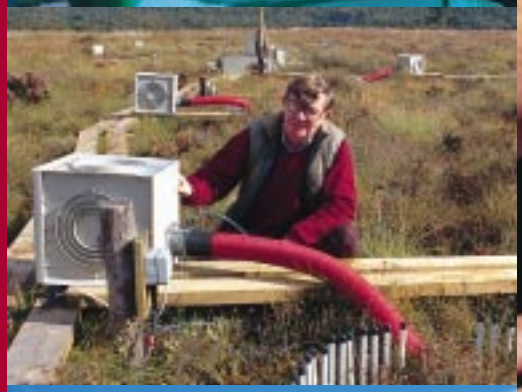
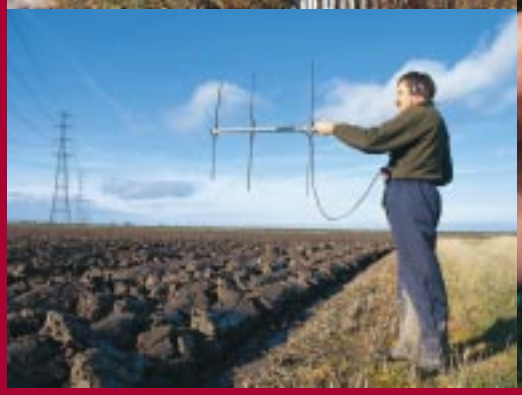
ENGLISH NATURE

Ancient woodland: guidance material for local authorities





working today
for nature tomorrow

Ancient woodland: guidance material for local authorities

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Contents

1 Introduction

Planning policy statement 9 (PPS9) states that local authorities should 'identify any areas of ancient woodland in their areas that do not have statutory protection' and normally 'not grant planning permission for any development which would result in its loss or deterioration'. This note provides some background material that may be helpful in implementing this guidance.

A starting point for identifying ancient woods is the ancient woodland inventory. Ancient woodland inventories are lists, by county, of sites greater than 2 ha that are thought to have been continuously wooded since 1600 AD. They include both ancient semi-natural stands and plantations on ancient woodland sites.

The inventories are not definitive registers of ancient woodland. The inventories are described as provisional: at any stage new information may become available that shows that woods not currently on the inventory are likely to be ancient or vice versa. In addition ancient woods less than 2 ha or open woodland such as ancient wood-pasture sites were generally not included on the inventories because the methods used could not identify them consistently.

The inventories were produced initially by the Nature Conservancy Council. Copies have been distributed to local authorities, the Forestry Commission and are held at English Nature local offices. The reports (also available from the English Nature Enquiry service at enquiries@english-nature.org.uk) include photocopies of 1:50,000 maps showing sites believed to be ancient. A digital version of the maps was produced (http://www.english-nature.org.uk/pubs/gis/tech_aw.htm) but is currently undergoing revision. We expect that an improved digital set of boundaries will be available on the English Nature web-site during the next six months. However this will still be only 'provisional' for reasons that are set out in more detail below.

Wealden District Council has pioneered a process for updating and revising the Ancient woodland inventory for their area, which has also tried to bring in woods below 2 ha. Reports on this work are available from the High Weald AONB Unit, Woodland Enterprise Centre, Hastings Road, Flimwell, East Sussex, TN5 7PR, www.highweald.org.

Extract from PPS9

Ancient woodland and other important natural habitats

10. Ancient woodland is a valuable biodiversity resource both for its diversity of species and for its longevity as woodland. Once lost it cannot be recreated. Local planning authorities should identify any areas of ancient woodland in their areas that do not have statutory protection (e.g. as a SSSI). They should not grant planning permission for any development that would result in its loss of deterioration unless the need for, and benefits of, the development in that location outweigh the loss of the woodland habitat. Aged or 'veteran' trees found outside ancient woodland are also particularly valuable for biodiversity and their loss should be avoided. Planning authorities should encourage the conservation of such trees as part of development proposals.

11. Through policies in plants, local authorities should also conserve other important natural habitat types that have been identified in the Countryside and Rights of Way Act 2000 section 74 list, as being of principal importance of biodiversity in England and identify opportunities to enhance and add to them.

This report explores issues such as the definition of what is meant by ancient woodland (both ancient semi-natural stands and plantations on ancient woodland sites), its importance, particularly in nature conservation terms; how it is identified; and the background to the ancient woodland inventories produced initially by the Nature Conservancy Council and its successor English Nature. Some commonly raised issues are also dealt with, including the concept of ancient woodland indicators, whether woods below 2 ha can be ancient; the boundaries between ancient woodland and wood-pastures. English Nature's position with respect to the protection of ancient woodland is given as Appendix 1.

Key ideas and definitions are in italics; references to other published papers are also included.

2 What is ancient woodland?

Ancient woodland in England is defined as an area that has been wooded continuously since at least 1600 AD. Ancient Woodland is divided into ancient semi-natural woodland and plantations on ancient woodland sites. Both types of stand are classed as ancient woods.

The trees and shrubs in ancient woodlands may have been felled or cut for coppice at various times since 1600, but as long as the area has remained as woodland, i.e the coppice stools have regrown or the stand has been replanted soon after felling, then it still counts as ancient woodland. Because it may have been cut over many times in the past, ancient woodland does not necessarily contain old trees.

If woodland has clearly been through a phase in the last 400 years when the land was open, for example as grassland, heath, moor or arable, then the site is classed as recent woodland. It may still have value for nature conservation, but it is not an ancient wood.

Some ancient woods may be 'primary' in the sense that they are on sites that have always been woodland, back to the pre-Neolithic wildwood. However in many cases ancient woods have been cleared in the distant past: for example they may contain the remains of early Medieval, Saxon, Roman or Iron Age remains. As long as there has been no complete clearance of the site since 1600 such woods are still 'ancient'.

The ancient woodland concept in its current form was proposed about 30 years ago by Peterken (1977) and Rackham (1971, 1976), albeit that Watkins (1988) has shown that the idea can be traced back to at least the 19th century.

The date used to define ancient woodland for England – 1600 AD – was chosen by Peterken (1977), because it reflected the point at which good maps started to become more common and was prior to the impetus for new woodland planting from the publication of Evelyn's influential book 'Sylva' (1670). Other dates could be argued for: 1650 was used by Peterken and Harding (1974) to distinguish post-medieval woods in Rockingham Forest, as a detailed map for that area was produced at that time, while Rackham uses 1700. In practice 1600 has been adopted for policy and practice purposes in England.

Ancient woodland is divided into ancient semi-natural woodland and plantations on ancient woodland sites. Both types of stand are classed as ancient woods.

> **Ancient semi-natural stands are those that are composed predominantly of trees and shrubs native to the site that do not obviously originate from planting. They include stands that may have been managed by coppicing or pollarding in the past, as well as those where the tree and shrub layer has grown up by natural regeneration.**
>
> **Ancient replanted woodland sites (also called plantations on ancient woodland sites) are areas of ancient woodland where the original native tree cover has been felled and replaced by planted stock most commonly of a species not native to the site, for example conifers such as Norway spruce or Corsican pine, but also broadleaves such as sycamore or sweet chestnut.**

The division between semi-natural stands and plantations is not always easy to make, because there are intermediates, for example small clearings within woods, old plantations of native species, semi-natural structured stands of introduced species, planted conifer stands that now contain a proportion of self-sown native broadleaves, or semi-natural tree layers with non-native understories or improved ground floras. Therefore a judgement may be necessary as to the balance between the planted/introduced elements versus the native/naturally regenerating elements.

Variations within the semi-natural category were recognised in the figure presented in the 1994 semi-natural woodland management guides (Forestry Authority 1994) and, more recently by Forest Enterprise who classified their woods into four degrees of 'naturalness' (Spencer 2002).

Many stands that did have conifer plantations on them are now being restored to native species, a process encouraged under the Biodiversity Action Plan (HMSO 1994) and through the UK Woodland Assurance Scheme (Goldberg 2003); Thompson and others 2003; UKWAS 2000; Kirby 1999; Pryor & Smith 2002; Curtis and Pryor 2002). It is uncertain, however, how far the features within these restored woods can ever be returned to the condition that they were in before.

3 The importance of ancient woodland

Ancient semi-natural woods are irreplaceable, and should therefore be protected and managed so as to maintain and enhance their special character (see Box 1). Many of the elements found in ancient semi-natural stands survive or can be restored in plantations on ancient woodland sites; hence they are also regarded as important.

Box 1 The values of ancient woodland (after Peterken 1983)

1. They include all primary woodland, the lineal descendants of Britian's primeval woodland, whose wildlife communities, soils and sometimes structure have been least modified by human activities. Their tree and shrub communities may preserve the natural composition of Atlantic forests. Once destroyed they cannot be recreated.
2. They provide baselines against which to measure the effects of man on, say, soils productivity of woodland communities, food-webs etc.
3. Their wildlife communities are generally but not invariably richer than those of more recent woods.
4. They contain a very high proportion of the rare and vulnerable wildlife species. Many of these species require the stability afforded by the continuity of suitable woodland.
5. Where large, old trees have been present for several centuries they provide refuges for characteristic inhabitants of primeval woodland such as lichens.
6. They contain other natural features which rarely survive in an agricultural setting such as streams in their natural watercourses and microtopographical conditions formed under periglacial conditions.
7. They are reservoirs from which the wildlife of the countryside has been maintained (and could be restored).
8. They have been managed by traditional methods for centuries. They are ancient monuments whose value to historians and village community consciousness is arguably as great as that of the older buildings a parish. Where traditional management continues or can be revived they are a living demonstration of conservation in the broader sense of a stable enduring relationship between man and nature.

Not all ancient woods will have all of the above values; it will depend on their size, location and past management. Conversely there are circumstances where some recent woods will contain the sorts of species or features normally associated with ancient woodland. Nevertheless studies in different parts of the country have confirmed Rackham's (1976, 1980, 2003) and Peterken's (1977, 1981) original observations that ancient woods are generally of higher importance for nature conservation than more recent woods. More recent work, such as that carried out in the ancient woods of Rockingham Forest, Northamptonshire, has emphasised their importance as treasure troves of archaeological interest (Kevin Stannard personal communication; Bannister 1995), because they have not been ploughed in recent centuries.

4 Identification of ancient woodland

Ancient woods is identified based on various types of evidence (Watkins 1990; Rackham 1980; Peterken 1981) such as:

- **presence on maps, particularly those from the early nineteenth century or before, and on all later maps;**
- **historical documents such as estate records, tithe and enclosure surveys;**
- **wood names reflecting nearby settlements, or old words relating to woods (hagg, frith, spring);**
- **their location towards the parish boundaries, on steep slopes or valley sides, or generally unsuitable agricultural ground;**

- **irregular woodland boundaries; or**
- **woodland boundaries that do not fit with seventeenth century (or later) enclosure patterns in the surrounding field boundaries.**

Field surveys may show:

- **Old/large coppice stools, or veteran trees;**
- **Well-developed boundary banks and ditches**
- **The presence of 'ancient woodland indicator' species, particularly in the ground flora (see later section on these).**

For most woods only some of the above will be available and it is a matter of judgement as to whether the evidence that a wood is ancient is strong enough. New information, for example from historical sources, or a more detailed field survey, may become available that confirms previous judgements or leads to their modification. New techniques such as GIS and the availability of some old maps on the web (www.old-maps.co.uk) are making it easier to collate the material on which decisions may be based.

The limitations of different types of evidence must be recognised.

- Early maps might omit some woods (particularly the smaller ones) or mark their location wrongly. An extreme example is the Dizzard oakwood which is undoubtedly ancient, based on its structure and composition, but is not shown on many historic maps or even the first 1:50,000 series.
- On some early maps woods on slopes might be obscured by hachuring used instead of contours, while recently cut-over areas (such as in worked coppice) might be shown as open.
- Historical records might be written by lawyers or land-owners with a point to make; they might omit reference to woods that were present, but not relevant to the particular document concerned.
- Wood-names can change; ancient woodland shapes may be altered to fit with new field patterns.
- In the uplands the boundaries of woods seem often to have been less fixed and while an ancient core may be clear there may be no clear external boundary feature (Whitbread 1990).
- Veteran trees may be relicts of a hedgerow that has been engulfed by newly-grown up woodland.
- 'Ancient woodland indicators' do sometimes occur in abundance in what are demonstrably recent woods.

Usually however a range of different strands point to a similar conclusion as to the origin of a wood.

5 Ancient woodland inventories

Ancient woodland inventories are lists, by county, of sites greater than 2 ha that are thought to have been continuously wooded since 1600 AD. They include both ancient semi-natural stands and plantations on ancient woodland sites. They are not however definitive registers of ancient woodland. The inventories are described as provisional because at any stage new information may become available that shows that woods not on the inventory are likely to be ancient or vice versa. In addition ancient woods less than 2 ha or open woodland such as ancient wood-pasture sites were generally not included on the inventories because the methods used could not identify them consistently. The inventories were produced initially by the Nature Conservancy Council. Copies have been distributed to local authorities, the Forestry Commission and are held at English Nature local offices.

During the 1970s Peterken (1974, 1977 and 1981) and Rackham (1976, 1980, 2003) showed that the woods of most importance for nature conservation tended to be those that had existed at least since the middle ages. Hence the concept of ancient woodland was developed (see sections 2, 3). In 1981 the Nature Conservancy Council started a project to identify ancient woods over 2 ha on a county by county basis (Spencer & Kirby 1992).

Evidence was sought along the lines outlined in section 4, but because of the numbers of sites involved it was not possible to track the history of each site in detail. The main sources used were the 1:25,000 maps from the 1930s, the first edition one-inch Ordnance Survey maps (largely from the first half of the nineteenth century), aerial photographs and, where available, recent survey reports. The individual county reports list other sources used and any particular problems encountered during the inventory production.

The information for any particular site (interpretation of old maps, field surveys, aerial photographs) was combined to enable a judgement to be made as to where the ancient woodland boundary should lie. The details of that judgement process can usually be reconstructed from information held on the original data-sheets, but may not be apparent from just the published boundary and entry on the original data-bases. Because the information available for many sites was limited the inventories are described as 'provisional': at any point it is possible than new data could lead to a re-consideration of the status of a wood.

The reports contained photocopies of 1:50,000 maps on which were drawn the boundaries of the inventory sites. These boundaries should be considered indicative only and not precise in detail.

Digitisation of the England ancient woodland data was carried out by the Forestry Commission in the mid-1990s from the 1:50,000 maps at the back of the county reports. This introduced some mapping discrepancies when the data were compared with other digital data-sets that were captured at finer resolutions. Errors were also identified when these boundaries were put on the web – sometimes in the original inventory report maps from which the data were taken, others introduced in the various data transfer stages. English Nature is seeking to eliminate these and at the same time flag up possible real changes in the composition or area of ancient woods through:

(a) a re-digitising process with boundaries being linked to Mastermap features where possible;

(b) a process of checking the inventory against the Forestry Commission's National Inventory of Woodland and Trees.

About 8 % of the area of ancient woodland on the inventory was not recorded by the Forestry Commission's inventory. Much of this is as very small discrepancies (92% less than 0.5 ha), i.e. smaller than the precision with which the original data were collected and hence likely to be mapping differences. Of the larger discrepancies some are differences in interpretation of what counts as woodland or as to when fragmented patches or open patches might be counted as one site. Even where there are clear losses of ancient woodland these may in some instances have taken place before the inventory was produced. A wood in Northumberland has become a quarry: although the inventory was dated 1986, the most recent information we had for it was an aerial photograph of 1971.

More precise boundaries are being defined using Mastermap and the Forestry Commission inventory. Some reinterpretation of the semi-natural/plantation classification has also been made where areas classed as semi-natural were shown as conifer on the NIWT. This has however to be done with care since in a few cases mixed or pure conifer stands may be native yew, or be a mistake in the National Inventory of Woodland and Trees – we believe that in places dense holly may have been interpreted as conifer. The rest of the counties have been redigitised during 2005. A revised, but still provisional, set of digital boundaries will then be put up on the English Nature web-site during 2006.

Separately some local authorities such as Wealden District Council have been carrying out updating of the ancient woodland inventories, with support from the Forestry Commission, English Nature and the Woodland Trust. These different updates will need to be reconciled.

6 Ancient woods less than 2 ha

Ancient woods may be less than 2 ha, but such sites were not included on the inventories for technical reasons. Where there is evidence (section 4) that these are ancient then they should be treated in the same way as larger ancient woods.

The original inventories included only woods that were above 2 ha on the base maps (generally 1:25,000 scale, from the 1930s), because the work involved in producing an inventory tends to be more closely linked to the number of sites rather than to their size. The number of sites increases almost exponentially below 2 ha, but the increase in total area of ancient woodland captured is much less (typically 10-20% increase in area for a doubling of the number of sites). In part of the Weald for example some 523 new polygons with an average area of 1.9 ha of possible new ancient woods have been identified, compared to 240 polygons on the original inventory (average area 13.3 ha). If all these new sites are accepted as ancient woodland then the number of polygons will increase three fold, but the overall area will go up by only about 30%.

Woods below 2 ha may show classic ancient woodland features such as wood-banks, old coppice stools and ancient woodland indicator plants. Individual veteran trees may support significant lichen or saproxylic species. However small woods are more subject to edge effects – loss of humidity to adjacent open ground, possible impacts of spray drift. There

tends to be more overlap between the number of indicator species present in small ancient and recent woods and the significance of the flora as a guide to history and conservation value becomes consequently more difficult to interpret (Hill 2003).

While the species populations in small ancient woods may be more vulnerable to extinction in the longer term they can form the nuclei from which species populations can expand back out into adjacent recent woods or other semi-natural habitats.

7 Ancient wood-pasture

Wood-pastures (Harding and Rose 1986), even those with only a thin scatter of trees, were recognised by both Rackham (1976, 1980, 2003) and Peterken (1977) as a distinct form of ancient woodland, particularly associated with lowland parks and areas of former common and Royal Forests. Many will however have been omitted from the inventories because their low tree density meant that they did not register as woodland on the historical maps consulted (Spencer & Kirby 1992). Where ancient wood-pastures are identified they should receive the same consideration as other forms of ancient woodland.

The last fifteen years have seen a remarkable increase in interest in wood-pasture systems in Great Britain, not least because of their importance for veteran trees (Kirby and others 1995; Read 2000; Stiven & Holl 2004). The role of grazing animals in the past has probably been underestimated, both in the former wildwood (cf Vera (2000)), but also in ancient woods of all types. The distinction between the two 'traditional' management systems with respect to grazing may have been over-emphasised: coppices might be grazed at some time; wood-pastures went through periods when the grazing pressure was reduced (Peterken & Tubbs 1965) and they might scrub up; subsequently such growth might be managed as coppice.

Common land, with a scatter of veteran trees, much of which in southern England has developed into dense woodland over the last 100 years, may at one and the same time (a) be really ancient wood-pasture, despite the predominance of young growth and its omission from the inventories (because it was shown as open on historical maps), and (b) be suitable for opening up by clearance of most of the (young) trees to restore heath/acid grassland to the point where in many instances it will fall below the Forestry Commission's definition of woodland (20% tree cover).

Wood -pastures comparable to those in the lowlands were and still are common in the uplands as well. A particularly distinctive type are the veteran alders *Alnus glutinosa* found in Glenamara Park (Cumbria) and The Allers (Northumberland).

A separate inventory of wood-pastures is being developed though the Wood-pasture Information System project (WAPIS www.wapis.org.uk) under the auspices of the Joint Nature Conservation Committee and the Wood-pasture Habitat Action Plan.

8 Ancient woodland indicators

Ancient woodland indicators are species, most commonly vascular plants although they have been identified in other groups (eg lichens, invertebrates), that are more common in ancient woods than in recent sites. The presence of such species may therefore be used as evidence for the wood being ancient. However no plant species are perfect ancient woodland indicators and the degree of association of a species with ancient woodland may vary across the country.

In Lincolnshire woods Peterken (1974) and Peterken and Game (1984) showed that there was a strong association between the distribution of some vascular plants and the history of the site, more particularly whether it was ancient woodland as defined by Peterken (1977). Since Peterken's initial work various other lists have been produced for different parts of the country. Ancient woodland indicator plants have also been identified elsewhere in Europe and North.

In Appendix 2 some lists of ancient woodland vascular plants suggested for different parts of Britain are combined, totaling 158 ground flora species, excluding trees and shrubs. In some cases there was independent historical information to show that the species listed were in fact associated more with ancient than recent woodland sites; in other instances the lists were based on the opinions of experienced surveyors. The definitions of what should be included as ancient woodland indicators also varied - how much more frequent in ancient woodland does a species have to be to count as an indicator? All authors stressed that it is the occurrence of a number of indicator species in a wood that should be used in interpreting site history, not the presence of individual species. Species may also be useful as an indicator in some regions and not others.

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Appendix 1. English Nature's position with respect to ancient woodland

1. English Nature's view is that ancient semi-natural woods are irreplaceable, and must be protected and managed so as to maintain and enhance their special character.

This view is supported by the following:

Government policies (as set out in the 1994 Sustainable Forestry document) are:

- to operate a general presumption against the conversion of woodland and trees to other use;
- to protect our ancient and semi-natural woodlands.

The England Forestry Strategy (1998) states that the government will:

- review the effectiveness of measures for protecting ancient semi-natural woodland and if necessary introduce new measures for giving them added protection.

The UK Biodiversity Action Plan (1994) states as Step 25 a commitment to:

- continue to protect ancient semi-natural woodland and encourage forms of management which conserve their special characteristics.

Much ancient semi-natural woodland is already included within priority BAP habitats and a recent proposal to include lowland mixed broadleaves as a priority habitat will be put to the UK Targets Group. All the existing woodland HAPs (and the lowland mixed one when it is written) stress the need to protect the existing ancient semi-natural resource.

One of the Government Indicators in the Quality of Life Counts is "Area of ancient semi-natural woodland in GB" to meet the objective of 'protecting and expanding ancient and semi-natural woodland'.

2. English Nature will seek to protect ancient semi-natural woodland while taking account of other nature conservation priorities.

On SSSIs English Nature will normally expect to take any proposals for destruction or significant damage to an ancient semi-natural woodland to Public Inquiry if necessary.

On non-SSSIs we will seek to ensure that those proposing activities that might damage ancient semi-natural woodland are aware of its significance and the policies relating to it. However we would expect the lead on objections to such activities to be taken by others such as local planning authorities, the local wildlife trust or the Forestry Commission.

Where questions arise as the status of a woodland (ancient or not; semi-natural or not) English Nature could be expected to give an opinion based on the evidence available.

Depending on other local priorities we may be able to offer other support on the protection of non-statutory sites.

3. English Nature considers that where ancient woods have lost nature conservation value through being converted to plantations restoration of their native tree and shrub communities should be encouraged.

English Nature has carried out research in this area in the past and will commission further studies as appropriate. We will support, through advice, the programmes of Forest Enterprise and others with major restoration programmes.

Where significant nature conservation interest survives within plantations on ancient woodland sites on SSSIs we may take proposals to damage or destroy such areas through to Public Inquiry.

4. English Nature will promote the monitoring of woodland biodiversity, and develop the use of our Inventories of Ancient Woodland as part of this process.

We will take the lead on monitoring of the condition of SSSIs and will carry out research on different measures of woodland biodiversity.

We will make the digital boundaries of the ancient woodland inventory more readily available via the Internet and will publish periodically our current estimates of the extent and distribution of ancient and ancient semi-natural woodland.

We will work with partners (particularly the Forestry Commission) to link our data-sets to those of others to provide a basis for assessing changes in the extent, distribution and quality of the woodland resource in England.

We will encourage the incorporation of indicators of the extent and condition of ancient woodland in plans and targets for biodiversity, sustainable development and best value.

5. English Nature will promote understanding by and conservation of ancient woodland through others.

We will develop and provide advice on best practice in woodland conservation and management.

We will encourage DETR to give formal planning guidance on the protection of ancient woodland either through a Trees and Woodland PPG or through incorporation of relevant wording in the revision of other PPSs (e.g. that on nature conservation PPS9).

We will support the incorporation of ancient woodland into local wildlife sites by local authorities and wildlife trusts.

We will work with the Forestry Commission to clarify and strengthen their role as consultees with respect to development proposals affecting ancient woodland.

Appendix 2 Ancient woodland indicator lists

The following lists have been collated from various sources over the years by Keith Kirby for English Nature.

Appendix 1. Species suggested as possible ancient woodland indicators and included as woodland specialists in this analysis. Species ordered by number of lists in which included.

List	1	2	3	4	5	6	7	8	9	10	11	12	13	
Galium odoratum	1	1	1	1	1	1	1	1	1	1	1	1	1	13
Luzula pilosa	1	1	1	1	1	1	1	1	1	1	1	1	0	12
Melica uniflora	1	1	1	1	1	1	1	1	1	1	1	1	0	12
Paris quadrifolia	1	1	1	1	1	1	1	1	1	1	1	1	0	12
Anemone nemorosa	1	1	1	1	1	1	1	0	0	1	1	1	1	11
Chrys. Oppositifolium	1	1	1	1	1	1	1	0	1	1	1	0	1	11
Lamiastrum galeobdolon	1	1	1	1	1	1	1	0	1	1	1	1	0	11
Lathraea squamaria	1	1	1	0	1	1	1	1	1	1	1	1	0	11
Luzula sylvatica	1	1	1	1	1	1	1	0	1	1	1	1	0	11
Milium effusum	1	1	1	1	1	1	1	1	1	0	1	1	0	11
Adoxa moschatellina	1	1	1	0	1	1	1	1	1	1	1	0	0	10
Carex pallescens	1	1	1	1	1	1	1	0	0	1	1	0	1	10
Carex pendula	1	0	1	1	1	1	1	1	1	1	1	0	0	10
Carex remota	1	1	1	1	1	1	1	1	1	0	1	0	0	10
Carex strigosa	1	1	1	1	1	1	1	1	0	1	1	0	0	10
Carex sylvatica	1	1	1	0	1	1	1	1	1	1	1	0	0	10
Convallaria majalis	1	1	1	1	1	1	1	1	1	0	1	0	0	10
Lysimachia nemorum	1	1	1	1	1	1	1	0	0	1	1	0	1	10
Melampyrum pratense	1	1	1	1	1	1	1	1	0	0	1	0	1	10
Neottia nidus-avis	1	0	1	1	1	1	1	1	0	1	1	1	0	10
Veronica montana	1	1	1	1	1	1	1	1	0	1	1	0	0	10
Allium ursinum	1	1	1	1	1	1	1	1	0	0	1	0	0	9
Carex laevigata	0	1	1	1	1	1	1	1	0	1	1	0	0	9
Euphorbia amygdaloides	1	0	0	1	1	1	1	1	0	1	1	1	0	9
Lathyrus linifolius	1	1	1	1	1	1	1	0	0	1	1	0	0	9
Orchis mascula	1	1	1	1	1	1	1	0	1	0	1	0	0	9
Oxalis acetosella	1	1	1	1	1	1	1	0	0	1	1	0	0	9
Primula vulgaris	1	1	1	1	1	1	1	0	0	0	1	0	1	9
Ranunculus auricomus	1	1	1	1	1	1	1	0	0	0	1	1	0	9
Aquilegia vulgaris	0	1	1	0	1	1	1	0	1	1	1	0	0	8
Campanula trachelium	1	1	1	1	1	1	1	0	0	0	1	0	0	8
Conopodium majus	1	1	1	1	1	1	1	0	0	0	0	0	1	8
Epipactis helleborine	1	1	0	1	1	1	1	0	0	1	1	0	0	8
Equisetum sylvaticum	1	1	1	1	1	1	1	0	0	0	1	0	0	8
Geum rivale	1	1	1	1	0	1	1	0	1	0	1	0	0	8
Hyacinth. non-scripta	1	1	1	1	1	1	1	0	0	0	1	0	0	8
Hypericum pulchrum	1	1	0	0	1	1	1	0	1	0	1	0	1	8
Poa nemoralis	1	0	0	0	1	1	1	1	0	1	1	0	1	8
Polystichum aculeatum	1	1	0	0	1	1	1	0	0	0	1	1	1	8
Sanicula europaea	1	1	0	0	1	1	1	1	0	1	1	0	0	8
Vicia sylvatica	0	1	1	0	1	1	1	0	1	1	1	0	0	8
Bromopsis ramosa	1	1	0	0	1	1	1	1	0	0	1	0	0	7
Dipsacus pilosus	1	1	1	0	1	1	1	0	0	0	1	0	0	7
Dryopteris affinis	1	1	0	1	1	1	1	0	0	0	1	0	0	7
Elymus caninus	1	1	1	0	1	1	1	0	0	0	1	0	0	7
Helleborus viridis	1	1	0	1	1	1	1	0	0	0	1	0	0	7

Narcis. pseudonarcissus	1	1	0	1	1	1	1	0	0	0	1	0	0	7
Platanthera chlorantha	1	0	1	1	1	1	1	0	0	0	1	0	0	7
Potentilla sterilis	1	1	1	0	1	1	1	0	0	0	0	0	1	7
Calamagrostis epigejos	1	0	1	0	1	1	1	0	0	0	1	0	0	6
Ceratocapnos claviculata	1	1	1	1	0	1	1	0	0	0	0	0	0	6
Chrys. alternifolium	1	1	0	0	0	0	0	1	1	0	1	1	0	6
Daphne laureola	1	1	0	0	1	1	1	0	0	0	1	0	0	6
Dryopteris carthusiana	1	1	0	0	1	1	1	0	0	0	1	0	0	6
Epipactis purpurata	1	0	0	1	1	1	0	0	0	1	1	0	0	6
Hyper. androsaemum	1	0	0	0	1	1	1	0	0	0	1	1	0	6
Lathyrus sylvestris	1	0	0	0	1	1	1	0	0	1	1	0	0	6
Moehringia trinervia	1	0	0	1	1	1	1	1	0	0	0	0	0	6
Myosotis sylvatica	1	1	1	1	0	0	0	0	0	0	1	0	1	6
Oreopteris limbosperma	1	1	0	0	1	1	1	0	0	0	1	0	0	6
Polygon. multiflorum	0	1	0	0	1	1	1	0	0	1	0	1	0	6
Ribes rubrum	1	0	0	0	1	1	1	0	0	0	0	1	1	6
Scirpus sylvaticus	0	1	0	0	1	1	1	1	0	0	1	0	0	6
Stachys officinalis	1	1	0	0	1	1	1	0	0	0	1	0	0	6
Vicia sepium	1	1	0	0	1	1	1	0	0	0	0	0	1	6
Blechnum spicant	1	0	0	0	1	1	1	0	0	0	1	0	0	5
Campanula latifolia	1	1	1	0	0	0	0	0	1	0	1	0	0	5
Festuca gigantea	1	0	0	0	1	1	1	1	0	0	0	0	0	5
Hordelymus europaeus	0	1	0	1	0	1	0	0	1	0	1	0	0	5
Iris foetidissima	1	0	0	0	1	1	1	0	0	0	1	0	0	5
Luzula forsteri	0	0	0	0	1	1	1	0	0	1	1	0	0	5
Mercurialis perennis	0	1	1	1	0	0	0	0	0	0	1	0	1	5
Phyllitis scolopendrium	0	1	0	0	1	1	1	0	0	0	1	0	0	5
Polypodium vulgare	1	1	0	0	1	1	1	0	0	0	0	0	0	5
Polystichum setiferum	1	1	0	0	1	0	1	0	0	0	1	0	0	5
Ribes nigrum	1	0	0	0	1	1	1	0	0	0	0	0	1	5
Ruscus aculeatus	1	0	0	1	1	1	1	0	0	0	0	0	0	5
Sedum telephium	1	0	0	0	1	1	1	0	0	0	1	0	0	5
Solidago virgaurea	0	1	0	0	1	1	1	0	0	0	1	0	0	5
Tamus communis	1	1	0	0	1	1	1	0	0	0	0	0	0	5
Cardamine amara	1	1	0	0	1	1	0	0	0	0	0	0	0	4
Colchicum autumnale	0	0	0	0	0	1	1	0	0	0	1	1	0	4
Dryopteris aemula	1	0	0	0	1	0	1	1	0	0	0	0	0	4
Gagea lutea	1	1	0	0	0	0	0	0	1	0	1	0	0	4
Rosa arvensis	0	1	0	0	1	1	1	0	0	0	0	0	0	4
Vaccinium myrtillus	0	0	0	0	1	1	1	0	0	0	1	0	0	4
Viola palustris	0	1	0	0	1	1	1	0	0	0	0	0	0	4
Calamagrostis canescens	1	0	1	1	0	0	0	0	0	0	0	0	0	3
Holcus mollis	0	0	0	0	1	1	1	0	0	0	0	0	0	3
Maianthemum bifolium	1	0	1	1	0	0	0	0	0	0	0	0	0	3
Melittis melissophyllum	0	0	0	0	0	0	1	1	0	1	0	0	0	3
Pimpinella major	1	0	0	0	1	0	0	0	0	0	1	0	0	3
Stellaria holostea	0	1	1	0	0	0	0	0	0	0	1	0	0	3
Aconitum napellus	0	0	0	0	0	0	1	0	0	0	1	0	0	2
Athyrium filix-femina	0	0	0	0	0	0	0	0	0	0	1	0	1	2
Cardamine impatiens	0	1	0	0	0	0	0	0	0	0	1	0	0	2
Cephal. damasonium	0	0	0	0	0	0	0	0	0	1	1	0	0	2
Cephal. longifolia	0	0	0	0	0	1	0	0	0	0	1	0	0	2
Epipactis leptochila	0	0	0	0	0	1	0	0	0	1	0	0	0	2
Equisetum telmateia	0	1	0	0	0	0	0	0	0	0	1	0	0	2
Festuca altissima	0	1	0	0	0	0	0	0	0	0	1	0	0	2
Geranium sanguineum	0	1	0	0	0	0	0	0	0	0	1	0	0	2
Gnaphalium sylvaticum	1	0	0	0	0	0	0	0	0	0	1	0	0	2
Gymn. dryopteris	0	0	0	0	0	0	0	1	0	0	1	0	0	2

Hymenoph. tunbrigense	0	0	0	0	0	0	1	1	0	0	0	0	0	2
Hypericum hirsutum	0	0	1	1	0	0	0	0	0	0	0	0	0	2
Listera ovata	0	0	0	0	0	0	0	0	0	0	1	0	1	2
Melica nutans	0	1	0	0	0	0	0	0	0	0	1	0	0	2
Monotropa hypopitys	0	0	0	0	0	0	0	0	0	1	1	0	0	2
Ophrys insectifera	1	0	0	0	0	0	0	0	0	1	0	0	0	2
Phegopteris connectilis	0	0	0	0	0	0	1	0	0	0	0	0	1	2
Primula elatior	1	0	0	1	0	0	0	0	0	0	0	0	0	2
Pulmonaria longifolia	0	0	0	0	0	1	1	0	0	0	0	0	0	2
Radiola linoides	1	0	0	0	1	0	0	0	0	0	0	0	0	2
Serratula tinctoria	0	0	0	0	1	1	0	0	0	0	0	0	0	2
Stellaria neglecta	1	1	0	0	0	0	0	0	0	0	0	0	0	2
Stellaria nemorum	0	1	0	0	0	0	0	0	1	0	0	0	0	2
Viola riviniana	0	0	1	0	0	0	0	0	0	0	1	0	0	2
Wahlenbergia hederacea	0	0	0	0	1	0	1	0	0	0	0	0	0	2
Alchemilla filicaulis	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Brachypod. sylvaticum	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Bromopsis benekenii	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Campanula patula	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Carex acutiformis	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Carex digitata	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Carex elongata	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Carex montana	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Circaea x intermedia	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Cirsium heterophyllum	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Daphne mezereum	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Epipactis phyllanthes	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Fragaria vesca	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Galanthus nivalis	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Geranium robertianum	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Geranium sylvaticum	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Helleborus foetidus	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Hymenoph. wilsonii	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Hypericum tetrapterum	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Lonicera periclymenum	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Lysimachia vulgaris	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Lythrum portula	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Melampyrum sylvaticum	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Ophioglossum vulgatum	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Orchis purpurea	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Orobanche hederae	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Polygonatum odoratum	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Pyrola minor	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Rubus caesius	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Rubus saxatilis	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Scrophularia nodosa	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Scutellaria minor	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Sibthorpia europaea	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Silene dioica	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Stachys sylvatica	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Trollius europaeus	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Valeriana officinalis	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Viola odorata	1	0	0	0	0	0	0	0	0	0	0	0	0	1
	83	86	55	51	86	86	88	31	25	38	95	20	23	

1 East England Rose (1999), 2 Derbyshire, Lincolnshire, 4 East England Rackham 1980, 5 South-east , 6 South , 7 South-West , 8 Carmarthen, 9 North Yorks, 10 Dorset , 11 Worcs, 12 Somerset, 13 Angus.

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Top left: Using a home-made moth trap.
Peter Wakely/English Nature 17,396
Middle left: Co_2 experiment at Roudsea Wood and Mosses NNR, Lancashire.
Peter Wakely/English Nature 21,792
Bottom left: Radio tracking a hare on Pawlett Hams, Somerset.
Paul Glendell/English Nature 23,020
Main: Identifying moths caught in a moth trap at Ham Wall NNR, Somerset.
Paul Glendell/English Nature 24,888