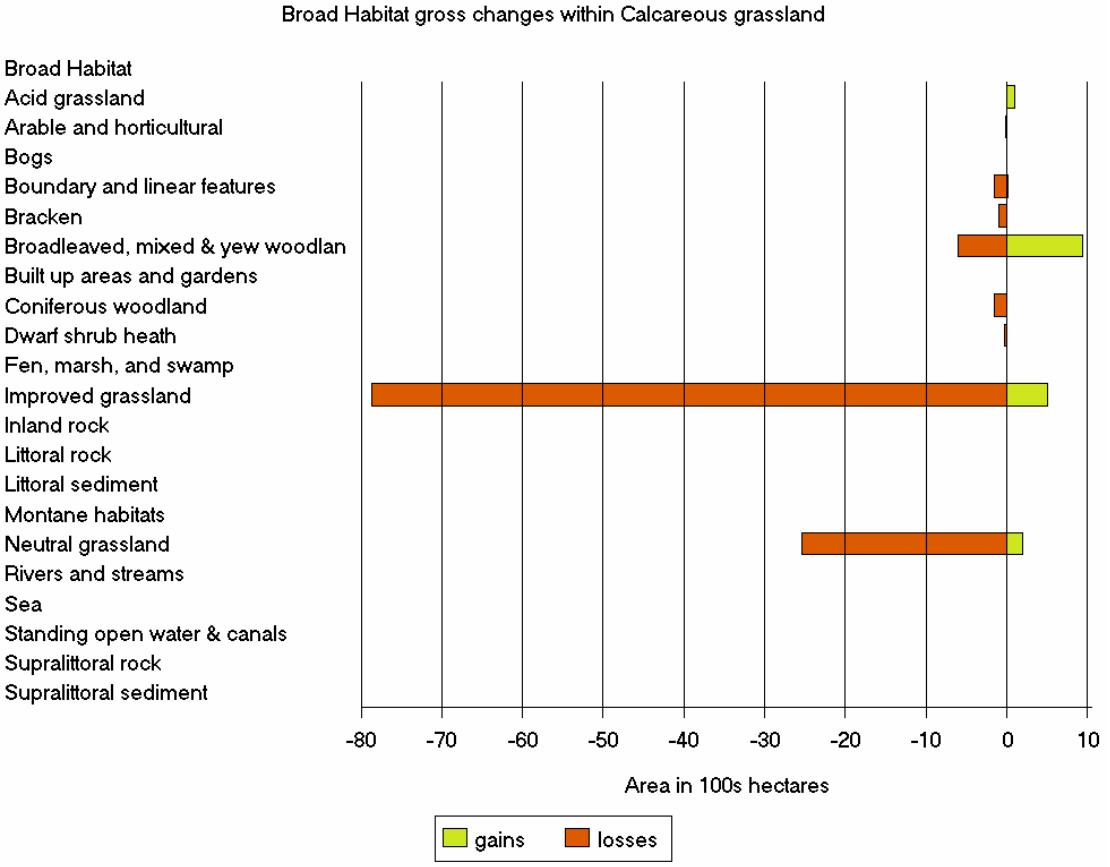
Fig 7.2e Interchanges in gross area (100's hectares) of Broad Habitat between *Fen, Marsh and Swamp* and other Broad Habitat types. (N.B. Due to the limited extent of this Broad Habitat the scale is x10 the scale for Broad Habitat flows in other chapters).



The expansion of *Fen, Marsh and Swamp* may be seen as favourable given BAP objectives for the habitat. However, the favourability of the expansion depends on where those gains are being made. As gains in *Fen, Marsh and Swamp* appear to be at the expense of other habitats for which there are BAP objectives, the expansion may not be wholly favourable. In addition, analysis of data collected as part of CS2000 has indicated that assignment of habitats to *Fen, Marsh and Swamp* may have been as a result of the expansion of rushes (*Juncus* spp.) characteristic of this habitat. If this is the case, gains in the area of *Fen, Marsh and Swamp* do not directly equate to gains in priority habitats.

Calcareous Grassland areas are concentrated into limited areas of GB which make it difficult for a survey of this kind to provide accurate figures of stock and change of this Broad Habitat. However, the stock figures published in the relevant Habitat Action Plan are similar to those published in the main CS2000 report (Haines-Young *et al.* 2000). The results of CS2000 suggest that there was a significant decrease in England only, of around 20% of 1990 stock, and that losses were primarily to *Improved Grassland* (Fig 7.1f). Degradation of these botanically rich habitats is being investigated further in the FOCUS (Finding out Causes and Understanding Significance) project.

Fig 7.2f Interchanges in gross area (100's hectares) of Broad Habitat between *Calcareous Grassland* and other Broad Habitat types. (N.B. Due to the limited extent of this Broad Habitat the scale is x10 the scale for Broad Habitat flows in other chapters).



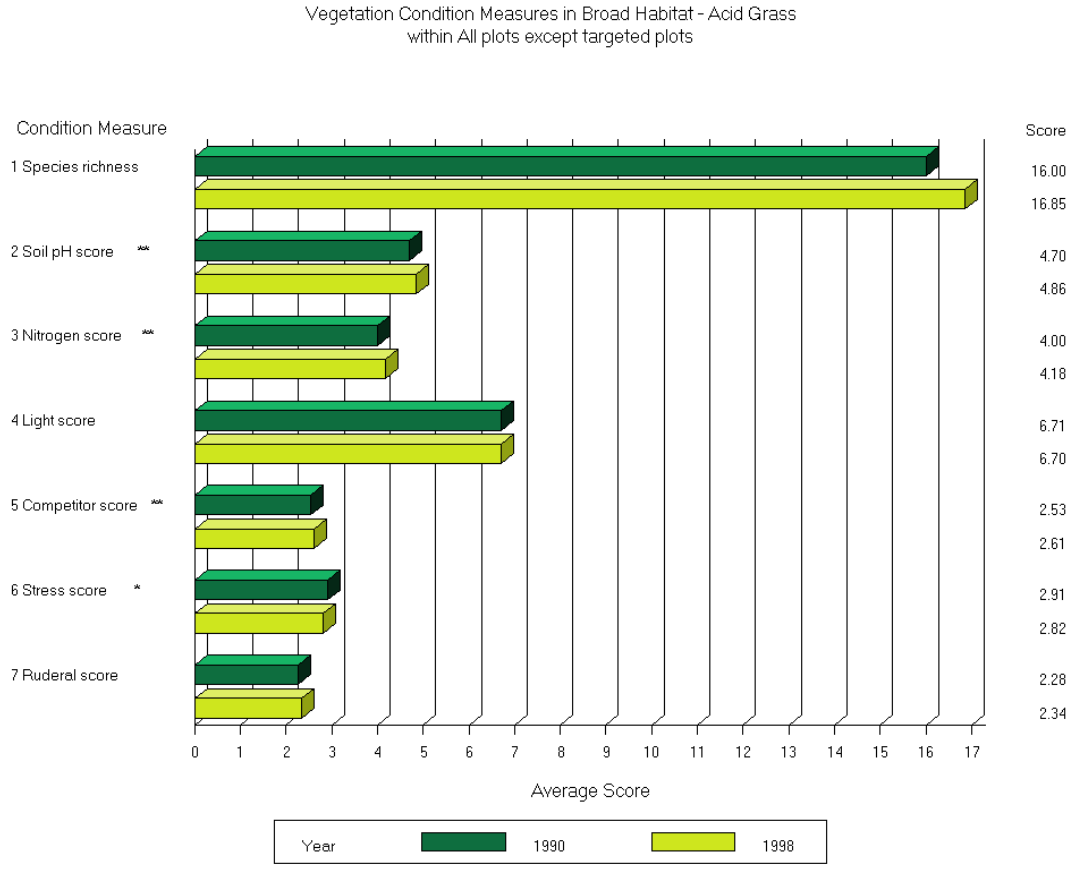
7.3 Changes in Condition

The findings from CS1990 indicated that there was a decline in the quality of some upland vegetation types. This took different forms in the different vegetation types, with some showing declines in species richness where increases would have indicated increasing quality (e.g. upland woods and grass mosaics) and others showing increases which indicated degraded habitats (e.g. heaths and bogs). Using the Broad Habitat definitions (as in CS2000) it is not always easy to pick up obvious trends in the semi-natural habitats in England covered here, and for the majority of Broad Habitats there were no significant changes in condition scores between 1990 and 1998.

However, in the *Acid Grassland* Broad Habitat there was evidence that the trends picked up in 1990 may be continuing. There were significant decreases in the proportion of stress tolerant plants typical of acid soils and increases in the proportion of competitive species which prefer more fertile soils. Significant increases in soil pH and nitrogen levels explain this shift in species (Fig 7.3). The only other significant change in condition in the Broad Habitats covered in this chapter was a decrease in species richness in the *Bracken* Broad Habitat.

The 42% increase in the numbers of sample squares in the English uplands together with the addition of U plots (2 x 2m plots introduced in CS2000 to help characterise the stock of Unenclosed Broad Habitats) in CS2000 as compared to the 1990 survey, will provide an improved baseline for detecting change in the group of habitats covered in this chapter.

Fig 7.3 Vegetation condition measures in *Acid Grassland* in all plots (excluding targeted) (n = 117).



8. RIVERS, STREAMS AND STANDING WATERS

Main Findings

There was no significant change in the stock of *Standing Open Water and Canals* between 1990 and 1998. Whilst the stock of *Rivers and Streams* showed a significant decrease over the same period, given the linear nature of these features, changes in area covered are more likely to be due to differences in interpretation than to real changes. Changes in the vegetation associated with *Rivers and Streams* were very marked and indicate changes in the successional state of the Broad Habitat.

8.1 Introduction

The results for these two Broad Habitats take in both the water body itself and the associated waterside vegetation. *Standing Open Waters and Canals* includes ponds, lakes, canals, ditches and reservoirs, whilst *Rivers and Streams* ranges from large rivers to small headwater streams. Several vegetation types can be found associated with *Standing Water* including aquatic vegetation (either free floating or rooted in sediments), emergent (e.g. reeds) or marginal vegetation around the edges of the water body. The vegetation associated with *Rivers and Streams* is found in the open channel between bank tops and includes aquatic and marginal vegetation alongside any growing on exposed sediments and shingle banks. The two freshwater Broad Habitats are important features of the English landscape, both as water resources and the wide range of plant and animal species associated with them as well as in their recreational role.

8.2 Trends

The results indicate a significant change in the stock of *Rivers and Streams* in England in the period 1990 to 1998 and no change in the stock *of Standing Open Waters and Canals*. The change in stock of *Rivers and Streams* is confounded by the problem of giving linear features an area and speculation as to causes for the change are not entered into here. Results in the main CS2000 report (Haines-Young *et al.* 2000) give more detail on changes in the numbers of inland water bodies in England and Wales, and on water quality, which have not been looked at on an England only basis.

8.3 Changes in condition

One of the plot types used in CS squares was a linear 10 x 1m ‘streamside’ plot placed along the edge of a watercourse. There were a number of significant changes in condition measures for these plots as shown in Fig 8.3.

Fig 8.3 Vegetation condition measures in *Rivers and Streams* (streamside and waterside plots) (n varies according to condition measure but always = either 890 or 892).

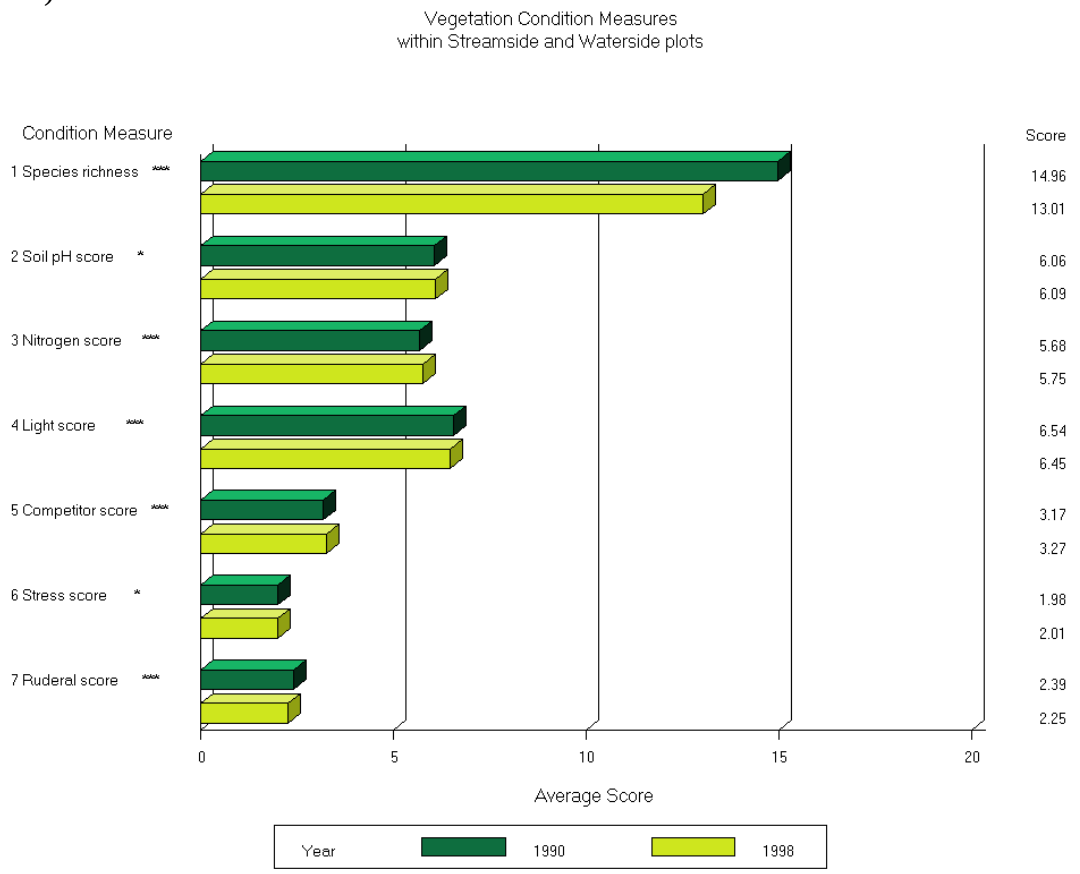


Fig 8.3 shows that there have been significant decreases in species richness in vegetation associated with this Broad Habitat. Aligned with this decrease are increases in fertility and the proportion of competitive, tall growing species combined with decreases in the light score and the proportion of ruderal species present. There were also significant increases in soil pH and the proportion of stress tolerant species. These changes did not occur in Scotland as a whole, although there was evidence of some negative changes in vegetation quality in the lowlands. The changes in England are consistent with successional changes of progressive colonisation by tall herbs, shrubs followed by trees and may be the result of less intensive management of streamside habitats. Significantly lower species richness occurred in streamside and riverside plots adjacent to several Broad Habitats, i.e. *Broadleaf, Mixed and Yew Woodland, Improved Grassland* and *Arable and Horticultural.*

Increases in the proportion of competitive species may result from increases in fertility from enriched run-off. The effective use of increased nutrients by such vegetation may actually enhance the water quality of the features with which it is associated, as well as providing habitats and corridors for invertebrates, birds and small mammals. However, the benefits are offset by losses of appropriate habitats for species that have become uncommon and rely on streamsides as a refuge. In the presence of taller growing, more competitive species, such species are out-competed. The changes in vegetation condition in this habitat were highly significant and indicate that vegetation associated with *Rivers and Streams* is very dynamic. The overall implications for biodiversity are being investigated further in the FOCUS (Finding out Causes and Understanding Significance) project.

9. DEVELOPED LAND IN RURAL AREAS – Linear Features (Transport Features), Built-Up and Gardens

Main Findings

Around 11% of rural land in England is covered by the *Built-up and Gardens* Broad Habitat and transport features[1]. There was a gain in the stock of *Built-up and Gardens* of around 43,000ha with net gains from a range of Broad Habitats. Whilst the stock of transport features showed a significant decrease over the same period (as with *Rivers and Streams*), given the linear nature of these features, changes in area covered are more likely to be due to error or differences in interpretation than to real changes. There were significant decreases in species richness in roadside and verge plots.

9.1 Introduction

Developed land in rural areas is grouped into one Broad Habitat, *Built-up and Gardens*. This Broad Habitat covers urban and rural settlements, farm buildings and all man-made structures including industrial estates, retails parks, derelict land, airports, urban parkland, mineral workings and transport infrastructures in urban areas.

Roads, railways and tracks are included within the definition of the *Boundary and Linear Features* Broad Habitat and make up the majority of the area of that Broad Habitat. The Broad Habitat also includes hedgerows, walls, wide headlands, and some features which are uncommon in the landscape, e.g. old railway tracks and disused roads. Most of these features do not have an area, e.g. hedgerows and walls. However, a small proportion of the land in the *Boundary and Linear Features* Broad Habitat is not covered by transport features, hence the use of 'transport features' rather than *Boundary and Linear Features*. In this chapter transport features and *Built-up and Gardens* are looked at together as developed land in rural areas.

In many parts of England there are increasing pressures of development on rural land. CS2000 was not designed to be a survey of urban areas, but it provides information on developed land that is part of the rural environment and in doing so can provide information about how development pressures are impacting on the rural landscape.

9.2 Trends

Across GB the cover of land by the *Built-up and Gardens* Broad Habitat in 1998 was around 6%. In England only, that figure was over 8%, accounting for the greater population density in England than in Scotland and Wales. Similarly transport features made up a further 2% of the GB landscape in 1998 and, in England only, the figure was nearer 3%.

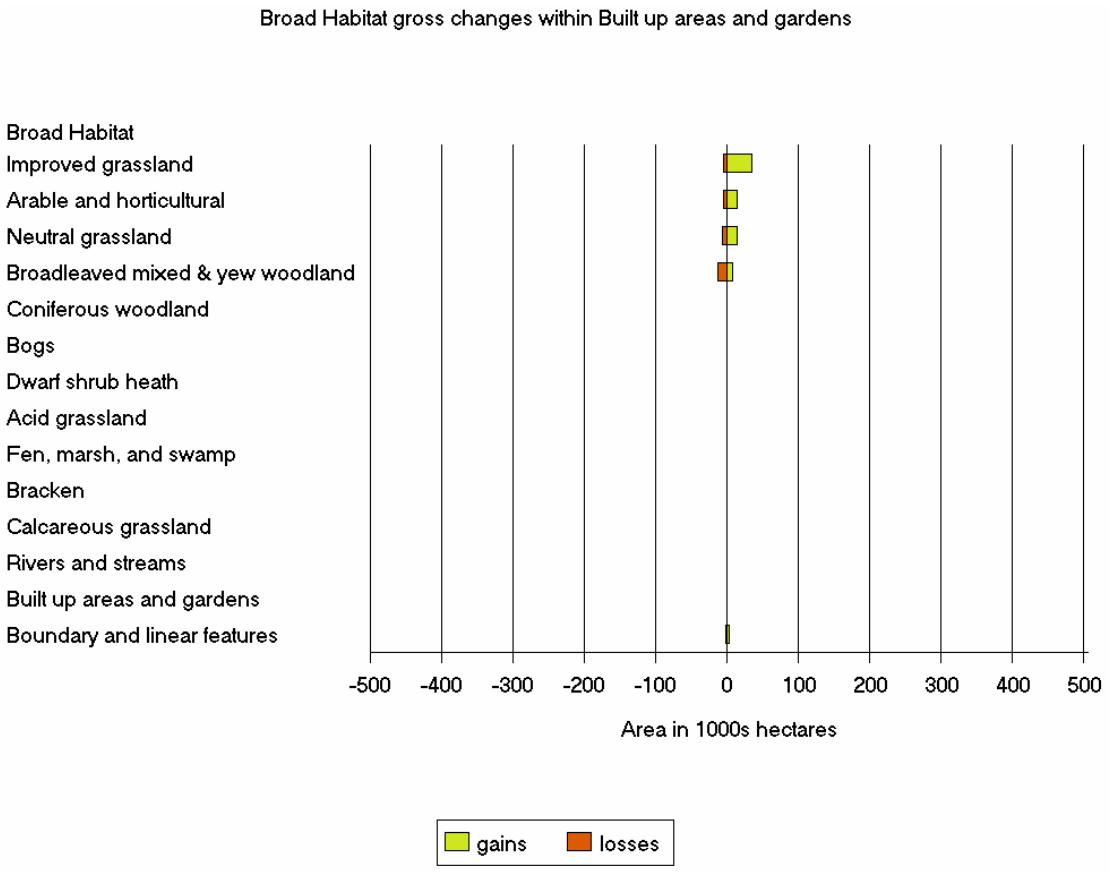
[1] CS2000 was designed as a survey of rural land in Great Britain. Urban areas were specifically excluded from the study by rejecting any of the randomly selected sample squares with more than 75% urban cover in 1990.

In the period 1990 to 1998 there was a significant increase in the stock of *Built-up and Gardens* in England of around 43,000ha, about 4% of the 1990 stock in England. The increase across both England and Wales in this Broad Habitat was estimated at 57,000ha, around 5% of the 1990 stock.

The significant decrease in the stock of transport features (using the area figures for the *Boundary and Linear Habitat*) may partly result from the difficulties of giving linear features an area (as with the *Rivers and Streams* Broad Habitat). In addition, the expansion of transport features may be masked by factors such as the incorporation of roads into new developments and their re-classification as part of the *Built-up and Gardens* Broad Habitat. Figures for Scotland show no significant change in the stock of these features.

The gains in *Built-up and Gardens* in England have largely been at the expense of intensively farmed habitats, i.e. *Improved Grassland* and *Arable and Horticultural* (Fig 9.2). However, there were also net gains from *Neutral Grassland* although the ecological significance of these gains require further investigation, in terms of the quality of the habitat that has been lost.

Fig 9.2 Interchanges in gross area (100's hectares) of Broad Habitat between *Built-up and Gardens* and other Broad Habitat types.

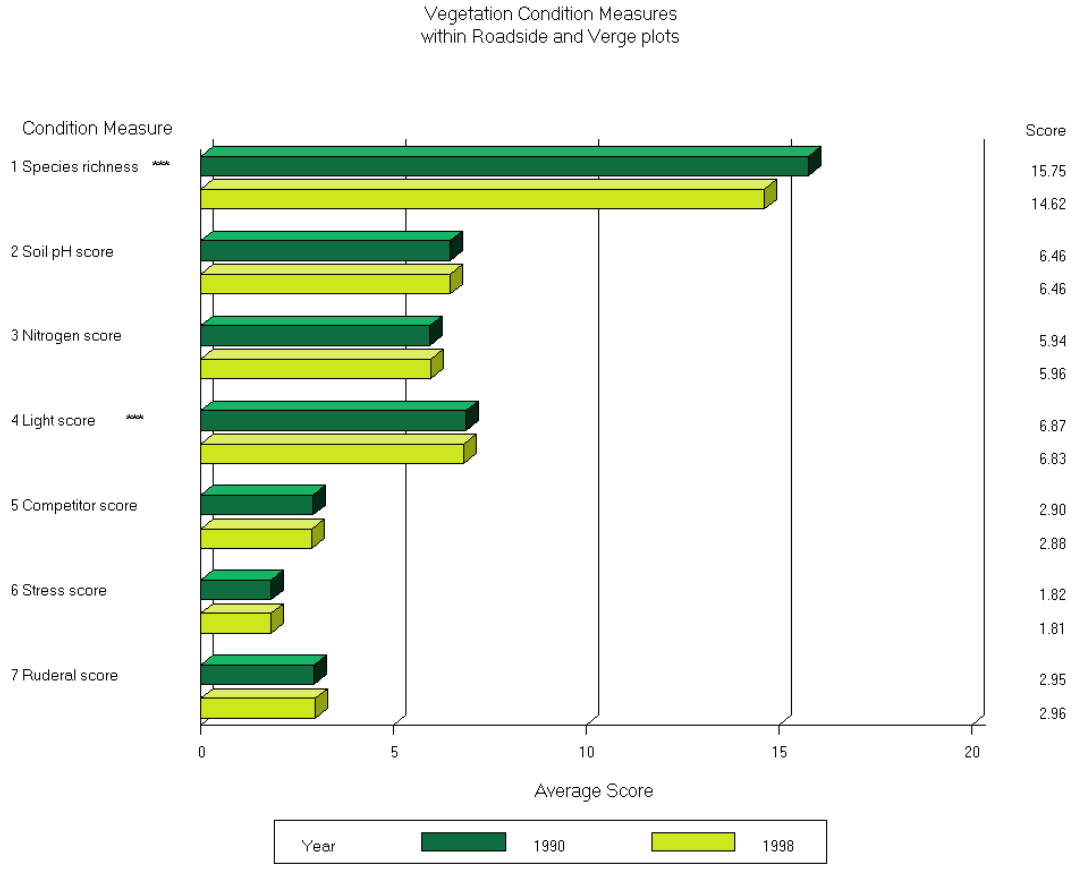


Losses of *Built-up and Gardens* can include reclamation of derelict land for environmental improvement and urban woodland planting schemes. Changes in the stock of transport features include cases such as farm tracks and disused railways which have been converted to other Broad Habitats. Because of the linear nature of transport features and the difficulties involved with giving them an area, the stock and change data are not very informative.

9.3 Changes in condition

There were no significant changes in condition of vegetation associated with the *Built-up and Gardens* Broad Habitat, although these results were constrained by the size of the dataset. However, there was a significant decrease in species richness in plots associated with transport features (roadside and verge plots) (Fig 9.3). Significantly lower species richness occurred in roadside and verge plots adjacent to several Broad Habitats, i.e. *Boundary and Linear Features*, *Improved Grassland* and *Arable and Horticultural.*

Fig 9.3 Vegetation condition measures in roadside and verge plots (n varies according to condition measure but always = either 1123 or 1124).



Decreased species richness in roadside and verge plots was in line with species richness decreases in other linear plot types (see Chapter 4). A concurrent significant decrease in the light score (Fig 9.3) indicates that changes in the successional status of road and vergeside vegetation may be the cause of declined species richness, with taller shade producing plants resulting in the loss of some species.

10. CONCLUSIONS

10.1 Trends in Broad Habitats between 1990 and 1998

There was evidence for some increases in species richness within arable fields, but there were decreases, many of which were significant in all other plot types in the *Arable and Horticultural* Broad Habitat.

In *Improved Grassland* plant diversity declined and nutrient levels increased in a number of plot types.

Neutral Grassland which covers around 3% of England showed non-significant gains in area during the period 1990-1998 with gains from the *Improved Grassland* Broad Habitat. However, the condition of plots within the *Neutral Grassland* Broad Habitat showed significant declines in species richness, significant increases in fertility and a shift in species composition towards more competitive species.

There was a significant net gain in stock of *Broadleaf, Mixed and Yew Woodland* between 1990 and 1998 and a significant net loss in the stock of *Coniferous Woodland*. Much of the increase in *Broadleaf Woodland* was at the expense of losses in *Coniferous* Woodland. The condition of *Broadleaf Woodland* appeared to show a successional change, with a decrease in species richness and the numbers of ruderal species and increases in the numbers of shade loving competitive species.

There was a significant increase in the stock of *Fen, Marsh and Swamp* with largest gains from *Neutral, Improved* and *Acid Grassland.*

There were significant decreases in stock of both the *Acid Grassland* and *Calcareous Grassland* Broad Habitats with losses chiefly to *Improved Grassland*. There was some evidence of changes in species composition in the *Bracken* and *Acid Grassland* Broad Habitats.

Changes in the vegetation associated with *Rivers and Streams* were very marked and indicate changes in the successional state of the Broad Habitat.

There was a gain in the stock of *Built-up and Gardens* of around 43,000ha with net gains from a range of Broad Habitats. There were significant decreases in species richness in roadside and verge plots.

Table 10.1 Summary of changes in stock and condition of Broad Habitats in England. Assessment of stock refers to net changes in the extent of habitats in England, 1990-1998. Assessment of changes in condition refers to changes in vegetation condition.

Broad Habitat	Change in stock	Change in condition
Improved Grassland	😐	😐
Arable and Horticultural	😐	😐
Neutral grassland	😐	☹
Broadleaf, Mixed and Yew Woodland	☺	☹
Coniferous Woodland	☺	😐
Bog	😐	😐
Dwarf Shrub Heath	😐	😐
Acid Grassland	☹	😐
Fen, Marsh and Swamp	☺	😐
Bracken	😐	☹
Calcareous Grassland	☹	😐
Standing Open Water and Canals	😐	
Rivers and Streams		☹
Built-Up and Gardens	☹	😐
Linear Features		☹

Table 10.1 summarises the change in the stock and condition of all Broad Habitats. Faces indicate an assessment against general UK BAP objectives in terms of whether they are moving towards or away from stated policy objectives.

- ☺= some favourable trends towards stated policy objectives.
- 😐 = no significant or consistent change
- ☹ = unfavourable trends away from policy objectives.

See text under individual Broad Habitats for details of stated policy objectives.

10.2 Quality of Life Counts

There was no significant change in the length of hedgerow in England. However, lengths of relict hedges, including lines of trees and shrubs, increased significantly whilst length of remnant hedge decreased significantly. Both of these imply possible deterioration in the management of hedgerows.

Increases in the nitrogen score in boundary plots associated with landscape features which form boundaries (including fences and hedges), together with decreases in species richness and the light score, accord with similar patterns found in a number of linear plot types (including, boundary, roadside and verge and all plots excluding targeted) within the *Boundary and Linear Features* Broad Habitat.

Analysis of the data for all plot types (excluding targeted plots) showed that species richness was significantly lower in 1998 than in 1990. Whilst main plots did not show a decline in species richness, linear plot types (boundary, roadside and verge and streamside and riverside) and targeted plots had a lower species richness in 1998 than in 1990.

In Broad Habitats decreased species richness appeared to be mainly associated with linear plot types. Overall losses in species richness were generally associated with agricultural grasslands, field boundaries and verges, whilst some gains occurred on fields in the *Arable and Horticultural* Broad Habitat.

10.3 Key messages

The changes in the stocks of the two woodland types in England indicate that policies encouraging the planting of broadleaved woodlands are succeeding.

The stock of semi-natural habitats (mountain, moor, heath and down) showed some trends which may need to be addressed. In particular the significant decrease in stock of *Acid Grassland*, as well as a potential reduction in the extent of *Calcareous Grassland*. An increase in the area of *Fen, Marsh and Swamp* may result from an increase in the presence of rush species which, if it occurred on *Neutral* or *Acid Grassland*, would be a deterioration of habitat quality. Further investigation will be necessary to ascertain what the changes in stock of *Fen, Marsh and Swamp* are due to.

Increases in the stock of *Built-up and Gardens* point to increasing development pressure on rural areas.

There were overall declines in species richness in the majority of plot types, (including all linear plots, except hedgerow). These declines may result from changes in the successional state of vegetation, possibly as a result of reduced management intensity of the habitats which they sample.

Shifts in the condition measures of vegetation (including declines in species richness) in a number of Broad Habitats may be due to increased fertility, or eutrophication. These shifts were particularly marked in the *Rivers and Streams* Broad Habitat, although there were also declines in species richness in both *Neutral* and *Acid Grassland*.

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