

Correction slip

On page 86, under the 'Data entry' heading, a standard Microsoft Access database is cited as being available at www.naturalengland.org.uk.

This database is no longer available and cannot be accessed.

Date of correction

1 July 2025.

Hedgerow Survey Handbook

A standard procedure for local surveys in the UK

Prepared on behalf of the Steering Group for the UK Biodiversity Action Plan
for Hedgerows

2nd edition



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Cover pictures:

Main picture	– Roadside hedgerow with trees (Jon Stokes)
Top left	– Hawthorn Berries (David Townshend)
Middle left	– Flowering Blackthorn (David Townshend)
Bottom left	– Blackthorn Sloes (David Townshend)
Middle right	– Primrose flowers (Rob Wolton)
Bottom right	– Hedge laying (Rob Wolton)

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Foreword



It is a good time for hedgerows across the UK. Thankfully, their removal is now largely a thing of the past, as society's recognition of their tremendous value for biodiversity, landscape and history grows. And far more money is available to help farmers look after their hedgerows through European and Government-funded schemes than when Michael Meacher, then Minister of State for the Environment, wrote the foreword for the first edition of this Handbook five years ago. In England over 165,000 km of hedgerows have already been entered into Environmental Stewardship.

Hedgerows have their part to play too in helping us to respond and adapt to climate change, providing conduits through which wildlife may move, and protecting soil, livestock and property against extreme weather events. They even help to lock up carbon and provide a sustainable source of fuel. Even on a small scale, this can help towards our goal of One Planet Living.

Yet we still don't know enough about the quality and make up of our hedgerows. At a national level we have a broad picture through the national Countryside Survey programme which Defra supports, but action requires local knowledge and this is lacking over the majority of the UK. I am pleased that the first edition of this Handbook promoted a good number of surveys, but we need more!

So I encourage all of you reading this new improved version of the Handbook to get surveys underway in your area, working with the local community and volunteers wherever possible. The rewards are likely to be considerable, not just in terms of knowledge leading to conservation action, but also in terms of raising awareness and interest in our fabulous hedgerow heritage.

The Steering Group for the UK Biodiversity Action Plan for Hedgerows has done well indeed to revise this much needed Handbook, and I am delighted to be able to commend it to you.

A handwritten signature in black ink that reads "Barry Gardiner". The signature is written in a cursive style with a long horizontal line extending from the end.

Barry Gardiner
Minister For Biodiversity, Landscape and Rural Affairs

Preface

This Handbook sets out a standard way of recording hedgerows. Its focus is on the wildlife, or biodiversity, of hedgerows. We recognise that hedgerows are also important for farming, for the contribution they make to the beauty of our countryside, and historically and culturally. Surveys covering these aspects will, we hope, build on the methods given in this Handbook.

The first edition of this Handbook, published in 2002, proved popular and was widely used. This second edition takes account of the feedback we have received, and many helpful suggestions for improvement. It also takes account of recent advances in our understanding of what a hedgerow looks like when it is in a good or 'favourable condition' for wildlife.

Information on whether or not hedgerows are in 'favourable condition' is important when it comes to making decisions on how they should be managed. It is also critical for policy decisions and setting nature conservation direction. Those responsible for delivering Biodiversity Action Plans (BAPs) for hedgerows, whether at local or UK level, particularly need this information. This is why the Steering Group for the UK BAP for Hedgerows has commissioned the second edition of this Handbook.

In 2006, we believe that only some 22% of the UK's hedgerows are in a favourable state. The survey method in this Handbook will give accurate, consistent information about the state of our hedgerows at a local level, what the main influences on their condition are, and what we need to do to restore them.

We have clearly distinguished between those aspects of hedgerows which it is essential to record as far as BAPs are concerned, and those which are optional. Among the optional elements is a brand new one on veteran trees.

We have improved the database that accompanies the Handbook. Our hope is that this database will be used and the information provided to local record centres and the like, so that survey findings are widely available and can be used to help build up the picture at regional, country and UK level.

We hope that the Handbook will raise awareness and interest among land managers and local communities about the considerable importance of hedgerows for wildlife, and help to identify the most pressing challenges and the best ways to address them.

One of our basic premises has been that surveyors should be able to go to any hedgerow and use the survey method without any historical records or prior information. The only exception to this is that the owner, or manager, must be known and their permission sought and gained.

Hedgerows are complex! They show great variety across the country and as a wildlife habitat they are the interface between woodland and open field. So, it has been a huge challenge to develop a survey method that will work just about anywhere in the country, with any type of hedgerow. We have tried to keep it simple and precise, but have found lengthy explanations and guidance at times unavoidable.

Even defining a hedgerow has required a lot of careful thought and careful drafting. Suggestions for further simplification and clarification of the Handbook are always welcome.

Why Survey?

Introduction

Hedgerows are of great importance across the UK, in our towns and cities as well as in the countryside. However, in most places we have remarkably little information on how many we have, or about their composition or structure, let alone their condition. As a result, it is often difficult to make informed decisions about what needs to be done to conserve these 'green veins' for the future. This Handbook is designed to help fill this gap in our knowledge through providing a practical way of carrying out surveys to a standard format.



Hedgerows and hedgerow trees provide a valuable habitat for bats (all bat species and their roosts are protected)

The focus of the Handbook is on collecting information pertinent to the wildlife that inhabits hedgerows and the biodiversity which they support. In particular, it has been written to help with the development and implementation of BAPs, both the UK hedgerow plan and local plans. Revised UK BAP targets for hedgerows can be found at <http://www.ukbap.org.uk/> and in Appendix 9.

Box 1: What is a hedgerow?

The survey method described in this Handbook covers a broad definition and was developed by the Local Surveys Sub-Group of the Steering Group for the UK BAP for Hedgerows.

A **hedgerow** is defined as any boundary line of trees or shrubs over 20m long and less than 5m wide at the base, provided that at one time the trees or shrubs were more or less continuous. It includes an earth bank or wall only where such a feature occurs in association with a line of trees or shrubs. This includes 'classic' shrubby hedgerows, lines of trees, shrubby hedgerows with trees and very gappy hedgerows (where each shrubby section may be less than 20m long, but the gaps are less than 20m).

Survey Objectives

Local hedgerow surveys can be carried out for a variety of reasons, including:

- Documenting the distribution, character and special attributes of hedgerows in the area.
- Establishing the state of the hedgerows, in terms of the length and condition, to help develop policies and strategies to ensure they survive well into the future, and to enable grants to be targeted most effectively.
- Identifying those hedgerows that are of particular importance for wildlife, landscape, cultural or historical reasons, and so particularly worthy of protection or conservation.
- Providing a baseline to allow future changes to be detected and evaluated and to document the success or otherwise of any conservation programmes.

The use of this Handbook will enable all these objectives to be met, only needing to be expanded should there be a strong focus on historical or cultural aspects.

Local surveys carried out using this Handbook will complement the Countryside Survey programme which is designed to identify trends in changes in the countryside at a country-wide level (see www.cs2000.org.uk for further information on the Countryside Survey programmes in Britain and Northern Ireland).

The survey method described in the Handbook has not been developed specifically to help with the Hedgerow Regulations (1997) in England and Wales, although some of the information collected will be relevant to their implementation.

Chapter 1

Box 2: Examples of surveys for local BAPs

Thin green line: application of the survey method as part of the Peterborough Countryside Protection Project

A survey of 390 hedgerows was undertaken by the local Wildlife Trust, as one of the targets set in the Peterborough Natural Environmental Audit and the Cambridgeshire and Peterborough Local BAPs. It aimed to increase public awareness of the importance of hedgerows and associated threats to enable appropriate management.

Funding was provided by Landfill Tax credits together with additional funds from Peterborough City Council.

The survey identified the extent and condition of ancient and species-rich hedgerows. This enabled a costed action plan to be developed.

Source: Precey P (2001). *The Thin Green line: ancient and species-rich hedgerows in Peterborough*. Bedfordshire, Cambridgeshire, Northamptonshire and Peterborough Wildlife Trust.

Bridgend hedgerow survey

A stratified random sample survey of 200 hedgerows was undertaken by the County Borough Council and the National Museum and Gallery of Wales. The survey was undertaken to contribute to the habitat and species coverage of the local Biological Database. In turn this helped establish which hedgerows might be protected under the Hedgerows Regulations (1997) and assisted with the preparation of the Local BAP.

The hedgerows in the Borough were found to be comparatively rich in species, and the survey concluded that they are a highly valuable local resource with respect to biodiversity. However, newly planted hedgerows associated with recent development did not reflect the local hedgerow character.

Source: White R, Clements D K, Moon S, Jones R, Rich T C G (2000). *Bridgend Hedgerow Survey 1999*. National Museums and Galleries of Wales, Cardiff.

Defining a hedgerow

The broad definition of a hedgerow used in the Handbook is described in Box 1 and in summary it is:

Any boundary line of trees or shrubs over 20m long and less than 5m wide between major woody stems at the base.

However, hedgerows in the countryside are usually in the form of a network of many hedgerows linked to each other. Critical questions for the surveyor are: where does an individual hedgerow start and stop; and what is the 'unit' of survey? To ensure that definable lengths of hedgerow can be surveyed, the **end points** of a 'unit' must be clearly identified. For the purposes of this Handbook, an end point, or node, is:

1. any point of connection between two, or more, hedgerows or to other features e.g. fences, walls, ditches, roads
2. the point at which a hedgerow stops and there is a gap of more than 20m to the next hedgerow (e.g. where the hedgerow ends in the middle of a field).
3. the point at which the hedgerow links to a woodland or other semi-natural habitat such as a pond.

Having defined the hedgerow using the above criteria, there may be significant variation along this length that may require refining lengths into '**survey units**'. These additional points where changes occur are as follows:

4. the point at which the hedgerow changes character from one **hedgerow type** to another for 20m or more
5. where there is a distinct change in hedgerow height for lengths of 20m or more
6. the ends of lengths (20m or more) of recent planting, coppicing or laying.

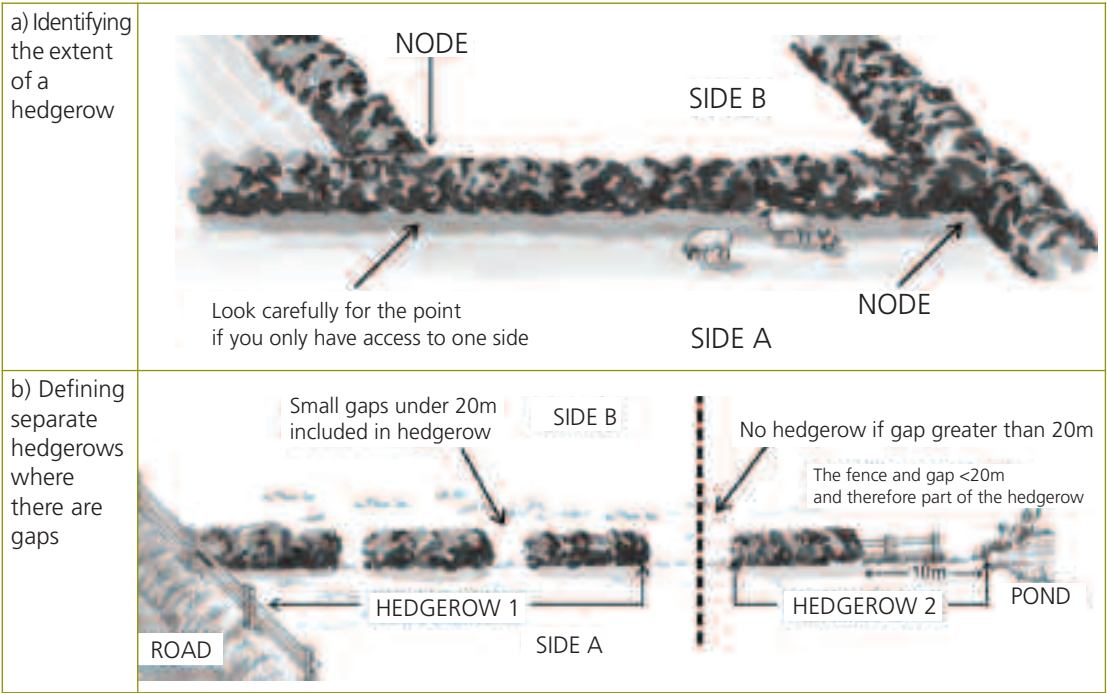
If the hedgerow is of a very variable species composition, such that different parts have markedly different species compositions¹, it should be recorded as one survey unit if the whole hedgerow is of similar size and shape along its length, except for recording woody species per 30m, when more than one survey section should be chosen to represent the differing species compositions along the hedgerow.

¹ Where there may be a change from species-poor to species-rich as the result of a multi-species replanting of gaps in a single-species hedgerow.

Chapter 1

Each section between two end points or nodes is considered a separate hedgerow (see Figure 1). Sometimes a section between end points may go round a sharp corner that may historically have been a 'T' junction or even a cross-intersection (this can often be checked with reference to historic maps, see Table 4). This is regarded as the same hedgerow as far as this Handbook is concerned (see Figure 1).

Figure 1 – Determining the extent of each hedgerow.



Box 3: Examples of other types of local hedgerow surveys

Hedgerow surveys in South Yorkshire

This overview of hedgerow surveys in the region found that, although a number had been completed, they were unevenly distributed and also the quality of data collected was very variable.

South Yorkshire Forest investigated the status and condition of hedgerows and dry-stone walls. The survey enabled them to make recommendations for the restoration of the boundary landscape features, as well as a basis for the selection of species for future hedgerow planting.

Other surveys in the region included those forming Habitat Action Plan Inventories, responses to planning applications/environmental impact assessment, defining important hedgerows to assist local authorities, assessing the age of hedgerows in an ancient landscape, and as part of a Government employment training scheme.

Source: J Flannigan (pers. comm.). *Survey of hedgerow surveys in South Yorkshire*. Council for the Protection of Rural England.

Brigg Town Council hedgerow project – educational role

Brigg Town Council, three local schools and the North Lincolnshire Council for the Protection of Rural England undertook a local hedgerow survey. The schools then incorporated the study of these hedgerows into their curriculum and produced a newsletter, *Hedgerow Herald*. Interviewed on local radio about their work, one pupil commented:

“Hedgerows are older and more interesting than they look. They are not just a bush growing in a straight line. We found eggshells, broken snail shells and lots of wood mice nests. Insects seem really boring when you don’t know anything about them, but when you look deeper into what they do it is really interesting.”

Source: *Hedgerow Herald*, July 2001.

East Anglesey Hedgerow Survey

This survey looked at ancient / species-rich hedgerows, and it confirmed that species-rich hedgerows occur in the areas of Anglesey that were thought to be richest, and are generally in good condition. An interesting finding was that the distribution of species-rich hedgerows showed no positive association with existing woodland, ancient or otherwise. The results of the survey will be used to target conservation effort in the area, and to identify potential seed sources and suitable species mixes for hedgerow restoration and creation.

Source: Geoff Radford, North Wales Environmental Services on behalf of Isle of Anglesey County Council.

Defining a species-rich hedgerow

Where the structural species making up the 30m section of hedgerow include at least five (or at least four in northern and eastern England, upland Wales and Scotland) woody species that are either native somewhere in the UK, or which are archaeophytes² (see Appendix 11), the hedgerow is defined as **species-rich**. Climbers and bramble do not count towards the total except for roses.

Hedgerows that contain fewer woody species but have a rich basal herbaceous flora may also be defined as species-rich, but the criteria to define these have to be set on a local basis as there is no national definition.

Hedgerow Condition Assessment

The main enhancement to the standard survey method in this edition has been to enable the collection of data that can be used to assess whether hedgerows are in 'favourable condition', as defined by the Steering Group for the UK BAP for Hedgerows. In addition, the length of hedgerows in an area can be established and other important features described, such as hedgerow trees. Using this survey method, the results can be directly related to BAP targets both for local and UK plans. This condition assessment is aimed at hedgerows comprising mainly native species, regardless of whether they are rural or urban.

Hedgerow condition assessment depends on recording hedgerow 'attributes'. These are measurable characteristics, like height and width, that have been given thresholds by the Steering Group to indicate whether a particular hedgerow is in 'favourable condition'. These attributes are all listed at Appendix 9. The basic attributes deemed to be indicative of 'favourable condition' include the height and width of the woody component, along with the degree of intactness of the hedgerow canopy, and also the height above ground at which the canopy starts. Other features of the hedgerow that are important measures of condition include the width of any perennial herbaceous vegetation and undisturbed ground adjacent to the hedgerow. Species composition is also important, specifically the presence of recently introduced or non-native species. These attributes will form the benchmark against which any decline or improvement in hedgerow condition can be monitored, for instance

² Being recorded as naturalised in the wild before 1500 AD.

in relation to Local BAP targets. The results can also inform strategic decisions that need to be taken to prevent the decline of hedgerows and to guide and encourage their restoration and management.

The survey method recognises that a range of hedgerow types is of value for wildlife; not just the 'classic' shrubby hedgerows, but also 'lines of trees' and combinations of shrubby hedgerows and trees. These types need to be assessed in slightly different ways to suit their individual character.

It is often helpful to provide some context for the condition assessment results when the conclusions of the study are drawn up. Table 1 links the condition assessment to practical conservation action.

Chapter 1

Table 1 – Guide to conservation action based on the condition assessment results.

Condition assessment attributes	Undisturbed ground and perennial herbaceous vegetation	Recently introduced, non-native species	Dimensions of woody component (Size)	Horizontal gappiness (Integrity/continuity)	Base of woody canopy (Integrity/continuity)
Problem	Width too narrow	Cover too great	Too low or narrow	Too many gaps	Base/hedge bottom too thin
Management actions to consider to restore hedgerow to 'favourable condition'	<p>Avoid disturbance, e.g. ploughing close to hedgerow</p> <p>Stop using herbicides close to hedgerow or use spot treatment</p> <p>Trim hedgerow and/or cut sward along edge of hedgerow to control woody plants</p>	<p>Remove or control introductions, plant up gaps if required</p>	<p>Change cutting regime</p>	<p>Lay, coppice, plant up gaps, fence if necessary</p>	<p>Lay, coppice, plant up gaps, fence if necessary</p>

Appendix 9 provides detailed criteria to determine whether a hedgerow is in 'favourable condition'.

Table 2 – Carrying out a local hedgerows survey: the key steps and decisions to take.

Step/Decision	
1	Define survey objectives.
2	Define survey area.
3	Define timescales.
4	Consult with key stakeholders such as local authorities, BAP groups, parish councils, farmer and landowner organisations, wildlife trusts and the Local Records Centres, and refine 1 – 3 above.
5	Decide whether to survey every hedgerow in the survey area (a census) or a sample of hedgerows (a sample survey). If sampling, determine necessary sample size to ensure statistical validity and decide on sampling strategy. Consider stratifying the sample, so that results can be compared with areas that may be different in hedgerow or landscape characteristics.
6	Decide whether to collect any of the optional information in addition to that considered essential in this Handbook, and any historical, cultural or other data required to meet survey objectives.
7	Decide whether or not to limit collection of some data to a single 30m section per hedgerow. Hedgerow length, the number of connections to other hedgerows and basic hedgerow type must be assessed over the whole length of each hedgerow, and woody species diversity must be assessed from 30m sections. All other essential information can be collected either from the whole hedgerow or from just a 30m stretch, depending on survey objectives and available resources. For large surveys using a 30m section is likely to be the most appropriate approach.
8	Decide whether to increase the level of accuracy to which measurements, such as hedgerow height, and width should be carried out, above the recommended minima in the Handbook.
9	Consider carrying out a pilot survey to refine sample size, to assist with resource assessment, and to tailor species lists, etc, to survey area. Re-visit 3 above.
10	Raise required funding and recruit necessary staff, co-ordinators and volunteers.
11	Obtain necessary equipment (e.g. maps, aerial photographs, measuring tapes and poles, GPS, computers, software).

Chapter 1

Table 2 – Carrying out a local hedgerows survey: the key steps and decisions to take. *Continued*

Step/Decision	
12	Train surveyors in field survey methods, data entry and health and safety requirements.
13	Obtain necessary access permissions, and carry out any desirable pre-publicity.
14	Start field work.
15	Enter information on each hedgerow surveyed into the Microsoft Access database that accompanies this handbook (may be done when field work ends).
16	Carry out periodic quality control.
17	End field work.
18	Analyse data and produce key results.
19	Complete Survey Summary Form (Appendix 7) and submit to local and UK BAP groups and Defra.
20	Ensure data and analyses are deposited with Local Records Centre, etc. (see Chapter 6).
21	Produce reports (preferably with non-technical summary) and publicise results.
22	Consider implementation of any recommendations and proposals that have come out of the work. Also consider timescales for repeat survey.

Survey Organisation

Introduction

For any hedgerow survey it is important to set aside sufficient time for planning. This will help to ensure that the survey runs smoothly and produces valid findings.



The brown hairstreak butterfly favours blackthorn hedgerows.



Song thrush with chicks. A BAP priority species



Hedgerow surveys may be undertaken with reference to particular species, such as the brown hairstreak butterfly or the dormouse.

The objectives (as set out in Chapter 1) and scale of the survey will help decide whether the project can be led by one person, or if a steering group is needed. It is important to establish who has overall responsibility for the survey, and to identify and agree the roles of other team members.

Chapter 2

Once the objectives are clearly set out, these will help to determine what information needs to be collected, the size of the sample, the ideal time to carry out the survey allowing for seasonal limitations, and the human and financial resource implications (determining the sample size is covered in Chapter 3).

Time should be allowed to apply for funding, if required, and to recruit and train surveyors, whether employed or volunteers. Autumn can be a good time to start planning for a survey taking place over the following summer. A longer period may be necessary if grant aid is required. As part of the planning it is advisable to contact local organisations such as the local authority/council, the county Wildlife Trust, the Campaign to Protect Rural England (CPRE) and the British Trust for Conservation Volunteers (BTCV). Such organisations may be undertaking hedgerow surveys already and/or may be prepared to provide some assistance.

Funding opportunities

Funding for local surveys may be available from Defra and a number of other sources. Contact points are given in Appendix 3. Applying for grant aid may require imagination or lateral thinking in terms of categories of funds to seek. Potentially, hedgerow surveys cover a wide range of interests including biodiversity, landscape history, landscape character, environmental awareness and community engagement.

When applying for funding, a careful check should be made of the entry criteria. Guidance is usually provided on completing applications, but as a general rule it is best to provide as much detail about the survey as possible, including clear objectives, likely outcomes and benefits, the survey method, the type of surveyors (voluntary or professional, skilled botanists, etc), and a breakdown of the estimated costs. Some grant schemes will fund only a proportion of the costs, with the remainder having to be obtained from other means, including 'in kind' contributions.

Hedgerow groups and publicity

In areas where hedgerows are considered to be a particular feature of the landscape character, some counties have established local groups focusing on a range of activities relating to hedgerows, including surveying (Box 4). Such groups are valuable for co-ordinating activities at a local level and may provide publicity.

Most farming organisations have a newsletter in which the survey could be announced. This, together with local newspapers, should help give credibility to the survey and will prove useful when it comes to asking for access consent.

At the completion of the survey, the publication of newsletter articles is a good way of reporting survey findings to a wide audience, as well as saying ‘thank you’ to any volunteers and land managers.

Survey team

Having decided on the sampling strategy (see Chapter 3), the number of surveyors required to complete the survey in the specified time/season can be calculated. Where several surveyors are required, a survey coordinator should be appointed to act as a focal point and cover aspects such as training, quality control, access, daily itineraries, data entry and subsequent analysis and reporting/publicity.

The survey may be undertaken by professional or volunteer surveyors, or a mix of both. This will have resource implications.

Professionals are recommended where a strict programme is required. Surveyors will require a good grounding in natural history and should at least be able to identify common native trees and shrubs as well as the recently-introduced species (listed at Appendix 8). Skills in surveying and map reading are useful. A valid driving licence is an advantage but not essential for all field surveyors. Transport can be a significant cost factor depending on the size of the area covered by the survey.

Box 4: Local Hedgerow Groups

The Devon Hedge Group was established to promote a wider appreciation and understanding of the importance of the county's hedgerows, their specific management requirements and their value for farming, wildlife, landscape, archaeology and cultural purposes. The Group was formed in 1996 and includes among its members farmers and their representatives (e.g. National Farmers' Union and Country Land & Business Association), nature conservation organisations, archaeologists and local authorities.

The Suffolk Hedge Group, made up of farmers and representatives of conservation groups, recognises the importance of hedgerows for wildlife and as landscape features. Their vision is for more hedgerow planting and improved management. Work by the Group includes an audit to estimate the length of hedgerows in Suffolk (Parker R, 2000).

Chapter 2

Surveying in pairs is recommended for health and safety reasons and should be considered within the resource assessment. Depending on the number of surveyors involved, it is good practice to mix surveying teams occasionally to ensure consistency between them and prevent bad habits developing. This can assist in quality control.

Greater botanical knowledge is required to complete the survey of ground flora (an optional part of the assessment), and, if this is to be included, surveyors should be competent botanists. If there is a shortage of such skills, a system could be developed whereby a more experienced botanist pairs up with a less experienced person. In all cases, it is essential that surveyors are honest in their identification of species. Unless they are believed to be rare or specially protected, unknown specimens can be collected (but not uprooted) for identification by a specialist. In this respect, the local Wildlife Trust or branch of the Botanical Society of the British Isles (BSBI) may be able to suggest someone who could help. An alternative approach is for a specialist team to survey subsequently.

For extensive surveys of several months' duration, the production of a short, internal progress newsletter provides a valuable means of contact between surveyors, including any 'reminders' relating to survey procedure.



Training is recommended to ensure accuracy and consistency in approach between surveyors

Timing of the field survey

The field survey period extends approximately from April to October, depending on the part of the country. June and July are ideal months, particularly where surveys include assessments of the ground flora. Over this period, a number of hedgerow shrubs may be flowering, and the spring flowering species will still be reasonably apparent, although the rank vegetation in a hedge-bottom will obscure evidence of plants like wood anemone, bluebell and dog's mercury later in the season.

Local hedgerow management practices are also important. By late summer, hedgerows may have been cut, making identification more difficult. If repeated surveys are intended, it will be important to survey at similar times of year to ensure that comparable results will be obtained in terms of width and height measurements.

Duration of survey

To calculate the amount of effort, and hence resources required, an estimate of how long the survey will take is needed. This will vary considerably between surveys, with the following factors being important:

- experience of surveyors
- difficulty in contacting farmers/landowners and obtaining access permission
- average distance, and ease of travel, between hedgerows
- average length of each hedgerow
- range of assessments to be made on each hedgerow
- ecological 'quality' of each hedgerow (e.g. species-rich hedgerows will take slightly longer to record)
- weather during the survey (e.g. surveys take longer in wet or very cold weather).



Roadside hedgerow in Warwickshire. Particular care must be taken if surveying roadside hedgerows. Always wear a fluorescent jacket.

Time must also be allowed for data entry into the associated database, and possibly a Geographical Information System (GIS), and for data handling/analysis – it is easy to underestimate the time needed for this.

Health and safety and insurance

All individuals have a responsibility for their own health and safety. Possible hazards are presented by survey locations alongside roads, railways and watercourses.

Surveyors should be made aware of health and safety issues, and should have a clear understanding of the procedure in case of accident or injury. This should be a fundamental element of any training.

Before a survey is carried out, a risk assessment should be completed to identify potential hazards and their associated risks, and to ensure that appropriate procedures are in place to control risks as far as reasonably practicable. Appendix 2 provides further advice on this aspect.

Equipment

The list at Table 3 will help to identify the materials and equipment that may be needed for the survey.

Table 3 – Checklist of survey materials which may be needed.

Office/coordinator	Health & safety for field work	Field survey
<ul style="list-style-type: none">• Aerial photographs• Ordnance survey maps 1:25,000 and 1:10,000• GIS computer package• Database and spreadsheet packages• Risk assessment forms and information	<ul style="list-style-type: none">• First aid kit including tweezers (for thorns)• Sturdy, waterproof footwear• Appropriate clothing• Mobile phone• Drinking water• Sun screen• Insect repellent	<ul style="list-style-type: none">• Rucksack• Maps (locational & survey)• Survey forms• Personal identification• Letter of introduction• Compass, preferably with scale rule• Binoculars

Table 3 – Checklist of survey materials which may be needed. *Continued*

Office/coordinator	Health & safety for field work	Field survey
<ul style="list-style-type: none"> • Contact details of surveyors • Hedgerow Survey Handbook • Document storage space • Specialist reference guides: flora and fauna • Biological records including Phase 1 Habitat Mapping 	<ul style="list-style-type: none"> • Fluorescent jacket, traffic cones and warning signs (if surveying highway hedgerows) • Explanation sheet/ code of conduct • Risk assessment sheet • Contact telephone numbers 	<ul style="list-style-type: none"> • Hand lens (x10) • Pen/pencil, eraser and spare note paper • Botanical field guide • Clipboard • Marker/measuring poles • Quadrat • Measuring tape minimum 30m • Camera and film or digital camera • Polythene bags (to protect completed paperwork) • Metal plates (150mm) and trowel if permanently marking plots, and metal detector to relocate • GPS • Handheld recording device e.g. Personal Digital Assistants (PDAs)

Chapter 2

A 'universal' marking/measuring kit can be assembled easily and cheaply using plumbers' push-fit overflow piping. This is normally available in grey or white. White is preferred for visibility reasons. The 21.5mm diameter piping can be cut to length easily and joined using push-fit in-line connectors and corners. For compactness, the pipe lengths could be 50cm, or 1m if compactness was not an issue. From a basic kit of pipe lengths and connectors, a range of measurements can be made and a ground flora quadrat constructed. The 'universal' kit is useful for:

1. Estimating the height and width of the hedgerow by placing several connected lengths next to the hedgerow, or pushing them through to measure width.
2. Estimating the height of the hedgerow canopy.
3. Measuring the diameter of an isolated hedgerow tree where lack of access to both sides precludes the use of a tape.
4. Laying against the hedgerow to mark out the start and end of the 30m survey section.
5. Forming a rigid 2 x 1m quadrat for ground flora recording.

A total of 6m of pipe will be needed, either 12x50cm lengths (plus eight in-line connectors) or 6 x 1m lengths (plus two in-line connectors), plus 4 corners. The pipes will need to be marked with critical measurements.

1. For height and width measurements the accuracy required is to the nearest 25cm. These can be indicated using bands of black or red tape. Length combinations using straight connectors can be used to record measurements from 50cm to 6m if required.
2. The height of the base of the hedgerow canopy can be estimated in a similar way.

3. Tree diameters can be measured by forming an 'L' shape with one of the lengths marked off in 1cm increments using an indelible marker pen³. When this 'right-angle' is placed against the tree at breast height (1.3m) the point at which the pipe touches the circumference of the tree is the radius. Multiplying by 2 gives the diameter⁴.
4. Sections can be joined to an appropriate length to lay against the hedgerow as a means of marking the start and end of the 30m sections (these may need to be re-used if quadrats are to be sampled).
5. A rigid quadrat can be formed using two 2m sections (each 2m section can be made up from two 1m lengths or four 0.5m lengths), two 1m sections and four corner joints. This will allow quadrats to be pushed under the hedgerow canopy relatively safely and easily. The bands of tape or connector positions can be useful guides in assessing percentage cover for abundant species e.g. nettles or cleavers (each 50cm x 50cm = 12.5% of the total area). For low frequency species a good guide is a standard A4 clipboard. This is approximately 3% of the area of the 2 x 1m quadrat.

Training

Training is essential to cover health and safety, and to ensure accuracy and consistency in approach between surveyors. It may be possible to complete training in one day, depending on the amount of detail required and the experience of the surveyors. Training should cover such items as the definition of terms, map reading and surveying. Special attention should be given to field identification of frequently occurring and indicator vascular plants. All surveyors should be familiar with this Handbook, in particular Chapters 4 and 5 and the Glossary of Terms at Appendix 1.

³ Because the connectors are a push-fit, joining two pieces of 50cm pipe may produce a total length of 102cm. Cutting to shorter lengths, say 49cm or 48.5cm, may be necessary to achieve the correct 'assembled' lengths.

⁴ Note that, if the tree is covered in ivy the 'tree' diameter measurement will need to be adjusted to take account of this.

Quality control

Quality control is important to ensure that the data collected are reliable and there is sufficient confidence in the survey's results and conclusions.

At the end of each day in the field, or before moving to a new location, surveyors should allocate time to checking survey forms for completeness and legibility. The Survey Summary Form (Appendix 7) should record any difficulties that have arisen while undertaking the survey.

Field supervision of surveyors, by an experienced surveyor, is advisable to ensure consistency between survey teams. In addition, quality control needs to be undertaken in the office and in the field to ensure data are being collected and processed to the required standard, and to measure observer error. A 10% randomly selected spot check is generally considered adequate as a repeat procedure. Where errors are discovered, further investigation may be required.

A Microsoft Access database has been designed to accept survey data (see Chapter 6). This has protected fields to reduce the likelihood of errors in data entry. A randomly selected quality check should be made of 10% of survey forms against the database. Spot checks should also be made of any data transferred from field maps onto 'neat' copies (although this practice should be discouraged, except where absolutely necessary) or GIS.

Pre-survey Preparations

Collation of background data

Depending on the survey objectives, background data will be required to assist with the design of a sampling strategy and, possibly, to supplement field survey records (Table 4). In most cases, this will only involve obtaining the necessary Ordnance Survey (OS) maps. A copyright licence is needed to copy OS mapping – details can be found on the OS website (<http://www.ordnancesurvey.co.uk>). In addition, other background information, such as aerial photographs, biological records and historical records will usually be useful and, for some surveys, will be vital.

A good source of information on environmental designations and schemes is the MAGIC (Multi-Agency Geographic Information for the Countryside) website: <http://www.magic.gov.uk>. This site provides free access to interactive maps which show the location and boundaries of Areas of Outstanding Natural Beauty, Sites of Special Scientific Interest, Special Protection Areas, Scheduled Monuments, and several other designated areas. Landscape Character/Natural Areas in England, Heritage Zones in Scotland and Landscape Character Areas in Northern Ireland provide a general framework for sampling.

Mapping

Various scales of mapping are helpful. The OS *Landranger* (scale 1:50,000) and *Explorer* (1:25,000) series are required to plan survey work. The 1:25,000 OS maps are the most useful when selecting sample grid squares, particularly for surveys covering more than a single parish. They are in colour and show field boundaries, contours, watercourses, CRoW⁵ access land and public rights of way.

Box 5: The application of GIS

Rotherham District Council has developed GIS with information on Heritage Sites, including the location of species-rich hedgerows. Barnsley Metropolitan Borough Council has included examples of species-rich and ancient hedgerows in their Habitat Action Plan inventory.

⁵ Countryside & Rights of Way Act (2000) (see <http://www.opsi.gov.uk/Acts/acts2000/20000037.htm>).

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For the field survey, 1:10,000 OS maps are required to plot and reference the hedgerows. The Landplan series at 1:10,000 scale is produced in colour or black and white, showing land features only. It is available through OS Superplan agents, who can also supply digital versions for use with GIS. GIS are a form of automated mapping, enabling the production of geographical and thematic maps. Whilst not essential, GIS have advantages in sample selection, presentation of findings and future record collation (Box 5). The local authority, Local Biological Records Centre or Wildlife Trust may be prepared to let their system be used.

Table 4 – Typical sources of supporting background information.

Data	Possible sources	Comments
Site designations	MAGIC website	www.magic.gov.uk
Biological records	County Wildlife Trust Biological Records Centre Government Wildlife Agency Local Authority Internet National Biodiversity Network	May know of previous hedgerow surveys May locate protected species associated with hedgerows
Phase I Habitat mapping	County Wildlife Trust Government Wildlife Agency	Check date of survey and whether it records field boundaries
Aerial photographs	Local Authority Government Wildlife Agency Internet	Check date and scale of photography
Survey maps	Ordnance Survey Local Authority	Local bookshop for 1:25,000; OS Superplan Agents for 1:10,000

Table 4 – Typical sources of supporting background information.
Continued

Data	Possible sources	Comments
GIS	Local Authority County/regional/local Wildlife Trust	May be prepared to let you use their system
Historical records	County Records Office Historic Environment Record Historic Landscape Character Map	The English Historic Landscape Character maps are produced on a county basis
Early editions of Ordnance Survey maps	Ordnance Survey British Museum Map Library County Records	Available on-line at: http://www.promap.co.uk or http://old-maps.co.uk
Other related surveys	Local BAP Group Local Authority Local Wildlife Trust Local history group Archaeological group CPRE Historic Environment Record Character Area profile descriptions (England) Butterfly Conservation Mammal Society Other specialist groups	Surveys for certain species may be related to hedgerows

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Aerial photographs

Before starting the field survey, aerial photographs (1:10,000 scale, approx) can be used to plot the extent of the hedgerow network.

The use of recent aerial photography avoids wasting valuable survey time visiting areas without hedgerows. However, care is needed to distinguish between very low hedgerows and ditches. These can be difficult to differentiate, depending on the quality and timing of the aerial photography, as can walls and low, compact hedgerows. Aerial photography is, at the very least, a valuable tool for identifying boundaries worth further inspection.



Before the field survey is undertaken aerial photographs can be used to plot the extent of the hedgerow network

Aerial photographs may be held by the local planning authority, possibly as part of their GIS. Colour sets are also available for consultation covering Scotland from Area Offices of Scottish Natural Heritage, and Wales from the Countryside Council for Wales. Other sources may be found from the Internet, such as www.local.live.com.

Biological records

Local Biological Records Centres may hold records on protected species as well as habitats. Habitat mapping may also be available, identifying intact, derelict and species-rich hedgerows, hedgerows with trees, and the habitats either side of hedgerows. However, as with aerial photography, much depends on the date of the survey, as conditions may have changed.

Historical records

If the survey's objectives require the collection of data on hedgerow history and the identification of ancient hedgerows and hedgerow networks, important background data can be collated from archival information such as estate maps, tithe maps and awards, enclosure maps, charters and manorial records and early editions of the OS. Much of this information should be available from the local County Records Office.

Additionally, Historic Landscape Character maps are produced on a county basis in England, through a programme by English Heritage. For local areas these should assist in relating the field layout to particular periods, for example pre-Medieval, thereby providing a context for individual hedgerows. In Wales, Cadw, has produced a Register of Landscapes of Outstanding Historical Interest including those where hedgerows feature. In Scotland, reference should be made to the Historic Landuse Assessment developed by Historic Scotland and The Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS).

Gaining site access

Public rights of way can be used to provide quick access to a particular hedgerow, but without the consent of the occupier they should not be used to survey a hedgerow. Permission to undertake surveys **must** be obtained in all circumstances. Experience shows that it is best to seek permission in advance of field work starting as it can take time to find out who owns or manages particular pieces of land.

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Traditional stile. Public rights of way can be used to provide quick access ('right of passage') to a particular hedgerow, but without the consent of the occupier they should not be used to survey a hedgerow.

It is recommended that contact is made with the local branch of the farmers' union or landowners' organisation (Table 5), to let them know about the survey. Their details are usually listed in the business section of the local telephone directory. In many cases it may be possible to include an entry about the survey in their newsletter, but an adequate lead-in time must be allowed.

Details of land managers are seldom easy to find. Although there is a range of potential sources of names and addresses for relevant

landowners, finding and contacting the right people can still be difficult and time-consuming.

A good place to start is to identify one or more farms that are clearly within the survey area, using a 1:25,000 OS map. The contact details for the farm(s) may then be obtained from the Yellow Pages or a web-based telephone directory that can be searched by business type and area. Local groups or organisations, for example the parish council, can also be helpful.

Initial contact with one key landowner, preferably face-to-face, can often provide the best source of information on land ownership in the survey area. Discussions with a farmer over a 1:10,000 OS map can help delineate farm boundaries and often provide contact names and telephone numbers for other landowners from whom access permission is needed.

Once the landowner, land manager or occupier has been identified, their consent must be obtained. Where large land holdings and estates are involved, it is recommended that a letter is written, explaining the survey objectives and asking for access consent. In most cases initial contact should be made by

Pre-survey Preparations

telephone, although in some circumstances it may be easier to gain consent immediately prior to the start of the field survey by visiting the farmhouse. Once identified, it is helpful to record (with agreement) their name, address and telephone number on the Survey Summary Form (Appendix 7) for future reference.

To help gain permission to undertake a survey, it is often very useful to engage the landowner/land manager in the project. Many are interested in the history or wildlife of their farm and this can be used as a means of introducing the survey to them. It may also help to offer feedback on the results of the survey on their land. In addition, the survey may provide them with information they could use in their application for an agri-environment scheme, such as Environmental Stewardship.

Table 5 – Farming organisations.

Organisation	Website	National tel. no.
Country Land and Business Association (CLA)	www.cla.org.uk	020 7235 0511
National Farmers' Union (NFU)	www.nfu.org.uk	024 7685 8500
NFU Scotland	www.nfus.org.uk	0131 4724000
NFU Cymru – Wales	www.nfu-cymru.org.uk	01982 554200
Farmers' Union of Wales	www.fuw.org.uk	01970 820820
Ulster Farmers' Union	www.ufuni.org	028 90 370222

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The varied pattern of hedgerows in the Black Mountains, South Wales. Note the absence of hedgerows on the higher ground.

A letter of authority should be carried by field surveyors at all times. In addition, a brief note describing the survey objectives should be offered to the landowner/land manager. In some cases, the land manager may want to accompany the surveyors and, wherever possible, this should be granted.

If ownership of the selected hedgerows cannot be determined or consent is refused, a standard procedure for selecting additional sample areas/hedgerows should be employed, for example taking the next nearest hedgerow to the sample selection point (see Chapter 4, including Figure 2).

Developing a sampling strategy

The resources available, together with the objectives of any particular survey, will affect the decision on how many hedgerows should be surveyed. There are two basic strategies: a census and a sample.

Box 6: Monitoring change

A study of hedgebanks in Dorset

The *Geographical Handbook of the Dorset Flora* was the result of an extensive botanical survey carried out by Professor Ronald Good, between the years 1931 and 1939, and represents the largest dataset collated for a single habitat type. In great detail, it records the condition of the county's hedgebanks during the 1930s, a time when the methods of hedgerow management and the agricultural landscape within which they stood were considerably different from today.

In 1999 the Dorset Environmental Records Centre secured a grant from the Heritage Lottery Fund for the computerisation of Good's records. This, together with a re-survey of the sites examined by Professor Good, has enabled an assessment of changes in Dorset's hedgebanks to be made. The bank flora was found to be less diverse, with a loss of rare species; the diversity of woody species had increased but there was a deterioration in hedgerow structure. These findings help to identify methods of favourable hedgerow management.

Source: Button, N (2003) Dorset's changing hedgebanks – a resurvey of Professor Good's hedgebanks in Dorset. Contract report for Defra.

A census survey includes all hedgerows within the survey area. Usually, limitations of finances and time mean that this approach can be used on only relatively small areas, for example a parish/township or an estate.

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Where a census is not possible, a sample of hedgerows will need to be selected for survey. The number of hedgerows that can be included in the sample will depend on the scale of the survey, available resources and the questions that the survey seeks to answer. In general, the greater the variability of hedgerows in the area, the larger the number of sample points that are required to produce sound results. There are various ways of selecting the hedgerows to be surveyed, but the method to be used should be objective, and agreed in advance. This is to ensure, as far as possible, that the sample provides a fair representation of the hedgerows in the area, and reduces any personal bias in selecting the hedgerows to be surveyed.

Kilometre grid squares are used widely as a sampling unit. Obtaining an objective sample within the grid square can be done in a variety of ways. The approach recommended here is to select nine hedgerows within a 1km square. This is covered in more detail in Chapter 5 and figure 2.

If there is a high density of hedgerows, and resources allow, a finer grid using 16, 25 or 36 cells can be applied. A quarter of a kilometre square may be more appropriate in parts of the country with a dense hedgerow network, for example North Wales or South West England.

For large scale surveys at a district or county level, it may be appropriate to randomly select a number of 1km squares and survey one hedgerow that is closest to the centre. If this route is chosen, it may be important to ensure that there is sufficient representation of all landscape types. A purely random selection of squares may not achieve this, so it may be necessary to specify a certain number of squares for each landscape category. Landscape character maps can assist with this and are available from Natural England, Scottish Natural Heritage and Countryside Council for Wales. Within each category it is still important to have a proportional random selection of survey squares.

If there is uncertainty over the most appropriate sampling strategy, it is essential to consult someone with experience in sampling and statistics at the outset.

Guidance is provided on how to select individual hedgerows in each sample unit in Chapter 4 and illustrated at Figure 2.

Trialling the survey method

Part A of the Field Survey Form presents the minimum information that should be collected (see Appendix 6). Where possible, a pilot survey should be undertaken, and should cover aspects such as the sampling strategy and procedure. The pilot can help determine whether the sample size is adequate.

Even if all the hedgerows in an area are being surveyed, a pilot survey is still recommended. It should check the local appropriateness of species lists and the need for any additional categories relating to 'other' features. For example, in the limited space available on the Field Survey Form it is better to include species and features that are likely to occur frequently (to save time writing them out in full). The pilot can also provide a basis for subsequent training sessions and assist in calculating the resources required for the full survey.

Box 7: Sample selection in Cumbria

The main objective of the Cumbria Hedgerow Survey was to provide baseline information on the hedgerows in the county. To survey all hedgerows would have been impractical, so a sample was selected. Few hedgerows occur above an altitude of 300m, and it was found that these areas could be excluded by rejecting the areas mapped as the four upland land classes in the Cumbria Land Classification. To cover some 10% of the non-upland area, a sample of 1km squares was selected from a 3 x 3 km grid. The squares were selected at random from the grid, whilst ensuring adequate representation of the remaining Cumbria Land Classes, and the Countryside Character areas that occur in Cumbria.

Source: Colin Barr (pers. comm.)
Cumbria Hedgerow Survey (2003).

Data collection

The survey forms are designed to allow easy data entry in the field and subsequently into the database that accompanies this Handbook.

For most small-scale, local hedgerow surveys, pen and paper will be the simplest and most efficient system for recording. However, for extensive surveys, and to reduce subsequent data entry, field survey forms can be adapted for application on a hand-held computer or data logger. A number of different types are

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available on the market. Decisions as to which type to use might be based on durability for outdoor application, length of battery life, data security and portability versus size of keyboard and screen. Some machines are capable of displaying mapping and can be used in conjunction with Global Positioning Systems (GPS) and GIS. Such equipment should be tested before embarking on the full survey, and surveyors will need to be trained in their use.



A recently laid hedgerow with male fern and greater stitchwort

Measurement of accuracy

The survey method requires a number of different measurements to be made on the hedgerows such as height and length. The level of precision is standardised for each type of measurement and surveyors should aim to be at least as precise as the recommended standards. Where desired, a greater level of precision can be adopted but this usually requires more time in the field. These measurements are used to determine whether hedgerows fall within the agreed limits and thresholds for condition assessment. Specific requirements can be found in Chapter 5.

Field Survey – what to record and why

Introduction

This chapter, and those that follow, detail the procedure for carrying out local hedgerow surveys. Chapter 4 describes how to locate the survey hedgerows and survey them. It also explains how to determine whether or not hedgerows are in 'favourable condition'. Chapter 5 provides a summary guide to completion of the field survey forms and the intention is that it will be 'essential reading' for field surveyors. The final chapter (Chapter 6) deals with the subsequent data management and reporting.

Reporting forms for the field survey elements are at Appendix 6 and a survey summary report form is at Appendix 7.

Locating hedgerows in sample surveys

The development of a sampling strategy is described in Chapter 3. The recommended approach is to select nine hedgerows within a 1km square, but the selection method described below can be adopted for other sampling densities. To select nine hedgerows, an acetate overlay of a 1km square with a grid of 9 cells (each 333m x 333m) should be prepared and the centre point in each cell marked. These centre points form the starting points for hedgerow selection. From these **selection points** the nearest hedgerow, in any direction should be located (see Figure 2). This requires using maps on which all probable hedgerows have been marked, either from interpretation of aerial photographs or visual ground reconnaissance. If the survey is based on 1km squares, there may be occasions where the selected hedgerow crosses into an adjoining square. The recommendation is that the hedgerow should be surveyed if it falls mainly inside the target square (>50% of its length).

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The sample hedgerows within the square should be numbered with their selection point number. These should be arranged from the south-west corner to the north-east corner in keeping with OS grid referencing (eastings before northings). If, for various reasons, certain hedgerows cannot subsequently be surveyed, the simplest approach is to ignore those numbers rather than re-number and cause possible confusion to surveyors on the ground. If this is likely to reduce the sample size then the approach would be to select the next-nearest candidate hedgerow to the selection point and give that hedgerow the appropriate number. An example would be where a hedgerow identified as 7 turned out to be too gappy to fall within the definition of a hedgerow, but the next-nearest hedgerow was more intact and could be surveyed. This hedgerow would then be surveyed as number 7 and the planning maps amended accordingly.

The unique reference number is very important and should be recorded on the survey map, along with cross-references to the hedgerow survey sides (A + B). The reference number will be used in the database and will enable individual hedgerows to be identified and the same side re-surveyed in the future.

All potential hedgerows that could be surveyed should be plotted on the base map as part of the survey preparation, but some adjustment in the field may be needed where there are breaks in the hedgerow of over 20m, and 'missing' hedgerows (as may have been misinterpreted from aerial photographs etc.). These may create additional hedgerows and/or survey units. If these are to be added to the survey they will need to be numbered to maintain a unique reference. The recommendation is to add a suffix to the hedgerow number. For example, if hedgerow 7 turned out to be two hedgerows, these would be numbered 7a and 7b⁶ on the maps and recording forms. GPS can provide a check that the right hedgerow has been reached, but this is not essential if the surveyors are good map readers.

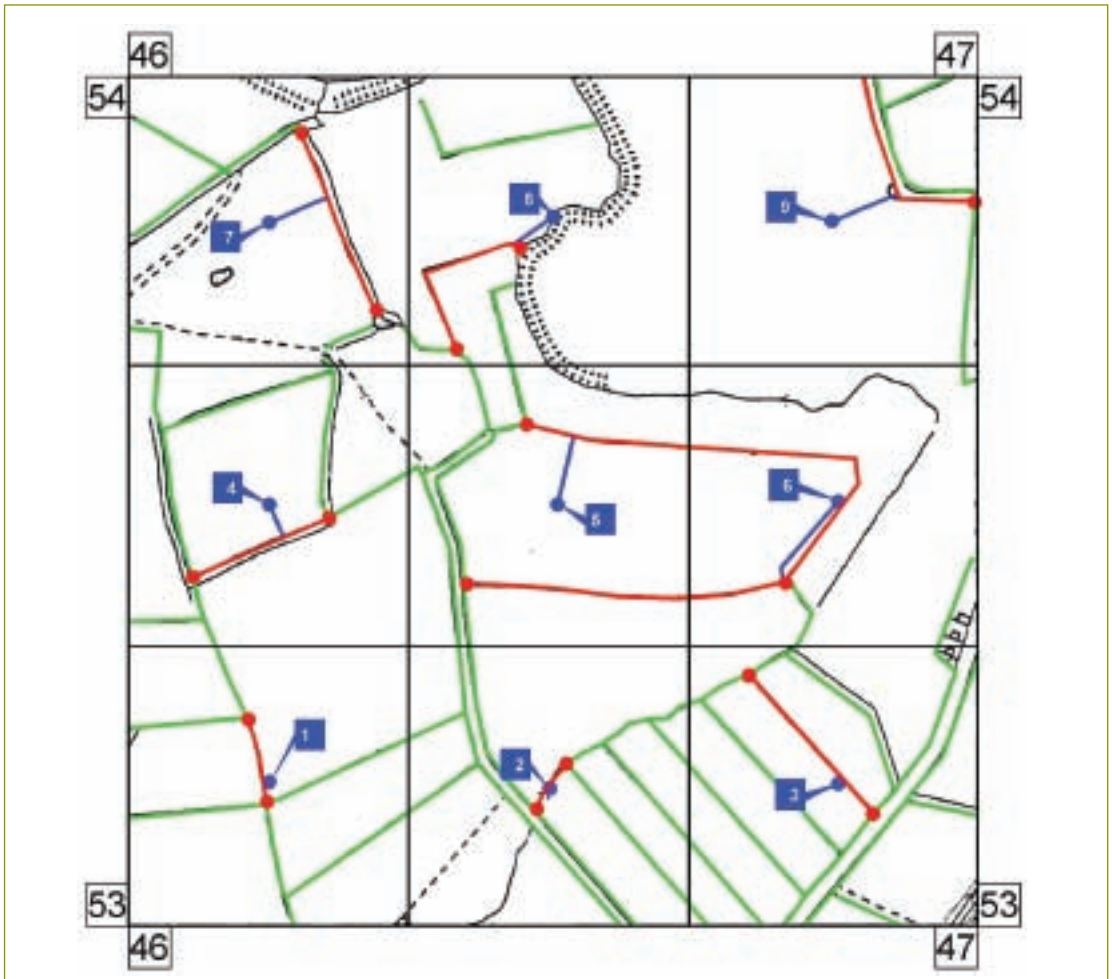


Measuring out the 30m section with a tape.

⁶ Using lower-case letters will avoid confusion with the upper-case letters used to identify the sides of each hedgerow.

Field Survey – what to record and why

Figure 2: Standard overlay for the objective selection of sample hedgerows.



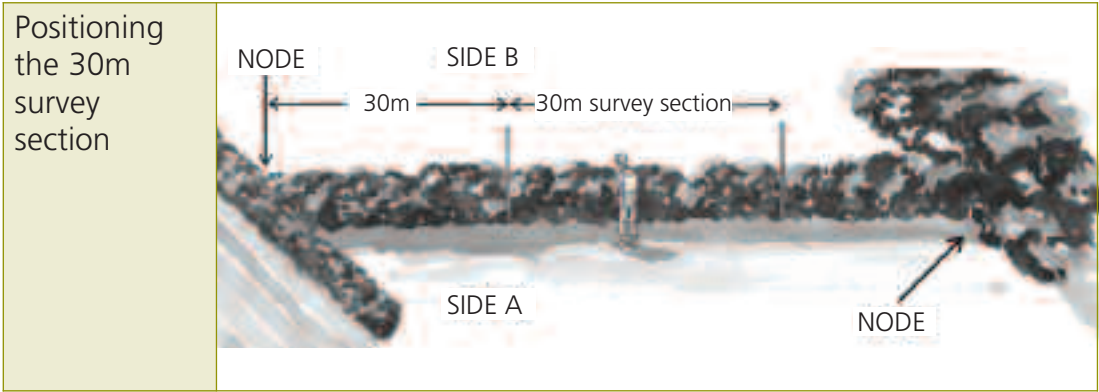
KEY: Marginal numbers = 1km grid square reference numbers from the OS base. Black vertical and horizontal lines = 3x3 sampling grid. Other black lines = features/boundaries that are not hedgerows. Green lines = hedgerows. Red dots = nodes. Red lines = the selected hedgerows. Blue dots = the centre-points of the 3x3 grid squares. Blue numbers + lines = reference numbers and links to the closest hedgerows.

*Note that hedgerows 5, 8 & 9 turn corners and hedgerow 9 goes into the next 1km square and is also part of a double hedgerow on a green lane. Also, having selected hedgerow 5, hedgerow 6 had to be the hedgerow to the south even though it was not the closest, but because hedgerow 5 had already been selected. If only one side is to be surveyed this should be the side **nearest** to centre-point for **even** numbers and the side **away** from the centre-point for **odd** numbers. Therefore it would be the green lane side hedgerow 9 that would be surveyed.*

Selecting the 30m survey section

The 30m section chosen for recording woody species and other features also needs to be selected objectively. A systematic way suggested in this Handbook is to measure 30m from one of the hedgerow end points and take the next 30m length as the survey section (Figure 2). The end point from which to start should ideally also be selected objectively, although this is not always essential. The recommendation is to work from the selection point used to identify which hedgerow to survey and to choose the closest end point for even numbered points and the furthest end point for odd numbered points. If the sample hedgerow is less than 60m in length then the survey section will include the ‘far’ end of the hedgerow and the length at the beginning will have to be reduced to accommodate the 30m survey section. For the woody species (see section 17 in the Field Survey Form) the 30m section should have as few gaps as possible, otherwise a different section may have to be selected. However, for sections 6-17 of the Field Survey Form, the 30m survey section must be representative and selected objectively.

Figure 3 – Standard field procedure for locating 30m survey section.



The easiest way to locate the 30m survey section is to measure with a tape 30m from the start of the hedgerow and then place markers at 30m and 60m to define either end of the survey section. A quick alternative method suitable for use by a surveyor working alone is to use a 2m length of pipe and lay it out fifteen times consecutively.

Field Survey – what to record and why

For repeat surveys of 30m sections, permanent buried metal marker plates e.g. 150mm x 150mm galvanised 'mending plates', available from builders' merchants, may be installed at each end. It is important to ensure that the plates are not located where they may be disturbed by cultivation. Guidance notes should be made and ground-based photographs taken to help future surveyors locate these plates (e.g. 'plate located 1m from hedgerow centreline' or 'on ditch-bank top, field-side', etc). It is important to obtain land manager/landowner consent for this operation. Usually, it will not be necessary to permanently mark 30m sections to meet a survey's objectives. Marking is normally only required where it is important to monitor change to individual hedges over time, as opposed to population of hedges.

Selecting the survey side and quadrat locations

Once the survey section has been located, the survey side should be selected. If both sides of the hedgerow are available for survey it is recommended that both are done. However, depending on survey objectives and resource availability, it is acceptable to survey one side only. This may be more practical in surveys covering large numbers of hedgerows where it is the state of the population that is important rather than that of individual hedgerows. If only one side is to be surveyed the primary survey side (Side A) will need to be selected (the aspect of the 'A' side (north, south etc) needs to be recorded at the top of the field recording form). This needs to be done objectively. The recommendation is to make side 'A' the side closest to the selection point for even numbered points and the far side of the hedgerow for odd numbered points (this will ensure that some 'internal' sides of double hedgerows along green lanes or roads will be surveyed). The 'A' side should be where any quadrats are placed for recording the ground flora in the optional part of the survey method (see Figure 18).

If the quadrat locations are to be permanently marked (and this will seldom be necessary), it is important to ensure that the plates are not located where they may be disturbed by cultivation. Assuming there will be no disturbance, the recommendation is to install two marker plates⁷ on the two corners furthest from the hedgerow centre. This will make access for relocation easier and will potentially avoid too many tree and shrub roots. Again, consent from the land manager/landowner must be obtained for this operation.

⁷ This will locate the hedgerow to within 100m if six figures are used and 10m for eight figures.

Completing the Field Survey Form – Essential and optional assessments of the survey method

The Field Survey Form (see Appendix 6) is divided into two parts:

Part A includes all of the **essential assessments** that should be completed in full for every surveyed hedgerow to enable BAP condition assessments to be made. The key uses of the results for the essential parts of the method are described in boxes after the relevant sub-sections.

Parts B covers various **optional assessments** that collect supplementary data on the ground flora, and more detail about associated features like banks, verges and veteran trees. Optional assessments will vary according to each local survey's objectives.

Most sections of the form can be completed by simply entering numbers, or circling or ticking the appropriate answer. Definitions of terms used on the form are included in the Glossary (Appendix 1).

Condition assessment and attributes

The attributes that enable the condition of a hedgerow to be assessed should be applied to all hedgerows **except those that have been recently laid, coppiced or planted**. If the type is 'shrubby hedgerow with trees', then the attributes are measured for the **shrubby layer** not the tree layer.

Part A – Essential Assessments

Elements that should be recorded for the whole hedgerow (Sections 1-6)

Referencing the hedgerow

Once the hedgerow has been located and any survey section(s) marked out, the following should be recorded:

- The **title of the survey** using a short, punchy name as surveyors will have to write this a number of times, or even adopt a standard abbreviation.
- The six, or eight⁸ figure **grid reference** of the mid-point of the whole hedgerow, survey unit or survey section. Depending on the scale of mapping used, acetate grids can be bought, or made, to overlay onto maps to provide precise identification of hedgerows. Alternatively, if GPS are available, the full two-letter and 10-figure grid reference can be recorded or downloaded onto a computer for subsequent incorporation into a GIS package.
- The **date(s) of the survey**. Ideally all survey elements should be done on the same day.
- The **hedgerow reference number**. This will normally be the sequential number as described earlier, with possibly a suffix if a plotted hedgerow turns out to be more than one hedgerow or comprises more than one hedgerow type (survey unit), for example 7a and 7b.
- The **name(s) or initials of the surveyor(s)**. If initials are used, ensure that they are unique.
- The **side or sides surveyed (N, E, S, W or both sides)**. The orientation of sides A & B should be indicated by circling the appropriate compass point letters. If the hedgerow runs due NE-SW the two sides could be recorded as either N+S or W+E. Surveyors should not be concerned about this as either indication is unambiguous when looking at the map. Ambiguity may arise where the hedgerow changes direction significantly along its length. It may start running

⁸ Using lower-case letters will avoid confusion with the upper-case letters used to identify the sides of each hedgerow.

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approximately W-E and then change to approximately N-S as shown in the example Hedgerow 8 at Figure 2. In this example, the end closest to the selection point (as it is an even number) is where the measurement would begin for locating the second 30m length as the survey section. It is here that the determination of the survey side should be made. If this hedgerow is surveyed along the southern/eastern sides, then the survey side recorded onto the form would be 'S'. If this principle is adopted, even if the whole hedgerow was surveyed there would be no ambiguity about which side was surveyed if both were not done. In extreme cases, the side surveyed may have to change along the length because of an obstruction. Details should be entered into the section on 'difficulties' (section 2d) about how much was done from which side and where the change occurred (also marking on the map).

1 – Name of landowner/contact details

Ensure that the landowner is willing to have this information held on the database relating to the survey and, if the data are to be made publicly available, that permission has been granted (Section 1a and 1b).

2 – Survey times and weather/other conditions

Information on survey times is needed to assist with future time planning and to record time inputs for the Survey Summary Form.

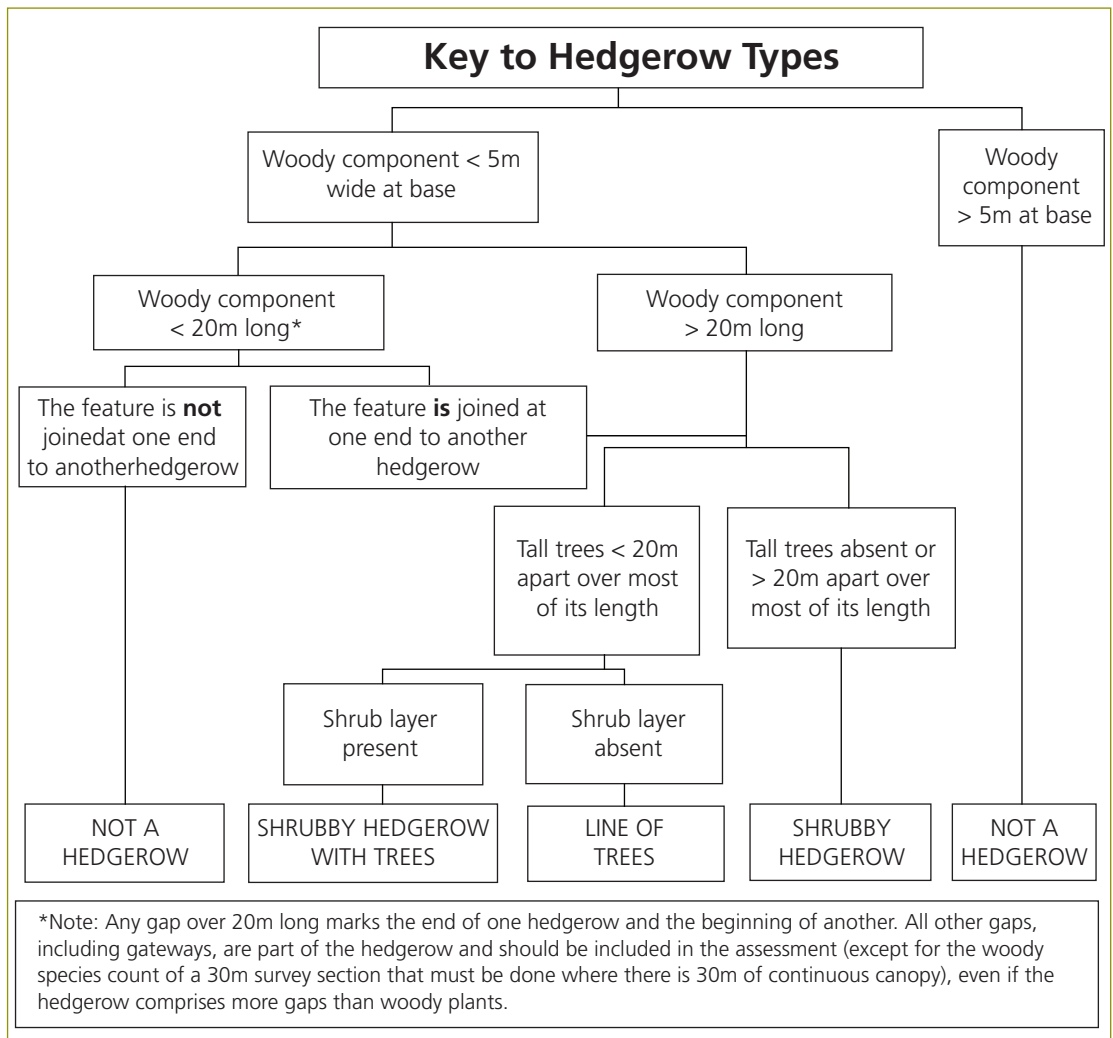
The general weather conditions may affect the accuracy of the results. Surveys should not be done in bad weather unless there are time constraints or other compelling reasons, for example the surveyor had driven a long way, or the weather deteriorated during the survey.

Any difficulties that may be encountered, including stock loose in the field, difficulty walking along the headland because of cleavers or oilseed rape, should also be recorded as this may be useful for any resurvey or for any specialist team doing additional work like ground flora quadrats.

3 – Hedgerow type

Identifying the different types of hedgerow is fundamental to the survey process. As described above, a hedgerow may be variable along its length and may need to be subdivided into a number of survey units based on changes in hedgerow type. A simplified key to determining whether or not a feature is classed as a hedgerow, and if so, what type, is at Figure 4.

Figure 4 – A key for determining if a feature is a hedgerow and the hedgerow type.



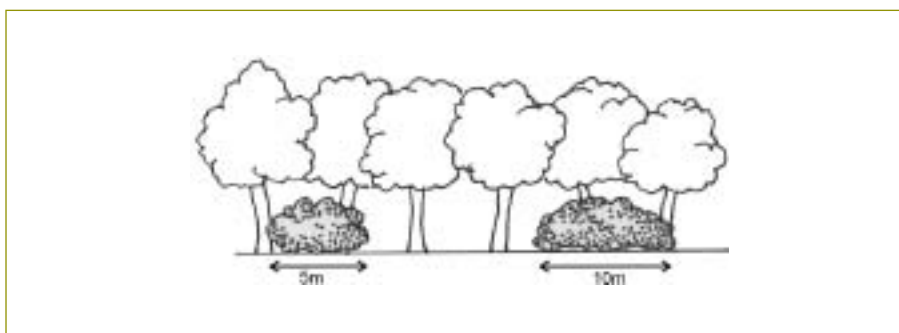
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Detailed definitions of the three different kinds of hedgerows are described below. There is inevitably some overlap and so judgement is needed to select the most appropriate type. A change in type within a 30m section is unlikely given the small size of this relative to the scale of the woody plants in the hedgerow, particularly trees, but the predominant type should be assessed if such a rare situation arises (see Hedgerow management shapes).

Shrubby hedgerow: The 'classic' shrubby hedgerow is a line of woody hedgerow plants that have some or all of their leafy canopies less than 2m in height from the ground, so that the woody linear feature as a whole appears as a 'shrubby' hedgerow, even though some of the woody species in it are capable of growing into trees. The shrubby component must be less than 5m wide. This hedgerow type may have hedgerow trees along its length, but their canopies should be more than 20m apart.

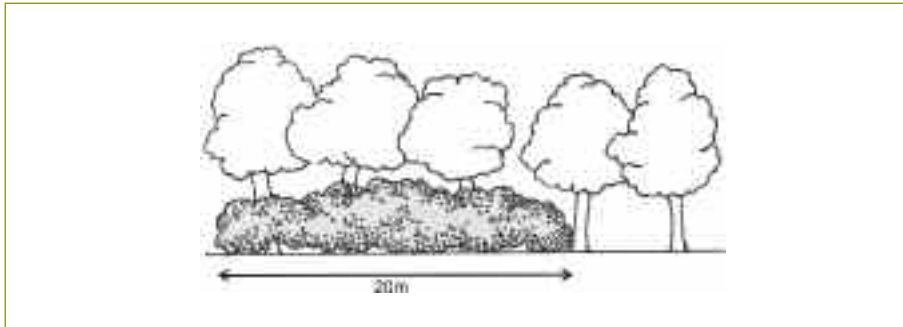
Line of trees: This is a line of trees where the base of the canopy is greater than 2m from the ground and the gap between tree canopies is less than 20m, so that the woody linear feature as a whole appears as a 'line of lollipops' (see Figure 5). The width of the feature at its base has to be less than 5m to qualify as a hedgerow. There may be a distinct shrub layer beneath the line of trees but this shrub layer must have less than 20m of continuous canopy cover (see Figure 5).

Figure 5 – A line of trees.



Shrubby hedgerow with trees: This is a shrubby hedgerow of more than 20m of woody hedgerow plants where the distance between the ground and the base of the leafy layer is less than 2m, so that the woody linear feature as a whole appears as a 'shrubby layer plus lollipops' (see Figure 6). The shrubby component must be less than 5m wide at its base.

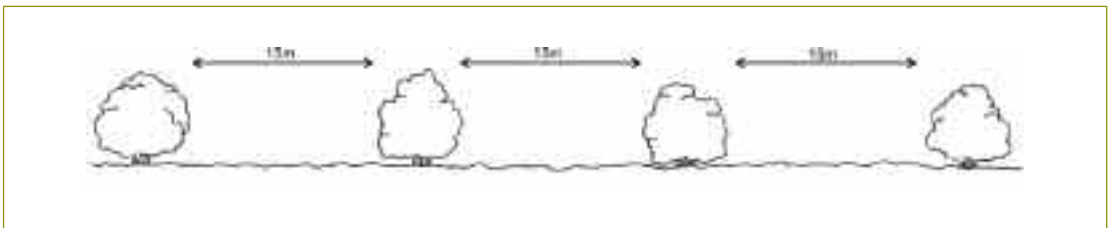
Figure 6 – Shrubby hedgerow with trees.



Very gappy shrubby hedgerows are included to ensure that hedgerows tending towards this level of gappiness are considered and can be condition assessed. Both shrubby hedgerows and shrubby hedgerows with trees can range from a complete continuous canopy cover to being gappy remnants of shrubs. The illustrations below (Figure 7) can be used to assist in determining whether to survey the feature.

The broad definition of a hedgerow used in this Handbook specifies that where there is a gap of more than 20m between woody plants the two sections either side of the gap are considered as separate hedgerows. However, some hedgerows are very gappy so that most of the feature is actually gaps, but no gap is greater than 20m. These hedgerows should be surveyed and condition assessed. When the gaps exceed 20m, and no woody section is greater than 20m long, then the feature can be described as the remains of a hedgerow, and should not normally be surveyed unless the objectives of the local survey require it.

Figure 7 – Gappy hedgerows.



a) Gaps between woody components less than 20m therefore condition assessment applies even where the woody sections are less than 20m in length.

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b) Gaps between woody components 20m or more and no woody section is 20m or more in length, therefore the feature is no longer a hedgerow and condition assessment not required.

4 – Length

This measurement should be made regardless of whether the whole hedgerow or just a 30m section within the hedgerow is surveyed. It can either be done with reference to a map or measured on the ground. Measurement on site is likely to be necessary where there are gaps greater than 20m in length creating several separate hedgerows.

5 – Connections

The survey hedgerow may be connected to other hedgerows and form part of a valuable hedgerow network, used, for example, as a flyway by foraging bats. This section of the form records the total number of other hedgerows that have a direct connection to the hedgerow being surveyed.

It should be noted that, for the purposes of the survey, the hedgerow is only that section between the two end points. Continuation beyond those end points, as well as any connecting hedgerows, will therefore count as 'connections'. Gaps in the woody component of up to 20m still count as being part of the hedgerow.

Key result for connections with other hedgerows

Sum of all connections divided by total number of hedgerows surveyed =
average number of connections per hedgerow.

6 – Extent of survey

Some of the essential assessments can only be applied to whole hedgerow lengths (sections 3-5 of the Field Survey Form at Appendix 6) while others can be applied to either whole hedgerows or to 30m survey sections. The aims of the survey should guide the choice of whether to assess the condition of the whole length of the hedgerow or 30m sections. For instance, where the condition assessments contribute to working out the amount of hedgerow restoration needed on a particular piece of land, then the whole length of each hedgerow on the land must be assessed. In contrast, for reporting on hedgerow condition across a county, recording from 30m samples is likely to be the only feasible method.

Elements that may be recorded for either the whole hedgerow or for a 30m survey section (Sections 7-16)

7 – Adjacent land use

Data should be gathered on the adjacent land uses either side of the hedgerow. The way that land adjacent to the hedgerow is managed can have a significant effect on the hedgerow itself. Intensive farming can result in enrichment of hedgerow bases and loss of herbaceous species. However, as a result of cross-compliance measures and agri-environment options many farmers are now leaving wide, uncropped margins alongside hedgerows to protect them. Around arable fields, they are mostly sown with perennial grasses, sometimes with added wildflowers or with pollen/nectar producing species. The presence of such margins is important to note in this section of the form, and their width should be recorded in section 9.

A range of land use options is provided on the survey form (arable, grass, woodland, road/route and water). These are then sub-divided. Some specialist knowledge is required to correctly identify improved, semi-improved or unimproved grassland (refer to the Glossary for these and other definitions). Presence of livestock includes obvious signs such as cow pats or sheep dung.

Details of types of road/route can be taken from OS Explorer maps, including class of road or public right of way. Major roads include all motorways, dual carriageways and other 'A' roads. Minor roads include 'B', 'C' and unclassified surfaced roads. Tracks include unsurfaced roads (e.g. on farms) and bridleways.

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Key result for adjacent land use

Percentage of total number (sides) of hedgerows or 30m samples immediately adjacent to each main land use: arable, grass, woodland, road/route, water, other.

8 – Associated features

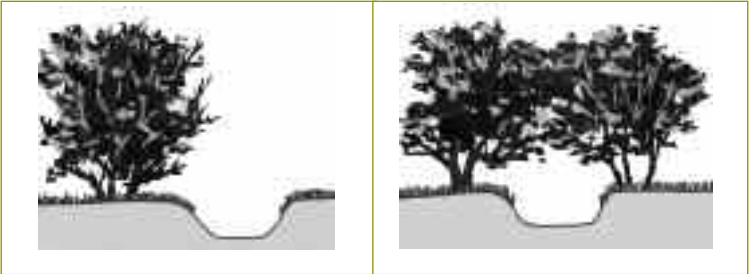
8a Bank: This section of the survey form asks for an estimate to be made of the height of any bank present. Hedge-banks or adjacent ditches also add to the ecological value of the hedgerow; for instance, banks can have a very rich flora, including plants like primroses, bluebells and ferns.

8b Average herbaceous vegetation height: The average height of herbaceous vegetation on banks and margins gives clues about the intensity of any grazing or mowing management, for example indicating the contrast between a tall, lightly-managed, sward of 50cm or more in height and a short grazed turf of only a few centimetres. The height of the main mass of herbage should be estimated or measured, not the tops of scattered flowering spikes of grasses and taller herbs which project above the main sward.

8c Fence: The presence of fences adjacent to hedgerows provides information about the level of protection from grazing animals.

8d-g Ditch – Any ditch next to, or within, the hedgerow should be recorded.

Figure 8a – External ditch Figure 8b – Internal ditch



Key results for associated features

Percentage of total number of hedgerows associated with banks, fences or ditches.

9 – Undisturbed ground and perennial herbaceous vegetation cover

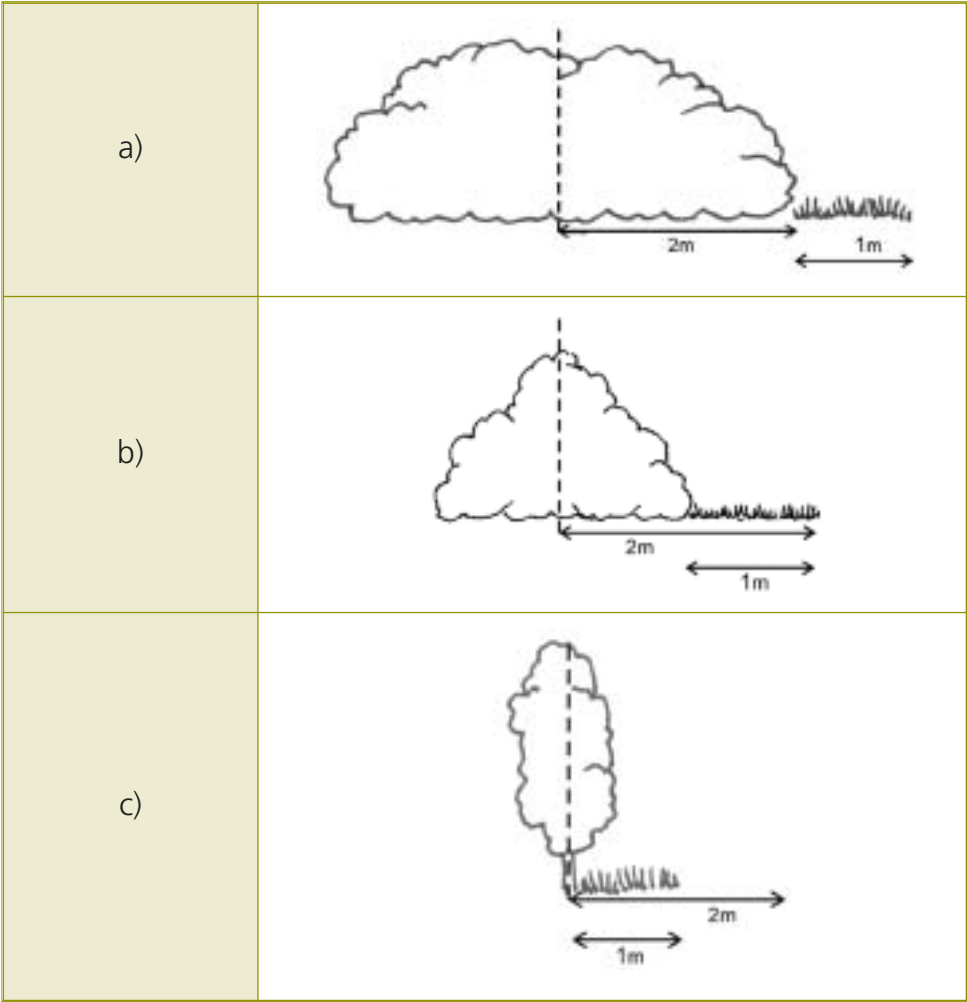
Two other important criteria for hedgerows in ‘favourable condition’ are the width of undisturbed ground and of perennial herbaceous vegetation adjacent to the hedgerow. These attributes pick up management close to the hedgerow that is likely to damage woody species, for example cultivation harming their roots. They also highlight the lack of perennial herbaceous habitat, such as due to ploughing or blanket, non-selective, herbicide use. Herbaceous vegetation is an important part of the hedgerow habitat as many animals rely on it for shelter, foraging and nesting (see Figure 9).

9a Average width of undisturbed ground: The threshold for ‘favourable condition’ is a width of at least 2m from the centre line of the hedge. Hedgerows adjacent to undisturbed vegetation such as permanent grassland or woodland (as recorded in 7b or 7c) automatically achieve the threshold for favourable condition.

9b Average width of perennial herbaceous vegetation: The continuous perennial herbaceous vegetation between the centre-line of the hedgerow and adjacent areas of disturbed ground should be recorded. In most cases this is likely to be less than the width of undisturbed ground, because of the presence of bare ground beneath most hedgerows (particularly the most dense hedgerows), but it may be further reduced by intensive grazing or herbicide applications. Hedgerows bordering grassland, even improved grassland (as recorded in 7b), automatically satisfy the ‘favourable condition’ for this attribute. The threshold to achieve ‘favourable condition’ is a width of at least 1m.

Figure 9 – Measuring the width of undisturbed ground and perennial herbaceous vegetation.

All hedgerows are in favourable condition.



Key results for undisturbed ground and perennial herbaceous vegetation cover

- 1) Percentage of hedgerows with a width of undisturbed ground greater than 2m.
- 2) Percentage of hedgerows with a width of perennial herbaceous vegetation of greater than 1m.

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10 – Nutrient enrichment ground flora indicator species

A high percentage cover of nettles (*Urtica* spp.), cleavers (*Galium aparine*) or docks (*Rumex* spp.) in the hedge-bottom is a broad indication that there is likely to be a species-poor ground flora, probably resulting from nutrient enrichment, for example, from agricultural fertilisers being spread beyond the edge of the crop into the hedgerow base.

The percentage cover is estimated either along the whole hedgerow length or in the 30m detailed survey section. No suitable thresholds have been developed for the enrichment species but cover of 20% or more of these species, singly or together, is likely to show that there has been significant enrichment of the hedgerow base and therefore this should be used to indicate 'favourable condition'.

More detailed recording of the ground flora as described in Part B of the Field Survey Form can give a better idea of enrichment as species diversity can be calculated and percentage cover of all species compared. Species that are particularly vulnerable to enrichment can be identified by using references such as Hill (2004).

Key result for nutrient enrichment of hedgerows

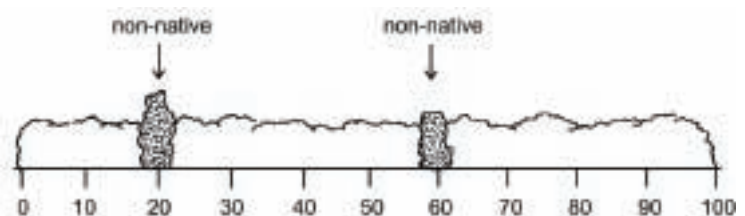
Percentage of hedgerows/30m samples recorded with more than 20% cover of nettles, cleavers and docks, either singly or together.

11 – Recently introduced, non-native species

Relatively recently introduced, non-native species – often originally imported to Britain as garden plants – can be very detrimental to the structure, diversity and ecological value of a hedgerow. These recently introduced species or 'neophytes' are defined in the '*New Atlas of the British and Irish Flora*' Preston (2002).

Figure 10 – Measuring the percentage cover of recently introduced species in the hedgerow woody component.

Favourable condition as the recently introduced species cover represents <10% (view facing hedgerow).



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For non-native woody species, the cover should be estimated as a percentage of the total area of the vertical face of the hedgerow on the side being assessed as shown at Figure 10. Where the whole length of hedgerow is being assessed, these need to be recorded along the whole length, as well as in the 30m section used for recording woody species richness (see below). The threshold for 'favourable condition' in both the shrub layer and ground flora is no more than 10% cover of recently introduced non-native species.

Key results for condition assessment

Percentage of whole hedgerows/30m samples with no more than 10% cover of recently introduced, non-native species.

12 – Hedgerow shape

This part of the form asks the surveyor to identify the general shape of classic shrubby hedgerows and shrubby hedgerows with trees (see 'Hedgerow types'). Lines of trees are not sub-divided into shapes. The shape of the hedgerow can give a good indication of how it has been managed over the last few years. The seven main hedgerow shapes illustrated on the form are:

- A. **Trimmed & dense:** Hedgerows that have obviously been trimmed in the fairly recent past (probably within the previous two to three years). If several months have passed since the last trimming, there may be some quite long shoots protruding from the hedgerow, but it will retain its basic shape. Hedgerows have a generally 'neat' appearance, with a rectangular, 'A' or 'topped-A' shape. This category also includes hedgerows that have most recently been trimmed only on one side, or on the top. Hedgerows are dense along most of their length, with branches and foliage in the lower parts of the hedgerow.
- B. **Intensively managed:** Hedgerows that have been closely and frequently flailed and/or browsed by high densities of livestock, especially sheep. These hedgerows are usually low and narrow, and characteristically lack branches and foliage in the lower parts of the hedgerow.
- C. **Untrimmed:** Hedgerows that have not been recently trimmed (probably not within the previous two to three years) and now have a very 'straggly' appearance, with numerous long and woody branches

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protruding from the main body of the hedgerow. They are usually still quite dense, with some foliage in the lower part of the hedgerow, although the increasing volume may be progressively shading out some of the lower branches. Essentially this is an unmanaged and slightly overgrown version of A. Such hedgerows may subsequently be trimmed (A) coppiced (F) or laid (G) but, if not, they will progressively take the shape of type D or E hedgerows.

- D. **Tall & leggy:** A hedgerow that has not been trimmed for many years (probably at least eight years). The hedgerow lacks any significant foliage in the lower parts. Neglected hawthorn hedgerows often take this form, forming lines of twisted and gnarled stems, beneath more dense canopies.
- E. **Untrimmed, with outgrowths:** Overgrown, usually very wide, hedgerows that no longer retain any clear evidence of their original shape. Hedgerows with a large proportion of blackthorn, or other readily suckering shrub species, may quickly develop into this type of hedgerow if left unmanaged.
- F. **Recently coppiced:** A hedgerow that has recently been coppiced, probably within the last five years, appears as woody trunks (or 'stools') cut down to be more or less level with the ground, and from which multiple, thin, woody stems are re-growing.
- G. **Recently laid:** A hedgerow that has obviously been recently laid, probably within the last 2-3 years (the illustration shows what this type would look like facing the hedgerow). It should still retain clear evidence of laying (e.g. stems cut at the base; horizontal and intertwined stems, supporting stakes in the hedgerow) and will not have attained the 'trimmed and dense' appearance of type A hedgerows.

The hedgerow should be placed in the most appropriate category (even if it does not quite resemble the hedgerow illustrated in section 12 of the Field Survey Form).

Key result for hedgerow management shape

Percentage of total number of hedgerows surveyed in each shape category.



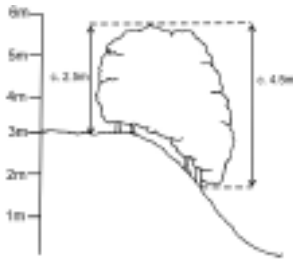
13 – Dimensions

The average height and width of the hedgerow need to be estimated and the cross-sectional area calculated. All measurements of height and width should be 'at the time of the survey' and take no account of any previous trimming heights or widths that might be evident. A 2m tall measure (clearly marked at 25cm intervals) allows precise height and width measurements to be made (see 'Equipment').

The conservation problems these dimension attributes illustrate are: too severe or frequent cutting; loss of shelter for fauna; and, in particular, unsuitable nesting habitat for most birds. With this in mind, the Steering Group for the UK BAP for Hedgerows has adopted a minimum cross-sectional area of 3m² as the threshold for hedgerows in 'favourable condition'. In addition to having a cross-sectional area of 3m², the hedgerow should be at least 1m high **and** at least 1.5m wide to be in favourable condition. When calculating the cross-sectional area it can be assumed that the hedgerow is rectangular (box-shaped) in profile.

13a Average hedgerow height: The average height of the woody growth should be estimated, excluding any bank beneath the hedgerow, gaps and any hedgerow trees (Figure 11a). Where a hedgerow is part way up a bank, the height is measured from the base of the main woody stems of the hedgerow plants on the bank (Figure 11b). Where the bank is asymmetric so that the height of the hedgerow is less on one side, the height is measured on the shorter side (see Figure 11c). If there is a clear shrub layer beneath a canopy of hedgerow trees (shrubby hedgerow with trees), the average height of this shrub layer should be recorded. The average height of a line of trees is recorded as the height of the top of the canopy. The higher a hedgerow is, the harder it is to make a precise measure of height. Surveyors should make their best estimate for high hedgerows; often this will in reality be to the nearest 1 or 2m. Standing a surveyor of known height up against the hedgerow (or alternatively using a 2m measure), and standing back to see them against the full height of the hedgerow can help in making these height estimates.

Figure 11 – Measuring the average height of the woody component.

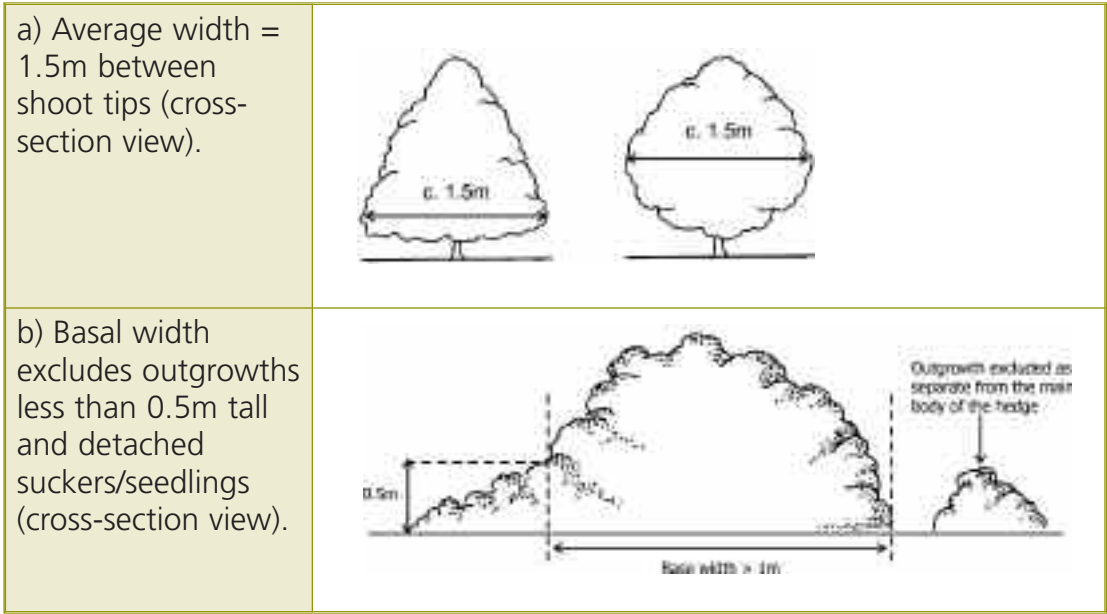
<p>a) Average height = 2m (view facing hedgerow).</p>	
<p>b) Average height on a hedgerow bank = 2m (cross-section view).</p>	
<p>c) Average height on a half bank = 2.5m (cross-section view).</p>	

13b Average hedgerow width: The average width of the woody growth should be estimated at the widest point of the hedgerow canopy (see Figure 12), again excluding gaps or isolated hedgerow trees. If the hedgerow width appears to be fairly uniform along its length, this can be done most easily at a gateway or gap. Alternatively (particularly for relatively thin hedgerows), the hedgerow could be measured by two surveyors on opposite sides pushing a measuring pole through the hedgerow (see 'Equipment'). Generally, banks should be excluded from width measurements. However, where there is a bank between woody vegetation, and it is hard to determine the width of woody growth in two sections either side of the bank, the width is measured at the widest point, including the internal bank. Some hedgerows have outgrowths at the base, perhaps of blackthorn suckers, which spread into the adjacent field

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margins. Outgrowths should only be counted as part of the hedgerow width when they are over 0.5m in height. It should be noted that the 'favourable condition' threshold for average width is at least 1.5m.

Figure 12 – Measuring the average width of the woody component



Key results for height and width

Percentage of hedgerows with:

- 1. Cross-sectional area at least 3m²
- 2. Height of at least 1m
- 3. Width of at least 1.5m.

14 – Integrity

This section relates to the structure and 'gappiness' of a hedgerow, both along the hedgerow and vertically (height of the canopy base). The conservation threats identified by these attributes include neglect through lack of cutting, laying and replanting, and intensive grazing. Over-intensive cutting management can also cause problems, reducing the life-span of woody species or their capacity to regenerate. Gaps at the base of the hedgerow mean that shelter for invertebrates, small mammals, amphibians and reptiles is lost, while gaps along the hedgerow reduce habitat continuity.

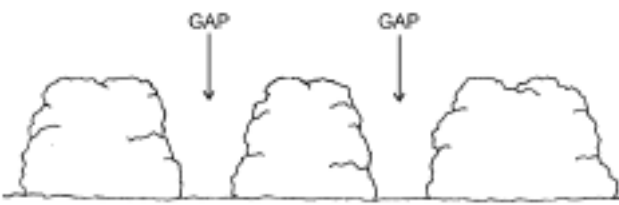
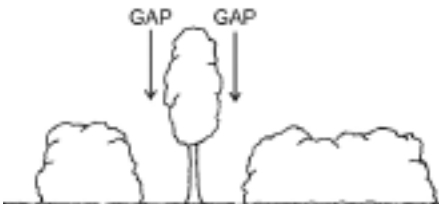

14a Continuity of canopy along hedgerow (% gaps): The total length of any gaps present as a percentage of the total hedgerow length, or 30m survey section (as appropriate) should be estimated. For example, suppose a 253m hedgerow has six gaps of widths, 2m, 4m, 7m, 1m, 1m and 3m, then the total length of gaps is 18m = 7%. The threshold for 'favourable condition' is less than 10% gaps, so this particular hedgerow would be in favourable condition. However, as there is one gap of greater than 5m it would fail on the next attribute, '14b Any gaps >5m wide'.

Even breaks in canopy of less than 1m are regarded as gaps and surveyors should try to estimate these breaks to the nearest 50cm. However, the gap has to be a complete break in the canopy; overlapping canopies are not considered as gaps (see Figure 13).

14b Any gaps >5m wide?: In the example above (14a), the hedgerow has one gap greater than 5m. The threshold for 'favourable condition' is achieved when no individual gap present is greater than 5m wide and so, in this example, the hedgerow is not in 'favourable condition' for this attribute. Access points are not included as gaps for the purposes of condition assessment for this attribute, because 5m is about the standard gate width in some areas and, thus, their inclusion would lead to automatic failure of some hedgerows that are otherwise in favourable condition. However, these gaps do contribute to the overall gappiness of a hedgerow and are included in the percentage total (see 14a).

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Figure 13 – Defining gaps in the hedgerow.

<p>a) Complete breaks in the shrub canopy are considered as gaps. This applies even if the gaps are <1m (view facing hedgerow).</p>	 A line drawing of three rounded shrubs of similar height and width, spaced apart. Two vertical arrows point downwards from the word 'GAP' to the spaces between the shrubs, indicating complete breaks in the canopy.
<p>b) These are considered to be gaps as there are complete breaks in the tree/shrub canopy and the hedgerow (even if the gaps are <1m (view facing hedgerow).</p>	 A line drawing of a central, taller, more upright tree flanked by two shorter, wider shrubs. Two vertical arrows point downwards from the word 'GAP' to the spaces between the central tree and the shrubs, indicating complete breaks in the canopy.
<p>c) There are no gaps as the tree canopy overlaps the hedgerow canopy (view facing hedgerow).</p>	 A line drawing of a central tree whose canopy is wider than the shrubs on either side, overlapping their canopies. The tree's base is also within the space between the shrubs, showing no gaps in the canopy.

14c ‘Average’ height of base of canopy: The ‘average’ height of the lowest leafy growth should be estimated to the nearest 25cm. This can be difficult as the height may vary considerably. One approach is to try to determine the ‘typical’ height along the length i.e. the mode (see Figure 14). If necessary, a measuring pole (see ‘Equipment’) can be used. Note that although this attribute can be recorded for lines of trees, it should not be used in the condition assessment of this hedgerow type, which by definition will have a canopy base that is 2m or more above the ground.

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Although the ‘favourable condition’ threshold height is 0.5m, it should be noted that some hedgerow types, like those dominated by hazel or where the hedgerow is affected by shading from other vegetation such as woodland, may naturally lack leafy growth around the base. For hedgerows where this is believed to be the primary, or only, reason for the average height of the base of the canopy being 0.5m or more, a note should be made on the form: such hedgerows are in ‘favourable condition’ for this attribute.

Figure 14 – Measuring base canopy of the woody component

‘Favourable condition’ as base of canopy <50cm from the ground (view facing hedgerow).



Key results for integrity

Percentage of hedgerows with:

1. Gaps less than 10% of the hedgerow length
2. No gap greater than 5m
3. Base of leafy growth less than 0.5m from the ground for a shrubby hedgerow

15 – Isolated hedgerow trees

Hedgerow trees can add greatly to the landscape and wildlife value of a hedgerow, and ancient, or veteran, trees are a specially valuable habitat. The long term future of the hedgerow tree population depends critically on replacement young trees being recruited into hedgerows. Part A of the survey form is used to record the species and trunk size diameter of isolated hedgerow trees (see definition of these in Appendix 1). Isolated hedgerow trees are those with canopies that do not touch those of other trees. They can be recognised by: having a clear stem; being twice the average height of the hedgerow; or being obvious as individuals that have clearly been favoured as single trees, even if young, by the management regime operating on the hedgerow (for

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example by being deliberately left unflailed when the rest of the hedgerow has been trimmed). These trees must be in the line of the hedgerow or the nearest point of the tree trunk must be less than 1m from the edge of the woody canopy of hedgerow, bearing in mind that a hedgerow can be up to 5m wide. Lines of trees are recognised as distinct from isolated hedgerow trees for survey purposes.

The numbers of trees in particular size classes can be used to broadly infer the age structure of the population. This information has to be carefully interpreted because different species of tree grow at different rates, have different life spans and attain different maximum Diameter at Breast Height (DBH). Therefore, recording the tree species as well as DBH is necessary. Trunk size can also be used to identify trees approaching, or achieving, likely veteran status. Again, species is important as veteran characteristics will appear in some species at much smaller trunk sizes compared to others. For example, plums of about 20cm DBH are old enough to have wood-decay habitat suitable for the endangered noble chafer beetle.

A 'rule of thumb' guide to detecting potential veteran trees based on their DBHs is given in Appendix 10. Most species of trees in the 'truly ancient' class using these rules have a DBH in excess of 1m, so this DBH is useful for classifying veteran trees for the purposes of the survey. However, further refinement is possible to ensure that smaller species, such as holly and rowan, are not ignored. The relevant species-specific size of 'truly ancient' trees can be used for such species. The characteristics of some species are not as yet known and so have not been included in Appendix 10. However, the results of future hedgerow surveys should contribute to the knowledge of the maximum DBHs that exist for these species and enable the list to be updated.

Limited resources may mean that not all isolated hedgerow trees in an area can be recorded. If so, then a way of identifying a sample of trees is needed. As a guide, a sample should include at

Figure 15 – Hedgerow trees must be less than 1m from the edge of the hedgerow (cross-section view).



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least 100 trees, so that there are likely to be more than a couple of representatives of young and veteran trees. A pilot survey will help to select an adequate sample size.

One way of selecting a sample is to use the selection points already used for identifying sample hedgerows and from a hedgerow to be sampled for other characteristics, select the nearest hedgerow tree to the selection point. There should then be no bias in these points in relation to factors such as distance along a hedgerow.

If the total number of isolated hedgerow trees in a survey area is to be estimated then, for at least some randomly chosen sample hedgerows, the number of trees in the hedgerow must be counted, even if the species and size information is not collected. The sample of trees will give the proportions of young and veteran trees even if an overall total number for the whole survey area is not available. However, it will not be possible to calculate how many young trees need to be recruited, for example by tree tagging to protect them from flailing.

Key results for isolated hedgerow trees

1. Percentage of young trees with a DBH of 1-5cm within the total number of trees in the sample.
2. Percentage of veteran trees with a DBH of 1m or more within total number of trees in the sample.
3. Average number of isolated hedgerow trees per 100m of hedgerow (extrapolate from 30m counts if necessary).
4. Total number of isolated hedgerow trees in the survey area.
5. Replacement rate per year = total number of trees over 5cm DBH divided by 100. It is assumed that a 100 year period is needed to replace the number of trees larger than 5cm ('older trees'). This is a generalisation but there is little information on specific mortality rates of trees over their potential life spans.

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16 – General notes on the whole hedgerow or 30m survey section

This section of the Field Survey Form has space for adding notes relating to special wildlife or nature conservation feature, such as evidence of fauna (16a) associated with the hedgerow, particularly that of a legally protected species. This might include, for example, hazel shells eaten by a dormouse, or a badger sett. Notes can be made of other features associated with the hedgerow such as a stile or a stone gate post.

A record should be made of other features (16b) such as hedgerows that have obviously been planted recently or where there are particular management issues, such as excessive cover of bramble, bracken or traveller's joy.

Photographs (16c) may be useful in the subsequent interpretation of features associated with the hedgerow or to provide a record of the condition of the hedgerow at the time of the survey.

A requirement to include photographic records should be agreed before the start of the field survey. Occasional photographs may be needed to illustrate a report or a presentation. Ground based photographs are also useful in relocating survey sections.



Photographs may assist in the subsequent interpretation of features, but must be cross-referenced to the hedgerow number and located on the map.

Digital cameras are becoming cheaper and have advantages in that the images can be stored electronically along with the rest of the data. Any photographic record of the hedgerow should have a unique reference number linked to the reference number of the hedgerow. In addition, the reference number, position and direction of the photograph should be shown on the field map. If feasible, the photograph itself should include some obvious reference point in the view so it will be possible to take a repeat photograph from a similar position at a future date. For repeat surveys, a note of the type of camera lens and the

Field Survey – what to record and why

distance of the photographer from the hedgerow are also useful. With a digital camera some information is normally recorded with the image (e.g. date and time, shutter speed, aperture and whether the shot used a wide angle or telephoto setting, etc).

Elements that should be recorded for the 30m survey section only (Section 17)

17 – Woody species per 30m

The final section of Part A of the Field Survey Form identifies the woody species within a 30m survey section. Woody species counts should only be performed on a 30m section or sections, even where the whole hedgerow is being recorded for other characteristics. This assessment can only be done on **30m sections** of **continuous** woody species cover. It cannot be done if the hedgerow is less than 30m long, nor can it be done if the 30m sample section contains any gaps, including gates. If the selected 30m survey section falls within a gappy part of hedgerow and can be moved to a part with continuous canopy, this should be done. This may not be possible on very gappy hedgerows. Note that this means the 30m section chosen for recording woody species may be different to that used for recording features in sections 7-16 of the Field Survey Form.

The average number of woody species per 30m length can assist in dating the hedgerow (in broad terms), as well as determining whether a hedgerow is defined as species-rich. Species that count towards species-richness are structural species, not climbers (other than roses) or bramble. They are also limited to woody species either native in the UK, or which are 'archaeophytes' (have been recorded as naturalised in the wild before 1500 AD). Sycamore (*Acer pseudoplatanus*) should also be included as its status as native/archaeophyte or recent introduction is unclear. The woody species that are classified as native or archaeophyte according to the *New Atlas of the British Flora* (Preston 2002) are listed in Appendix 8. However, all species in the woody canopy of the hedgerow should be recorded because it is necessary to know the cover of recently introduced species ('neophytes') for the relevant condition assessment attribute (see 'Recently introduced, non-native species'). Also, the percentage cover of climbers and bramble provides useful information, for example on the scale of problems such as the swamping of hedgerows by traveller's-joy (*Clematis vitalba*). In practice, it is easier to include them in the cover estimates rather than trying to exclude them.

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Where possible, identification should be made at a species level. A number of field guides are available to suit individual skill levels and preferences, but the recommended names of species should follow the '*New Flora of the British Isles*' (Stace 1997). If surveyors cannot be sure of the species, the genus (e.g. rose *Rosa* sp.) should be recorded instead. If there are clearly two or more different but unidentified species of the same genus, this should be made clear on the recording form (e.g. rose sp. 1 and rose sp. 2). This will ensure that the data recorded gives an accurate picture of species richness (number of woody species per 30m) for that hedgerow section.

The species list on the form is **not exclusive** and may need to be adapted to include other frequently occurring species in an area. The list should be reviewed at the time of the pilot survey and/or based on local knowledge. Space is provided on the form to add other, less frequently occurring, species.

A decision should be made whether each woody species in the survey section occurs in the shrub layer or as isolated hedgerow trees, or both. Sometimes this can be difficult to determine. Some tree species may have been managed by trimming them as an integral part of the hedgerow structure and should be recorded as shrubs. At the other extreme, shrub species might have developed into a tree form. As a useful guide, hedgerow trees have a clear trunk/stem (i.e. few or no woody outgrowths from the base or lower part of the stem) and/or are twice the average height of the hedgerow. In many cases, it will be evident that a section of hedgerow has been trimmed to favour the growth of a young tree.

Within the 30m length, once a clear separation between the shrub layer and trees has been established, all **shrub** layer species should be identified and the percentage cover of each estimated by visual assessment. Having identified each species present it is sometimes easier to then stand back from the hedgerow to assess their relative cover. This is where measuring poles marking out the survey section are useful as they provide clearly defined end-points for estimating the cover values.

Field Survey – what to record and why

Key results for woody species

1. Percentage of hedgerows that are species-rich
2. Average number of qualifying species per 30m section
3. Percentage of hedgerows with at least 80% cover of native woody species (including archaeophytes and sycamore) in the survey area
4. Percentage of hedgerows with at least 80% cover of native woody species (not include archaeophytes and sycamore) in the survey area.

Part B: Optional Assessments (Sections 18-21)

This part of the survey methodology is intended for selective use in local hedgerow surveys that require more than just the essential assessments described above. Where the objectives of a survey require more detail about associated features, hedgerow management, hedgerow trees or the ground flora, then surveyors should select the appropriate section from those shown below.

18 – Associated features

Data should be gathered on features typically associated with hedgerows that could influence their structure, species composition and management. The most common features are: banks; ditches/streams; verges/headlands; dry-stone walls; and fences. If other features are present, an additional space is available for recording these. In certain parts of the country it may be necessary to include additional categories to cover specific local features. This should be determined from the pilot survey together with local knowledge, but the additional features must be clearly defined.

A range of options is provided on the form for commonly occurring features:



An earth half-bank in Devon

Chapter 4

18a – Banks

Hedgerows may be assessed with either one-sided (half-bank) or two-sided banks. Hedgerows on top of two-sided banks are typical in the western counties, where they are called hedgebanks, and tend to be locally distinctive. Half-banks are more widely distributed, particularly along country lanes.

Information on whether the bank is earth or stone faced should also be recorded. Stone-faced banks are traditional in Cornwall and other western counties.

18b – Ditches

The width and type of any associated ditch should be recorded. Where an internal ditch is present, it is not always possible to measure accurately the width at the base because of access difficulties.

18c – Walls and fences

The presence of a dry-stone wall along all or part (more than 20%) of the hedgerow length, and its general condition should be recorded.

If a fence is present, the height and type should be recorded. Most agricultural fences will be approximately 1.2m high. 'Netting' includes all wire mesh and 'chicken wire' fences, with holes of varying sizes, such as those used for sheep or rabbit fencing. For the 'other fence' category the type of fence should be described.

The 'other feature' category includes features such as traditional farm gates with stone gateposts, or stiles within or alongside the hedgerow.

19 – Hedgerow/margin management

19a Hedgerow management

Any evidence of hedgerow management should be recorded here, and this should indicate whether this management was very recent (within the past two years), recent (2-10 years) or older (more than 10 years).

When recording whether or not management has been undertaken, some knowledge of hedgerow management techniques is necessary, and this should be covered in training sessions. Obvious signs of management may include more than one category stated in the Field Survey Form. For example, there may be signs of older hedgerow laying, with more recent evidence of trimming and gapping up (i.e. hedgerow planting to fill gaps). All categories that apply should be recorded.

Field Survey – what to record and why



Overgrown, leggy hedgerow, with evidence of previous laying



Recently coppiced hedgerow bank In North Wales



Clipped and dense hedgerow in Worcestershire

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Hedgerow that has previously been subjected to annual flailing and heavy grazing by sheep – but now showing early signs of recovery



Newly laid hedgerow. Similarly angled stems are clearly evident in all recently laid hedgerows

Identification of management activities undertaken in the more distant past will require a close look at the structure of the hedgerow. For example, multi-stemmed vertical growth suggests previous coppicing (Figure 16a), whilst horizontal/acute-angled stems or 'elbows' suggest previous laying (Figure 16b).

19b Hedge-bottom management

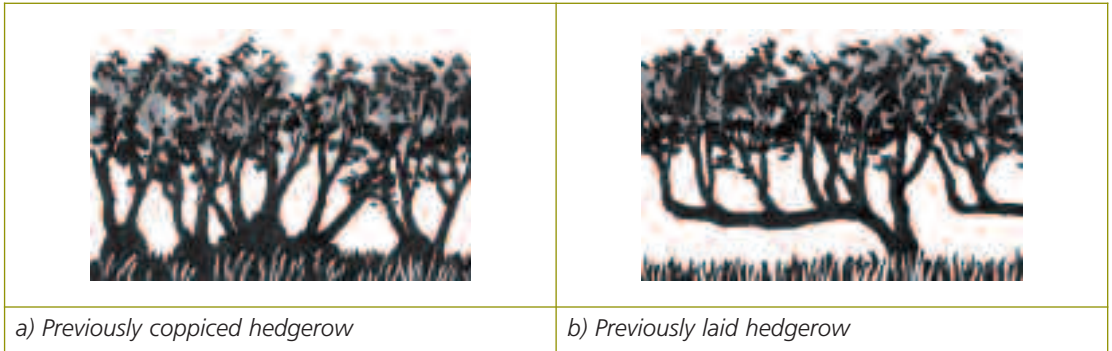
Evidence of recent hedge-bottom management should be recorded in this section. This includes details of any mowing, herbicide application and cultivation. Any lack of management should also be recorded.

19c Margin/headland management

The margin/headland is the area between the edge of the hedgerow and the land use recorded in Part A, for example cultivated land or a road. Margins are usually grass, and are either dense and tussocky or mown/cut. Margins within agri-environment schemes, like Environmental Stewardship, should also be recorded.

Field Survey – what to record and why

Figure 16 – Evidence of old former management.



20 – Ground flora species per 30m

The ground flora is an important component of hedgerows and can contribute significantly to species diversity. Recording species presence and cover is desirable but requires good identification skills. The ground flora can be recorded under lines of trees as well as for shrubby hedgerows.

The species are grouped according to type i.e. grasses, forbs and ferns. Any climbers/creepers present are associated with ground cover species rather than in the vertical component of the hedgerow. Species such as ivy may form components of both ground and shrub layers.

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All species present in the ground flora should be recorded. Plants shown in the photographs include bluebell, dog's mercury, cleavers, violet, hart's-tongue, ivy and bramble.

As with the woody component, the species list on the form is not exclusive. The list may need to be adapted to include frequently occurring species in the locality. Space has been left to record other species present (likely to be less frequently occurring species).

The ground flora should be sampled using two quadrats measuring 2m x 1m (with 2m axis running down the line of the hedgerow and the 1m axis extending out from the hedgerow bottom as shown at Figure 17).

The quadrats should be positioned at points 10m (Q1) and 20m (Q2) along the 30m hedgerow survey length (see Figure 17).

The plastic pipe work described under 'Equipment' provides an effective rigid quadrat.

Figure 17 – Standard field procedure for locating 30m ground flora survey quadrats.

Locating the ground flora quadrat positions within the 30m survey section



The survey should record the ground flora influenced by the hedgerow rather than by the adjoining land use. One quadrat (Q1) should be placed under the canopy and as close to the woody stems as possible (as shown in Figure 18). The second quadrat (Q2) can be used to record variation in the ground flora. This can be richer in species at the edge of the woody canopy or on the hedgerow bank if present. The position of each quadrat should be recorded as being under the canopy, on a bank, on an adjacent verge or on the field edge as appropriate.

A value for bare ground should also be recorded and this may be related to dense shading. Each species present should be assigned a percentage cover, estimated to the nearest 5% (or to nearest 1% if less than 5%). If using plastic piping, bands of tape or connector positions can be useful guides in assessing percentage cover for abundant species (e.g. nettles or cleavers) as each 50cm x 50cm is equivalent to 12.5% of the total area. For low frequency species a good guide is using a standard A4 clipboard. This is approximately 3% of the area of the 2m x 1m quadrat.

21 – Veteran tree features

A veteran tree is of value because of its age, size and condition. A tree may be considered a 'veteran' if it has any of the features listed under 'Condition' in Section 21 of the Field Survey Form. Fay's *'Evaluation of the specialist survey method for veteran tree recording'* (Fay 2003) defines veteran trees in more detail.

Figure 18 – Quadrat (2m x 1m) positioned in a hedge-bottom



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In addition to size (see Section 15), work on wood-decay invertebrates has shown that the numbers of species can be influenced by the relative abundance of veteran tree features among a tree population. The incidence of these features can be recorded on any tree of 100cm DBH and over, or on any of the smaller species of less than 100cm DBH that is in the truly ancient class for that species (see Appendix 10).

Other types of tree that may be encountered in hedgerows are ancient coppiced stools. These can have ground-level diameters greater than 1m. The current pole growth will probably appear young and vigorous and care should be taken not to overlook the old stool from which these poles emerge. Any old coppices should be recorded as veterans by measuring the stool base and making notes on the form. Often these coppice stools will be far from circular. If so, record the maximum diameter in any one direction.

Survey Summary Form

This form (see Appendix 7) summarises the key information that will be most useful for informing policy and the development of conservation action at both national and local levels.

It is very important to estimate the total length of hedgerows surveyed and the total length in the survey area. These results will enable future surveys to detect losses or gains and show how successful hedgerow conservation action has been since the first survey. The length of each different type of hedgerow is also helpful to know (see section 3 – Hedgerow type). The total length is easy to calculate where a census approach is used. However, if there are too many 1km squares in a survey area to map them all, lengths of hedgerows in particular sample areas should be mapped and the results extrapolated to the wider area. A sample of squares can be drawn at random from those 1km squares where individual hedgerows have been selected for survey. Then the extent of the hedgerows in each 1km square in the sample is mapped, if possible subdividing the mapped hedgerows into the hedgerow types (shrubby hedgerows, lines of trees, shrubby hedgerows with trees). The amount of mapping that can be done will be dependent upon resources; the more squares that can be mapped, the more confidence can be placed in the estimates for the whole area that are based on this mapped sample of squares. Print-offs of aerial photographs that show hedgerows clearly can be very useful in cutting down the amount of mapping required in the field, especially when these photographs are taken out into the field by the surveyors.

Field Survey – what to record and why

The relationship between the total length of hedgerows surveyed in detail to the estimate of the total length in the survey area will show how representative the results from the sample hedgerows are likely to be. In terms of precision in mapping, surveyors should aim to be precise about a mapped length of hedgerow to within 20m in each 1km square, while the length of individual hedgerows surveyed in detail should be estimated to within 5m.

Key results for hedgerow length in survey area

1. Number of hedgerows individually surveyed
2. Total length of surveyed hedgerow = sum of lengths of individual hedgerows surveyed
3. Total length of hedgerows in the survey area
4. Total length of different types of hedgerow

Summary guide to completion of the Field Survey Forms

Part A – Essential Assessments

Elements that should be recorded for the whole hedgerow (Sections 1-6)

Referencing the hedgerow

Once the hedgerow has been located and the survey section marked out, record:

- The title of the survey
- The date in DD/MM/YYYY format
- The grid reference of the mid-point of the whole hedgerow or survey section using either letter codes for the 100km square, i.e. SE, or the grid numbers⁹
- The hedgerow reference number and suffix if necessary
- The name of the surveyor(s)
- The side surveyed (N, E, W, S or both sides).

1 – Name of landowner/contact details

Enter the details for the owner/occupier who has given permission to survey the hedgerow.

2 – Survey times and weather/other conditions that may affect the survey

Enter the start (2a) and finish (2b) times for each survey.

Record the general weather conditions: fine, breezy, cool, etc. (2c).

Record any difficulties encountered in surveying the hedgerows (2d).

⁹ These are the small prefix numbers found in the corners of any paper OS map: 1:10,000, Explorer 1:25,000 or Landranger 1:50,000.

Summary guide to completion of the Field Survey Forms

3 – Hedgerow type

Definitions of the different types of hedgerows and hedgerow trees are described in Chapter 4. Record the appropriate category.

4 – Length

Measure and record the length to the nearest 5m.

5 – Connections

Record the total number of other hedgerows that have a direct connection to each end of the hedgerow being surveyed.

6 – Extent of survey

Record whether the whole hedgerow (6a) or a 30m section (6b) is being surveyed.

Elements that should be recorded for the whole hedgerow or on 30m survey section (Sections 7-16)

The remainder of Part A of the form can relate to either the whole hedgerow, or just to the 30m survey section, depending on the nature of the survey.

7 – Adjacent land use

Complete this section for both sides of the hedgerow, even if most assessments are done from one side. If the far side of the hedgerow cannot be visited and is not visible, record as 'not known'.

8 – Associated features

8a Bank: Estimate height on each side (A & B), if applicable, to the nearest 25cm.

8b Average herbaceous vegetation height: Estimate height of main mass of herbage to the nearest 5cm.

8c Fence: Record presence.

8d-g Ditch: Record whether internal or external, and whether wet or dry at the time of survey.

Chapter 5

9 – Undisturbed ground and perennial herbaceous vegetation cover

Note that for hedgerows within 2m of walls, buildings, tarmac roads or other existing 'built' features this attribute does not apply.

9a Average width of undisturbed ground: Estimate (to the nearest 50cm up to 2m wide then to nearest 1m) from the centre-line of the hedgerow to the edge of any ploughed or otherwise cultivated or disturbed land.

9b Average width of perennial herbaceous vegetation: Estimate the average width of the continuous perennial herbaceous vegetation (to the nearest 50cm up to 2m wide then to nearest 1m), between the centre-line of the hedgerow and adjacent areas of disturbed bare ground (ignore very small patches), or annual crops.

Hedgerows bordering grassland and woodland automatically qualify as being in 'favourable condition'.

10 – Nutrient enrichment ground flora indicator species

Estimate percentage cover of nettles (*Urtica* spp.), cleavers (*Galium aparine*) and docks (*Rumex* spp.) to the nearest 5%, in a 2m wide band, parallel with the centre-line of the hedgerow, on each side of the hedgerow.

11 – Recently introduced, non-native species

Estimate and record percentage cover of recently introduced species to the nearest 5%. If there is less than 5% cover just record the name(s).

Shrub layer: Estimate the cover of introduced woody species as a percentage of the total area of the vertical face of the hedgerow on the side being assessed.

Hedge-bottom: Estimate the percentage cover of introduced ground flora species within a 2m band parallel with the centre-line of the hedgerow.

12 – Hedgerow shape

Choose the shape illustrated on the recording form that most closely resembles the hedgerow being surveyed.

If the hedgerow clearly does not fit any of these categories, note and sketch the shape on the form. Disregard any associated features e.g. hedge-banks or ditches.

Summary guide to completion of the Field Survey Forms

13 – Dimensions

13a Average height: Estimate the average height of the woody growth to the nearest 25cm (unless measuring the heights of lines of trees which should be estimated to the nearest 1-2m).

13b Average width: The average width of the woody growth should be measured or estimated to the nearest 25cm.

14 – Integrity

14a Continuity of canopy along hedgerow (% gaps): Estimate the total length of any gaps (excluding gateways) as a percentage of the total length of the hedgerow.

14b Any gaps >5m wide? Simply record 'Y' or 'N'.

14c Average height of base of canopy: Estimate the average height of the lowest leafy growth to the nearest 25cm.

15 – Isolated hedgerow trees

Record the species and trunk size diameter of isolated hedgerow trees¹⁰. Diameters should be recorded to the nearest 5cm, or to the nearest 1cm if DBH is less than 5cm. If the tree forks below 1.3m, measure immediately below the fork. Also, if there are bulges, burrs or other irregular features, measure at the nearest point below these features where the trunk is more regular. Measure any coppices round the stool base and any pollards below the ring of pollarding.

16 – Notes

Record evidence of fauna (16a) or other features (including recent planting) (16b) in relation to the whole hedgerow or a 30m survey section. Record any photograph numbers of the hedgerow (which should be indicated on the field map).

¹⁰ Trunk size is measured by recording the diameter of the trunk at 1.3m from the ground (Diameter at Breast Height or DBH).

Chapter 5

Elements that should be recorded for the 30m survey section only (Section 17)

17 – Woody species per 30m

Record all woody species, and whether each occurs in the shrub layer or as isolated hedgerow trees, or both.

For all shrub layer species estimate the percentage cover by visual assessment ignoring any gaps.

If the species is present only as a hedgerow tree, put a tick in the 'Tree no.' column (species that would not occur as trees have a shaded box in this column). Do not attempt to estimate percentage cover for these species. Species which occur in both shrub and tree layers should be entered in both columns, but only the specimens in the shrub layer estimated for percentage cover. In general, record cover to the nearest 5%. However, for species with little cover, try to record a cover less than 5%.

Part B: Optional Assessments (Sections 18-21)

18 – Associated features

18a – Banks

Record whether any bank is one-sided (half-bank) or two-sided, and whether it is earth or stone faced.

Note if the bank is fenced, and whether there is evidence of grazing (by livestock) or mowing/cutting.

18b – Ditches/streams

Record the width of the base to the nearest 25cm. If there are access difficulties, note such problems on the form.

18c – Walls and fences

Record the presence of any dry-stone wall along all or part (more than 20%) of the hedgerow length and note its general condition.

If a fence is present, record the height and type. Most agricultural fences will be approximately 1.2m high. For the 'other fence' category describe the type.

Summary guide to completion of the Field Survey Forms

In the 'other' category, record features such as a traditional farm gates with stone gateposts, or stiles within or alongside the hedgerow.

19 – Hedgerow/margin management

Record any evidence of hedgerow management here, and state whether this management was very recent (within the past two years), recent (2-10 years) or older (more than 10 years). If there is evidence of more than one form of management, record all that apply.

For margin/headland management, record the width of the margin on each side of the hedge and whether it is grazed, cut or unmanaged.

20 – Ground flora species per 30m

Record the presence and percentage cover (to the nearest 5%) of all ground flora species sampled using two quadrats measuring 2m x 1m. Only record climbers/creepers which cover the ground.

Mosses and liverworts present should be grouped and recorded as bryophytes unless surveyors have specialist expertise.

A value for bare ground should also be recorded.

21 – Veteran tree features

Record presence/absence of the features listed below, and the percentage of the canopy which is alive to nearest 5%. Recording should be done from both sides of the tree if practicable. Include old coppiced tree stools, if present, and measure the basal diameter.

- Dead wood attached to the tree, any piece more than 1m long and 8cm in diameter
- Loose, split, missing and dead bark, any patches more than 30 x 30cm
- Bark sap runs
- Tears, splits, scars, lightning strikes >30cm length
- Hollow trunks or hollows in major limbs
- Major rot sites, any more than 15cm across

Data Management, Storage, Analysis, and Reporting

Data entry

It is strongly advised that all records and associated information are computerised. This will enable the data to be fully analysed and will facilitate distribution to other interested parties. A standard Microsoft Access database has been developed for this purpose. The database is available from the website (www.naturalengland.org.uk) along with details on how to enter data. GIS can be used to digitise the map-based information gathered in the field. The database can be linked to a GIS or used independently.

For repeat surveys a database on contact details of land managers should be established within the constraints of the Data Protection Act (see section 1a at Appendix 6).

Data storage

In addition to the data stored on the Microsoft Access database, other data might include mapped information and photographs. These may exist in a paper or electronic format and this will determine the type of data storage and management. Storing data in a variety of ways and locations is desirable. Clear reference to the author of all documents is essential. A description of the survey method must accompany the survey data so that any subsequent users will be able to interpret the results correctly. Data can be sent to Local Record Centres (LRCs); their contact details can be found on the National Federation of Biological Recording (NFBR) website (www.nfbr.org.uk). Completed Survey Summary Forms, and a report if it has been produced, can also be sent to Defra (contact details can be found in the acknowledgements section) on behalf of the Steering Group for the UK BAP for Hedgerows.

Data analysis, reporting and survey outcomes

Completion of the Survey Summary Form at Appendix 7 is necessary as a minimum level of analysis. This can then be used as the basis of a short report providing details of the survey method, including such aspects as the survey period, the sampling strategy, quality control, the main findings and any problems encountered. Consideration will need to be given to the audience and circulation of the report. If the survey received Defra funding there is a requirement to submit a final report and a completed Survey Summary Form.

Acknowledgements

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Acknowledgements

This document and the survey forms can be viewed and downloaded from:
<http://www.defra.gov.uk/farm/environment/landscape/hedgerows.htm>

Copies of this document are also available from the at the following address:

Natural England

Enquiries
Northminster
Peterborough, PE1 1UA
Tel: 0845 600 3078
Fax: 01733 455 103
Email: enquiries@naturalengland.org.uk

Reports and/or completed Survey Summary Forms should be sent to:

ELM Divisional Support Team

3rd Floor
Nobel House
17 Smith Square
London
SW1P 3JR
Email: farmland.conservation@defra.gsi.gov.uk

References and further reading

Background reading

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Campaign to Protect Rural England: www.cpre.org.uk

Centre for Ecology and Hydrology: www.ceh.ac.uk

Country Land and Business Association: www.cla.org.uk

Countryside Council for Wales: www.ccw.gov.uk

Countryside Survey: www.cs2000.org.uk

Department of Agriculture and Rural Development NI: www.dardni.gov.uk

Department for Environment, Food and Rural Affairs: www.defra.gov.uk

English Heritage: www.english-heritage.org.uk

Farmers' Union Wales: www.fuw.org.uk/

Historic Mapping: www.old-maps.co.uk

Legislation: www.legislation.hmso.gov.uk/acts

Local Live (aerial maps): <http://local.live.com/>

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MAGIC: www.magic.gov.uk

National Federation of Biological Recording: www.nfbr.org.uk

NFU: www.nfuonline.com/

NFU Scotland: www.nfus.org.uk/

Natural England: www.naturalengland.org.uk

Old Maps: <http://old-maps.co.uk>

Ordnance Survey: www.ordnancesurvey.co.uk

Promap: www.promap.co.uk/promap/index.jsp

Royal Society for the Protection of Birds (RSPB): www.rspb.org.uk

Scottish Natural Heritage: www.snh.gov.uk

The Stationery Office: www.tso.co.uk

Ulster Farmers' Union: www.ufuni.org/portal.aspx

Glossary of terms

Arable: Land cultivated for the production of crops including cereals (wheat, barley, oats, etc.), oilseed rape and root crops (turnips, sugar beet, potatoes, etc.).

Archaeophytes: Species recorded as naturalised in the wild before 1500 AD.

Bank – half: A hedgerow with a bank on one side only. Tends to be alongside a road or track, as a form of terrace or cut embankment.

Bank – stone-faced: Stone-faced banks are traditional in some parts of the country, such as Cornwall and other western counties, whereby an earth filled bank is faced with stone to support the woody component of the hedgerow. In Ireland and parts of Wales the bank may be referred to as a 'ditch'.

Bank – lynchett: A form of bank with a near vertical face on one side.

Cloddiau/clawdd: Welsh term for a stone-faced earth bank usually supporting a hedgerow, similar to a Devon bank.

Coppicing: The practice of periodically cutting down woody vegetation almost to the ground and allowing it to regenerate. It is recognised by multiple stems growing from the base of the hedgerow.

Ditch: Linear excavation for the purpose of drainage; It may be internal (through the middle) or external (alongside) to the hedgerow (Figure 7 and Figure 8).

End point, node: An end point is any point of connection between two hedges or other features (road, track, fence, ditch etc.) or the point at which a hedgerow stops and there is a gap of more than 20m to the next hedgerow (e.g. where the hedgerow ends in the middle of an agricultural field, or links to a woodland or another semi-natural habitat). For the purposes of the survey each section between two end points is considered as a separate hedgerow.

Fence – netting: A fence with vertical posts and some form of mesh or netting. Includes sheep fencing, rabbit fencing, chain link or chicken wire.

Fence – wire/wire strand: A fence with vertical posts and strand(s) of any type of wire running horizontally.

Fence – post and rail: A fence with vertical posts and horizontal railings, usually made of wood.

Flailed: Hedgerow cut/trimmed using a tractor-mounted flail. Branches in flailed hedges may be shattered or smashed at the ends.

Gap: Any section of a hedgerow that is not occupied by woody vegetation and is under 20m in length (a gap over 20m is not included as part of the hedgerow). Even breaks in canopy of less than 1m are regarded as gaps. Gaps also include spaces filled by walls, fences, brambles or other non-structural hedgerow species, including climbers (such as traveller's joy), and dead sections of hedgerows. Access points are not included as gaps for the purposes of condition assessment. A gateway or entrance should be identified separately.

Grassland – Improved: Bright green, lush sward dominated by grasses and with a low diversity of forbs, i.e. non-grasses (less than 5 species per 2 x 2m). (*Lolium perenne*, *Phleum pratense* and/or *Trifolium repens* and other agricultural grasses more than 50% cover).

Grassland – Semi-improved: Grasses abundant but forbs usually 10-30% cover (generally 5 to 10 forb species per 2 x 2m). *Lolium perenne* cover is generally less than 20-30%. *Lolium* may be replaced by other competitive grasses such as *Dactylis glomerata*, *Festuca rubra*, *Agrostis stolonifera*, *Holcus lanatus* and *Bromus hordeaceus*. (Note: Unimproved acid grassland can be anomalous. It typically has forb species such as *Potentilla erecta*, *Galium saxatile* and *Rumex acetosella* as well as abundant fine leaved grasses including *Festuca* spp and *Agrostis capillaries*). Forb cover may be less than 10% and the sward relatively species-poor, i.e. less than 5 forb species per 2 x 2m, but *Lolium* cover is generally less than 10%. Bryophyte and/or lichen cover can be high).

Grassland – Unimproved: Often species-rich (but see note above about acid grassland), with more than 10 forb species per 2 x 2m and forb cover usually greater than 20%. *Lolium perenne* generally less than 10% cover. Grassland types may be acidic, calcareous or neutral in character and include wet grassland, thus composition can vary widely. Note that ungrazed or lightly grazed grassland, including rush pastures, can have high grass or rush cover

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and low forb species numbers/cover but the grass or rush cover is made up of low nutrient species such as *Brachypodium pinnatum*, *Molinia caerulea* or jointed rushes such as *Juncus subnodulosus*.

Ground flora: Plants in the hedge-bottom that may also include some woody species.

Heathland: Vegetation dominated by ericaceous sub-shrubs (e.g. heather, bilberry, *Erica* species or dwarf gorse species).

Hedgerow: A hedgerow is defined as any boundary line of trees or shrubs over 20m long and less than 5m wide between major woody stems at the base, provided that at one time the trees or shrubs were more or less continuous. It includes an earth bank or wall only where such a feature occurs in association with a line of trees or shrubs. This definition includes 'classic' shrubby hedgerows, lines of trees, shrubby hedgerows with trees and the gappy 'remains' of hedgerows (where the shrubby component may be less than 20m long, but the gaps are less than 20m).

Hedgebank: An earth bank or mound relating to the hedgerow, distinct from the surrounding landform. Hedgerows on top of two-sided banks are typical in the western counties where they are called hedgebanks.

Hedgerow – established: Hedgerow over 5 years old, thereby distinguishing it from a 'new hedgerow'.

Hedgerow – laid (Cut and laid): A hedgerow that has had its stems partially cut through, near the base, and then bent and positioned to form a barrier. Also known as 'cut and pleach', 'steep and lay' or 'stop and lay'. Recognised by the horizontal or diagonal angle (elbows) of the larger stems in the hedgerow (see Figure 16).

Hedgerow – leggy: Hedgerow that is 'thin' at and near the base (lower than 0.5m), with few or no horizontal branches and leafy shoots.

Hedgerow – new: Hedgerow which is still establishing (may be indicated by the presence of plant shelters/guards for plant protection and immature plants) and likely to have been planted within the previous 5 years.

Hedgerow – shrubby: The ‘classic’ shrubby hedgerow is a line of woody hedgerow plants that have some or all of their leafy canopies less than 2m in height from the ground, so that the woody linear feature as a whole appears as a ‘shrubby’ hedgerow, even though some of the woody species in it are capable of growing into trees. The shrubby component must be less than 5m wide at the base. This hedgerow type may have hedgerow trees along its length, but their canopies will be more than 20m apart.

Hedgerow – species-rich: This is where the structural species making up the 30m section of hedgerow include at least five (or at least four in northern and eastern England, upland Wales and Scotland) woody species that are either native somewhere in the UK, or which are archaeophytes, that is, they have been recorded as naturalised in the wild before 1500 AD. Climbers (except roses) and bramble do not count towards the total. Hedgerows that contain fewer woody species but have a rich basal herbaceous flora may also be defined as species-rich, but at present the criteria to define this have to be set on a local basis as there is no national definition.

Hedgerow – shrubby with trees: A shrubby hedgerow of more than 20m of continuous vegetation, which also has a distinct line of trees extending above it, their canopies being closer than 20m, so that the woody linear feature as a whole appears as a ‘shrubby layer plus lollipops’ (see Figure 6).

Hedgerow – stock-proof: One through which livestock cannot easily pass so forming an effective barrier to movement without the need for a fence.

Isolated hedgerow tree: A tree, the canopy of which does not touch those of other trees. They can be recognised by having a clear stem or being twice the average height of the hedgerow. Alternatively they are obvious as individuals that have clearly been favoured as single trees, even if young, by the management regime operating on the hedgerow, for example by being deliberately left unflailed when the rest of the hedgerow has been trimmed. These trees must be in the line of the hedgerow or the nearest point of the tree trunk must be less than 1m from the edge of the woody canopy of hedgerow, bearing in mind that a hedgerow can be up to 5m wide at the base. Lines of trees are recognised as separate from isolated hedgerow trees for survey purposes.

Lake: Any inland water-body larger than 2ha (i.e. larger than a pond).

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Line of trees: This is a line of trees where the base of the canopy is greater than 2m from the ground and the gap between tree canopies is less than 20m, so that the woody linear feature as a whole appears as a 'line of lollipops' (see Figure 5). The width of the feature at the base of the tree trunks has to be less than 5m to qualify as a hedgerow for this Handbook method. There may be a distinct shrub layer beneath the line of trees but this shrub layer has less than 20m of continuous canopy cover (see Figure 5). See also 'Shrubby hedgerow with trees'.

Livestock: Cattle, sheep, goats, pigs, horses or other farmed mammals

Margin: The grassy verge or uncropped strip adjacent to a hedgerow. Around arable fields, the margin may extend 12m or more from the hedgerow. The margins of grassland fields are often undistinguishable from the main field but are sometimes managed differently, perhaps fenced off or tussocky because they are cut infrequently.

Mode: The mode is the 'most popular' measure among a set of measures, i.e. the one that occurs most often in the data set, rather than an arithmetic mean (sum of measures divided by the number of measures). The mode reflects the ecological character of a hedgerow better than an arithmetic mean.

Pollard: A tree where canopy branches have been cut back to the main stem, generally at a height of 2-3m, and new ones have been allowed to sprout.

Pond: A body of standing water, 25m² to 2ha in area, which usually holds water for at least 4 months of the year.

Recently introduced species or 'neophytes' are species that have been introduced to the UK after 1500AD.

River: Any natural watercourse (linear and flowing) with an average width greater than 2.5m.

Stream: Any natural watercourse (linear and flowing) with an average width of 2.5m or less.

Tree – ancient or veteran: Generally any tree with a diameter of more than 1m at breast height. Smaller species may, however, have smaller diameters

(see Appendix 10). Other trees may also be classified as ancient or veteran regardless of size through the possession of large coppice stools, dead wood, dead bark, sap runs, tears, splits, scars or lightning strikes, hollow trunks or limbs and major rot sites.

Tree – hedgerow: Generally any tree that stands within, or 1m or less from, a hedgerow (see also ‘isolated hedgerow tree’). It can either be a young tree (sapling) with a clear stem, which is obviously being allowed to grow clear of the hedgerow (e.g. by deliberately trimming the hedgerow to avoid the tree) or an older tree that is at least twice the average height of the hedgerow. (See also ‘Line of trees’).

Trimmed: Hedgerow cut, usually with a flail, to give a neat, cropped appearance.

Wall: A vertical structure to include dry stone, mortared or any other form of wall.

Weed control: Common signs of herbicide applications in hedge-bottoms are strips of dead or dying vegetation (usually yellowed or brown) alongside arable fields or patches of dead/dying nettles, docks or thistles on the margins of agricultural grassland. Weed control in new hedgerows may also include use of black polythene or mulches, or application of residual herbicides to maintain weed-free soil along the hedgerow.

Woodland – Broadleaved: An area of trees occupying more than 0.25ha with a canopy cover of more than 25% and less than 10% coniferous species in the canopy.

Woodland – Coniferous: An area of trees occupying more than 0.25ha with a canopy cover of more than 25% and less than 10% broadleaved species in the canopy.

Woodland – Mixed: An area of trees more than 0.25ha with a canopy cover of more than 25% and with at least 10% of both broadleaved and coniferous species in the canopy.

Guidance on health and safety

Potential hazards and procedures to consider when surveying hedgerows

A risk assessment should be undertaken before the field survey is commenced. The following are some of the aspects which should be considered.

General points

Appropriate clothing should be carried and worn when required.

Plenty of drinking water should be available to prevent dehydration, even on cooler, wet days.

Note any allergies or medical requirements that may be relevant, including hay fever.

An up-to-date tetanus vaccination is advised.

A first aid kit should always be available.

Working in pairs/lone working

It is advisable to work in pairs whilst surveying.

Location: Be conscious of the varied dangers associated with different natural habitats e.g. marsh, waterside.

Isolation: Be aware of the location of the nearest house/public telephone; carry a mobile phone and/or phone card.

Communication: Always advise someone of your exact site location and route, accompanied by expected return time. Telephone if you are going to be late, and have an agreed contingency plan if you should not return.

Roads and railways

For hedgerows alongside a public highway the following should be considered:

Fluorescent clothing should be worn for visibility.

Keep off open roads wherever possible, stay on verges.

Place warning signs 100m either side of a survey area where there is no verge. A 'look-out' may be required.

Surveys along railways require the consent of the track operator and their Health and Safety procedures will apply. Specialist safety training will probably be necessary in advance of any surveys on railways.

Fauna and flora

Most wildlife and livestock are not a threat to humans or will avoid humans, but the following should be considered:

Some frequently occurring hedgerow shrubs such as blackthorn have sharp thorns and protective gloves and a hat should be considered.

Bracken spores are carcinogenic. Where possible avoid dense stands and/or wear a mask.

Some plants (e.g. giant hogweed) release irritants and toxins. Some caterpillars have hairs which can cause intense irritation – beware of larval webs of the brown-tail moth.

Avoid startling animals and livestock as far as possible. Be particularly wary of bulls and bullocks, especially if you have a dog with you.

Ticks may transmit Lyme disease (attacks nervous systems with neural and psychiatric consequences). To reduce the potential of ticks attaching, cover bare skin. If a tick does attach, seek medical advice.

Fences and gates

Be aware of electric fencing – the land occupier should be able to let you know where it is located.

When climbing over gates that cannot be opened, it is good practice to go over the hinged end.

Appendix 2

Water bodies

Hedgerows can be associated with deep ditches and other water bodies.

Where water is present in some form, use common sense, such as avoiding steep banks, and do not enter unless you have tested the bottom and/or can see it. Also be aware of the potential to get trapped in muddy/silty conditions.

Leptospirosis (Weil's disease): In the UK this disease is most commonly associated with rats, through bacteria in their urine, which can survive up to 4 weeks in water. However, water voles, cows and other animals can also carry the bacteria. Therefore humans can become contaminated via infected urine, water or mud. The bacteria enter humans via cuts or through mucous membranes (e.g. eyes and inner nose). Simple precautions include: cleansing and covering cuts with waterproof plasters; avoid rubbing eyes, nose and mouth; wash hands thoroughly after the survey; and clean equipment and clothing after use. If the disease is contracted the symptoms are similar to flu and could be accompanied by jaundice and/or conjunctivitis. If these symptoms occur 3-19 days after the survey where possible transmission could have occurred, contact a doctor and ask for an ELISA blood test.

Insurance

Some land occupiers, particularly large firms, may insist that you have insurance or indemnification before you are allowed to carry out any field surveys on their land. Insurance should be the responsibility of the coordinator to organise.

Sources of possible funding for hedgerow surveys

There are a number of possible sources of funding for hedgerow surveys. Some of these possible sources are listed below:

Countryside Council for Wales

Plas Penrhos
Ffordd Penrhos
Bangor
Gwynedd
LL57 2LQ
www.ccw.gov.uk

Department for Environment,
Food and Rural Affairs

Nobel House
17 Smith Square
London
SW1P 3JR
www.defra.gov.uk

Environment and Heritage Service,
Northern Ireland

Commonwealth House
35 Castle Street
Belfast
BT1 1GU
www.doeni.gov.uk

Environment Wales

Enterprise House
127 Bute Street
Cardiff
CF10 5LE
www.environment-wales.org

Esmee Fairbairn Charitable Trust

7 Cowley Street
London
SW1P 3NB
www.esmeefairbairn.org.uk

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Heritage Lottery Fund	Head Office 7 Holbein Place London SW1W 8NR www.hlf.org.uk
National Museum and Gallery of Wales	Cardiff CF10 3NP www.museumwales.ac.uk
Natural England	1 East Parade Sheffield S1 2ET http://www.naturalengland.org.uk
Scottish Natural Heritage	12 Hope Terrace Edinburgh EH9 2AS www.snh.org.uk
Wales Council for Voluntary Action	Baltic House Mount Stuart Square Cardiff CF10 5FH www.wcva.org.uk

You should also contact your local county council, who may also be able to provide advice and/or funding.

Legal protection of hedgerows

By way of background and to assist in conducting hedgerow surveys, this section outlines the statutory framework governing the protection of hedgerows. Differences between England, Wales, Scotland and Northern Ireland should be noted.

The Environment Act 1995 provides the framework for the protection of 'important' hedgerows in England and Wales. These are defined in the Hedgerows Regulations 1997 and are outlined below, together with other instruments relevant to the protection of hedgerows.

Hedgerows Regulations 1997

The Hedgerows Regulations (made under Section 97 of the Environment Act 1995) were introduced in England and Wales in 1997 to protect this characteristic element of the countryside. The Regulations prohibit the removal of most countryside hedgerows without first submitting a hedgerow removal notice to the local planning authority. Local planning authorities are able to order the retention of 'important' hedgerows (but not others). The Regulations set out criteria to be used by the local planning authority in determining which hedgerows are important. The Government is currently reviewing the Regulations.

For more detailed information on the Regulations please see Defra's guidance 'The Hedgerows Regulations 1997: A Guide to the Law and Good Practice' which can be requested by emailing: farmland.conservation@defra.gsi.gov.uk.

Tree Preservation Orders

Trees within a hedgerow can be subject to a Tree Preservation Order (TPO) (Town and Country Planning Act 1990). Consent is required from the local planning authority before such protected trees are cut down, topped or lopped.

Other policy mechanisms

As a 'cross compliance' condition of payment of subsidy under the Single Payment Scheme, farmers must comply with the requirements of the Hedgerows Regulations and must not trim or cut their hedgerows between 1 March and 31 July.

Some hedgerows may also be protected because they are part of a legally designated (protected) site of nature conservation importance such as a Site of Special Scientific Interest (SSSI) (Wildlife and Countryside Act, 1981), or Special Area of Conservation (SAC) (Habitats Directive, 1992). Hedgerows may also be protected as part of a Scheduled Ancient Monument (Ancient Monuments and Archaeological Areas Act, 1979).

In addition, a hedgerow may be indirectly protected where it forms a habitat for a legally protected species under the Wildlife and Countryside Act 1981, or the Conservation (Natural Habitats etc.) Regulations 1994. Where hedgerow surveys are being undertaken it is very important not to disturb such species.

The value of hedgerows is also recognised in Government guidance including: in England, Planning Policy Statement 7; in Wales, Technical Advice Note (Wales) 5; in Scotland, National planning policy guidelines 14: Natural heritage, and; in Northern Ireland, Policy and planning statement 2: Nature conservation.

Appendix 5

UK Biodiversity Action Plan priority species associated with hedgerows

Common name	Scientific name
Mammals	
Barbastelle bat	<i>Barbastella barbastella</i>
Bechstein's bat	<i>Myotis bechsteinii</i>
Greater mouse-eared bat	<i>Myotis myotis</i>
Greater horseshoe bat	<i>Rhinolophus ferrum-equinum</i>
Lesser horseshoe bat	<i>Rhinolophus hipposideros</i>
Pipistrelle bat	<i>Pipistrellus pipistrellus</i>
Brown hare	<i>Lepus europaeus</i>
Dormouse	<i>Muscardinus avellanarius</i>
Red squirrel	<i>Sciurus vulgaris</i>
Reptiles and amphibians	
Great crested newt	<i>Triturus cristatus</i>
Sand lizard	<i>Lacerta agilis</i>
Birds	
Bullfinch	<i>Pyrrhula pyrrhula</i>
Cirl bunting	<i>Emberiza cirlus</i>
Grey partridge	<i>Perdix perdix</i>
Linnet	<i>Carduelis cannabina</i>
Reed bunting	<i>Emberiza schoeniclus</i>
Red-backed shrike	<i>Lanius collurio</i>
Song thrush	<i>Turdus philomelos</i>
Spotted flycatcher	<i>Muscicapa striata</i>
Tree sparrow	<i>Passer montanus</i>
Turtle dove	<i>Streptopelia turtur</i>
Insects	
Maple wood-boring beetle	<i>Gastrallus immarginatus</i>
Noble chafer beetle	<i>Gnorimus nobilis</i>
Stag beetle	<i>Lucanus cervus</i>
Dotted bee-fly	<i>Bombylius discolor</i> (adults)
Pearl-bordered fritillary butterfly	<i>Boloria euphrosyne</i>
Barberry carpet moth	<i>Pareulype berberata</i>
Buttoned snout moth	<i>Hypena rostralis</i>
Heart moth	<i>Dicycla</i> sp.
Square-spotted clay moth	<i>Xestia rhomboidea</i>
White-spotted pinion moth	<i>Cosmia diffinis</i>

Appendix 5

Common name	Scientific name
Fungi	
Sandy stilt puffball	<i>Battarraea phalloides</i>
Plants and lichens	
Purple ramping fumitory	<i>Fumaria purpurea</i>
Western ramping fumitory	<i>Fumaria occidentalis</i>
Lichen	<i>Bacidia incompta</i>
Lichen	<i>Teloschistes chrysophthalmus</i>
Orange-fruited elm-lichen	<i>Caloplaca luteoalba</i>
Round-leaved feather-moss	<i>Rhynchostegium rotundifolium</i>

Source: Simonson, W. and Thomas, R. (1999). Biodiversity: making the links. English Nature, Peterborough.

N.B. The list of UK BAP priority species is currently (2006) under review.

Appendix 6

Field Survey Form

Local Hedgerow Field Survey Form													
PART A – ESSENTIAL ASSESSMENTS (To be completed for all local hedgerow surveys)													
TITLE OF SURVEY:													
Grid Ref	100km	Easting					Northing						
	Letters or numbers	10km	1km	100m	10m	1m	10km	1km	100m	10m	1m		
Date								Hedgerow No					
Surveyor(s):									Side Surveyed – Both Y/N				
									Side A	N	E	S	W
									Side B	N	E	S	W
WHOLE HEDGEROW													
1 – NAME OF LANDOWNER/CONTACT DETAILS													
Name:				Address:				Tel:					
1a – Permission granted to enter details onto database YES/NO													
1b – Permission granted to publish ownership information (if relevant) YES/NO													
2 – SURVEY TIMES AND WEATHER/OTHER CONDITIONS THAT MAY AFFECT THE SURVEY													
2a – Start time:			2b – Finish time:			2c – Weather:							
2d – Were there any difficulties in surveying the hedgerows? If so describe											YES	NO	
Difficulty(ies):													

Appendix 6

3 – HEDGEROW TYPE							
3a – Shrubby hedgerow		3b – Line of trees		3c – Shrubby with line of trees			
4 – LENGTH (m) – between nodes or intersections with other hedgerows, to nearest 5m							
5 – CONNECTIONS – total number of other hedgerows connected to each end of the hedgerow				End 1	End 2	Total	
6 – EXTENT OF SURVEY	6a – Whole hedgerow		6b – 30m Section(s)				
WHOLE HEDGEROW OR 30m SURVEY SECTION (Section 7-16)							
7 – ADJACENT LAND USE							
		Side A	Side B			Side A	Side B
7a – Arable	Arable crop			7e – Road/Route	Major Road		
	Uncropped margin				Minor Road		
7b – Grass	Improved				Track (unsurfaced)		
	Semi-improved				Footpath		
	Unimproved				Rail		
7c – Woodland	Young				Canal		
	Semi-mature			7f – Water	River		
	Mature				Stream		
7d – Other					Lake/pond		

Field Survey Form

8 – ASSOCIATED FEATURES – See also Part B section 18

	Side A	Side B		
8a – Bank – Height (in metres) to nearest 25cm			8f – Ditch – internal – Dry (tick)	
8b – Average herb vegetation height (cm) to nearest 5cm			8g – Ditch – internal – Wet (tick)	
8c – Fence (tick)				
8d – Ditch – external – Dry (tick)				
8e – Ditch – external – Wet (tick)				

9 – UNDISTURBED GROUND (measured from the centreline of the hedgerow)

	Side A	Side B
9a – Average width of undisturbed ground (m) to nearest 50cm*		
9b – Average width of perennial herbaceous vegetation (m) to nearest 50cm*		

NB * mark N/A or road etc if a road or built feature or hedge is adjacent to grassland or woodland

10 – NUTRIENT ENRICHMENT GROUND FLORA INDICATOR SPECIES

Estimate % cover of each species within a 2m wide band alongside the hedgerow (to nearest 5%)








10a – Nettles	Side A	Side B	10b – Cleavers	Side A	Side B	10c – Docks	Side A	Side B

11 – RECENTLY INTRODUCED, NON-NATIVE SPECIES

11a – RECENTLY INTRODUCED, NON-NATIVE GROUND FLORA SPECIES

	Species	Side A	Side B
% cover of introduced species in the hedge-bottom (to nearest 5% or enter just the name if <5%)			

Appendix 6

11b – RECENTLY INTRODUCED, NON-NATIVE WOODY SPECIES			
	Species	Side A	Side B
% cover of introduced species in the shrub layer (to nearest 5% or enter just the name if <5%)			
12 - HEDGEROW SHAPE – See also Part B section 19a			
What shape is the hedgerow? – Circle diagram of cross-section that most closely resembles hedgerow.			
			
a) Trimmed & dense	b) Intensively managed	c) Untrimmed	d) Tall & leggy
			
e) Untrimmed, with outgrowth	f) Recently coppiced (facing view)	g) Recently laid (facing view)	h) Other – Sketch
13 – DIMENSIONS			
13a – Average Height (m) Excluding bank, to nearest 25cm		13b – Average Width (m) At the widest point of canopy; excluding bank, to nearest 25cm	
14 – INTEGRITY – Continuity and height of canopy along hedgerow			
14a – % GAPS – percentage gaps, to nearest 5%			
14b – Any gaps >5m? (Y/N)		14c – Average height of base of canopy (m) to nearest 25cm	

Field Survey Form

15 – ISOLATED HEDGEROW TREES – See also Part B section 21

Use one row per specimen or one row and a number if there are many individuals of the same species in the same size class. Estimate DBH to nearest 5cm or nearest 1cm if DBH less than 5cm.

[illegible]

Appendix 6

16 – NOTES – Whole hedgerow or 30m survey section
16A – Fauna (evidence of)
16b – Features (including evidence of recent planting)
16c – Photograph numbers (and locate on map)

30m SURVEY SECTION ONLY



17 – WOODY SPECIES IN 30m SURVEY SECTION ONLY – Add any others, including non-natives					
Species	Shrubs % cover	Trees No.	Species	Shrubs % cover	Trees No.
Alder, common (<i>Alnus glutinosa</i>)			Plum, wild (<i>Prunus domestica</i>)		
Apple, crab (<i>Malus sylvestris</i>)			Poplar, black (<i>Populus nigra betulifolia</i>)		
Ash (<i>Fraxinus excelsior</i>)			Privet, wild (<i>Ligustrum vulgare</i>)		
Aspen (<i>Populus tremula</i>)			Rose, dog- (<i>Rosa canina</i>)		
Beech (<i>Fagus sylvatica</i>)			Rose, field- (<i>Rosa arvensis</i>)		
Birch, downy (<i>Betula pubescens</i>)			Rose (<i>Rosa</i> sp.)		
Birch, silver (<i>Betula pendula</i>)			Rowan (<i>Sorbus aucuparia</i>)		
Blackthorn (<i>Prunus spinosa</i>)			Spindle (<i>Wuonymus europaeus</i>)		
Broom (<i>Cytisus scoparius</i>)			Sycamore (<i>Acer pseudoplatanus</i>)		
Buckthorn (<i>Rhamnus cathartica</i>)			Wayfaring-tree (<i>Viburnum lantana</i>)		
Cherry, wild (<i>Prunus avium</i>)			Willow, grey (<i>Salix cinerea</i>)		
Dogwood (<i>Cornus sanguinea</i>)			Willow, goat (<i>Salix caprea</i>)		
Elder (<i>Sambucus nigra</i>)					
Elm, English (<i>Ulmus procera</i>)					
Elm, wych (<i>Ulmus glabra</i>)					

Field Survey Form

17 – WOODY SPECIES IN 30m SURVEY SECTION ONLY – Add any others, including non-natives (continued)

Species	Shrubs % cover	Trees No.	Species	Shrubs % cover	Trees No.
Elm, (<i>Ulmus</i> sp.)					
Gorse (<i>Ulex europaeus</i>)					
Gorse, western (<i>Ulex gallii</i>)					
Guelder rose (<i>Viburnum opulus</i>)					
Hawthorn (<i>Crataegus</i> sp.)					
Hazel (<i>Corylus avellana</i>)					
Holly (<i>Ilex aquifolium</i>)					
Hornbeam (<i>Carpinus betulus</i>)					
Lime, large-leaved (<i>Tilia platyphyllos</i>)					
Lime, small-leaved (<i>Tilia cordata</i>)					
Maple, field (<i>Acer campestre</i>)			Bramble (<i>Rubus fruticosus</i> agg.)		
Oak, pedunculate (<i>Quercus robur</i>)			Honeysuckle (<i>Lonicera periclymenum</i>)		
Oak, sessile (<i>Quercus petraea</i>)			Ivy (<i>Hedera helix</i>)		
Pear, (<i>Pyrus communis</i> sensu lato)			Traveller's-joy (<i>Clematis vitalba</i>)		
Pine, Scots (<i>Pinus sylvestris</i>)			% Gaps/access openings		

Appendix 6

PART B – OPTIONAL ASSESSMENTS						
18 – ASSOCIATED FEATURES						
18a – Banks						
Typical cross section of hedgerow-banks where present (please circle one)						
						
a) Half-bank	b) Full hedge-bank		c) Other (sketch)			
Bank type and management						
	Bank type		Bank Management			
	Stone	Earth	None	Fenced off	Grazed	Mown/cut
Side A						
Side B*						
18b – Ditches/Streams						
					Side A	Side B*
Ditch/stream – Width at base (m) to the nearest 25cm						

Field Survey Form

18c – Walls and Fences					
Fence	Side A	Side B*	Dry-stone Wall – Condition	Side A	Side B*
Height (m), to nearest 25cm			Good		
Type	Side A	Side B*	Poor		
Post & rail			Remnant		
Post & netting			Other feature – State	Side A	Side B*
Post & wire					
Other fence – state	Side A	Side B*			
* Where visible					

19 – HEDGEROW/MARGIN MANAGEMENT						
19a – Hedgerow Management	Flailed/ trimmed	Coppiced	Laid	Planting/ Gapping	Pollarding trees	None
Signs of Recent Management <2 years						
Signs of Management 2-10 years						
Signs of older Management >10 years						

19b – Hedge-bottom Management	Mowing/ cutting	Herbicides	Cultivation	Grazing	None
Signs of Recent Management <2 years					
Signs of Management 2-10 years					

Appendix 6

19c – Margin/Headland Management								
Average width (m)	Side A			Side B*				
Margin Management								
Grazed	Side A	Side B*	Cut	Side A	Side B*	Unmanaged	Side A	Side B*
* Where visible								

20 – GROUND FLORA SPECIES PER 30M					
Species		% cover		Species	
		Q1	Q2		
<i>Agrostis</i> sp. Bent				<i>Plantago lanceolata</i> – Ribwort plantain	
<i>Alopecurus pratensis</i> – Meadow foxtail				<i>Plantago major</i> – Greater plantain	
<i>Anthoxanthum odoratum</i> – Sweet vernal-grass				<i>Potentilla reptans</i> – Creeping cinquefoil	
<i>Arrhenatherum elatius</i> – False oat-grass				<i>Primula vulgaris</i> – Primrose	
<i>Cynosurus cristatus</i> – Crested dog's-tail				<i>Pteridium aquilinum</i> – Bracken	
<i>Dactylis glomerata</i> – Cocksfoot				<i>Ranunculus repens</i> – Creeping buttercup	
<i>Elytrigia repens</i> – Couch				<i>Rubus fruticosus</i> – Bramble	
<i>Festuca rubra</i> – Red fescue				<i>Rumex</i> sp. – Docks	
<i>Holcus lanatus</i> – Yorkshire fog				<i>Senecio jacobaea</i> – Ragwort	
<i>Holcus mollis</i> – Creeping soft-grass				<i>Silene dioica</i> – Red Campion	
<i>Lolium perenne</i> – Perennial rye-grass				<i>Stellaria holostea</i> – Greater stitchwort	
<i>Phleum pratense</i> – Timothy				<i>Trifolium pratense</i> – Red clover	
<i>Poa annua</i> – Annual meadow-grass				<i>Trifolium repens</i> – White clover	
<i>Poa trivialis</i> – Rough meadow-grass				<i>Urtica dioica</i> – Common nettle	
				<i>Veronica chamaedrys</i> – Ivy-leaved speedwell	
				<i>Viola</i> sp. – Violet	

Field Survey Form

20 – GROUND FLORA SPECIES PER 30M (continued)					
Species	% cover		Species	% cover	
	Q1	Q2		Q1	Q2
<i>Achillea millefolium</i> – Yarrow					
<i>Alliaria petiolata</i> – Garlic mustard					
<i>Anemone nemorosa</i> – Wood anemone					
<i>Anthriscus sylvestris</i> – Cow parsley					
<i>Arum maculatum</i> – Lords-and-ladies					
<i>Centaurea nigra</i> – Common knapweed					
<i>Cirsium arvense</i> – Creeping thistle					
<i>Cirsium vulgare</i> – Spear thistle					
<i>Galium aparine</i> – Cleavers					
<i>Galium mollugo</i> – Hedge bedstraw					
<i>Geranium dissectum</i> – Cut-leaved cranesbill					
<i>Geranium molle</i> – Dove's-Foot cranesbill			<i>Bryophytes</i> – mosses & liverworts		
<i>Geranium robertianum</i> – Herb-Robert			Bare ground		
<i>Glechoma hederacea</i> – Ground ivy			Location of quadrats		
<i>Hedera helix</i> – Ivy			Under canopy		
<i>Heracleum sphondylium</i> – Hogweed			Bank		
<i>Hyacinthoides non-scripta</i> – Bluebell			Verge		
<i>Mercurialis perennis</i> – Dog's mercury			Field edge		
Record all ground flora species within each of the two 2 x 1m quadrats and estimate percentage cover to the nearest 5%.					

Appendix 6

21 – VETERAN TREE FEATURES												
To be recorded on any tree of 1 metre DBH and over, or any tree smaller if in the truly ancient class for that species.												
Species									Hedgerow reference			
Surveyor									Date			
Grid Ref	100km	Easting					Northing					
	Letters or numbers	10km	1km	100m	10m	1m	10km	1km	100m	10m	1m	
Diameter at Breast Height (1.3m) in metres (To nearest 5cm).							m					
Form		Maiden		Pollard		Coppice		Other:				
Condition												
Percentage of live canopy (To nearest 5%)											%	
											Tick	
Dead wood attached to the tree, any piece more than 1m long and 8cm in diameter												
Loose, split, missing and dead bark, any piece more than 30cm x 30cm												
Bark sap runs												
Tears, splits, scars, lightning strikes more than 30cm long												
Hollow trunks or hollow major limbs												
Major rot sites, any more than 15cm across												

Field Survey Form

Notes – e.g. photograph numbers, threats, landscape/social importance, bracket fungi, mosses, lichens, nest holes etc.

Survey Summary Form

Steering Group for the UK Biodiversity Action Plan for Hedgerows

1. Survey title

2. Year(s) of survey

3. Surveyed area

(Place)

ha

4. Report reference(s)

5. Lead body

Contact name

Telephone number *(including national dialling code)*

Email

Address

Postcode

6. Key partners

7. Survey cost *(only include actual expenditure)*

Total

£

Defra grant

£

Survey Summary Form

8. Overview of objectives and results (100 words max)

9. Survey method

Hedgerow Survey Handbook 2nd Edition (without modification) ☐

Other (specify) ☐

10. Survey type

Full census ☐ Random sample ☐

Non-random Sample ☐

11. Survey level (Refers to different parts of the Field Survey Form – tick all which have been used)

Core Assessments (Part A) ☐ Associated features/Hedgerows/Margin management (Part B) ☐

Ground flora (Part B) ☐ Veteran tree features (Part B) ☐

12. Hedgerow length & Numbers

	Length (km)	Number
Total of surveyed Hedgerows		
Total in survey area (if different)		

Appendix 7

13. Main hedgerow types (give rough proportions for each type)

Hawthorn dominated	<input type="text"/> %	Mixed species	<input type="text"/> %	Ancient Pre 1845	<input type="text"/> %
Recent Post 1845	<input type="text"/> %	Hedgebanks	<input type="text"/> %	*Managed	<input type="text"/> %
Unmanaged	<input type="text"/> %	Lines of trees	<input type="text"/> %		

**Managed hedges are those which have been trimmed, cut, laid, coppiced or planted in the last 10 years*

14. Main land use of surveyed area:

Grassland	<input type="text"/>	Arable	<input type="text"/>
Other (specify)	<input type="text"/>		
<input type="text"/>			

15. Proportion of species-rich Hedgerows

(% of hedgerows with 5 or more native woody spp/30m or 4 more in N&E England or Scotland) %

16. a. Proportion of Hedgerows made up of >80% native woody species (include archaeophytes and sycamore)

 %

16. b. Proportion of Hedgerows made up of >80% native woody species (not including archaeophytes and sycamore)

 %

17. Isolated hedgerow trees % in size classes (cm DBH)

(only include large species, e.g. oak, ash, beech and sycamore)

<5cm	<input type="text"/> %	5-20	<input type="text"/> %	20-60	<input type="text"/> %
60-100	<input type="text"/> %	>100cm	<input type="text"/> %		

18. Total number of isolated hedgerow trees in survey area

19. Data storage

Standard Microsoft Access Database	<input type="text"/>	GIS	<input type="text"/>
Other (specify)	<input type="text"/>		
<input type="text"/>			

Survey Summary Form

20. Data held by:

Local Records Centre/
Biological Records Centre ☐

Biodiversity Action
Reporting System ☐

Other (please *specify*) . . .

21. Volunteers

Number of individuals

Number of volunteer days

22. Changes noted from previous surveys

(e.g. *extent, condition, woody species diversity, new planting, management, connections*) (optional)

Signature

Date

Name in BLOCK LETTERS

Contact telephone number

List of recently introduced species

a) WOODY SPECIES	
Broom, Montpellier	<i>Genista monspessulana</i>
Butterfly-bush	<i>Buddleja</i> spp.
Cherry laurel	<i>Prunus laurocerasus</i>
Cornelian cherry	<i>Cornus mas</i>
Dogwood, red-osier	<i>Cornus sericea</i>
Dogwood, white	<i>Cornus alba</i>
Fuchsia	<i>Fuchsia magellanica</i>
Gorse, Spanish	<i>Genista hispanica</i>
Norway maple	<i>Acer platanoides</i>
Oak, evergreen (holm)	<i>Quercus ilex</i>
Privet, garden	<i>Ligustrum ovalifolium</i>
Rhododendron	<i>Rhododendron ponticum</i>
Rose, Japanese	<i>Rosa rugosa</i>
Shallon	<i>Gaultheria shallon</i>
Snowberry	<i>Symphoricarpos albus</i>
Stag's-horn sumach	<i>Rhus typhina</i>
Tamarisk	<i>Tamarix gallica</i>

List of recently introduced species

b) CONIFERS (Pinopsida)	
Cedars	<i>Cedrus</i> spp.
Cypresses	<i>Chamaecyparis</i> spp.
Douglas fir	<i>Pseudotsuga menziesii</i>
Firs	<i>Abies</i> spp.
Hemlock-spruces	<i>Tsuga</i> spp.
Larches	<i>Larix</i> spp.
Lawson's cypress	<i>Chamaecyparis lawsoniana</i>
Leyland cypress	<i>x Cuprocyparis leylandii</i>
Pines*	<i>Pinus</i> spp. *
Spruces	<i>Picea</i> spp
Western red cedar	<i>Thuja plicata</i>

* Except Scot's pine (*Pinus sylvestris*) in Northern Scotland

NOTES

This list is not exclusive – there will be other recently introduced species that occur in hedgerows.

The following species should not be considered as 'recent introductions' for the purposes of this survey: sycamore (*Acer pseudoplatanus*), horse chestnut (*Aesculus hippocastanum*), sweet chestnut (*Castanea sativa*) and wild plum (*Prunus domestica*, including the plum sub-species bullace/damson, *P. domestica* ssp. *insititia*).

c) GROUND FLORA (climbers)	
Ground-elder	<i>Aegopodium podagraria</i>
Hogweed, giant	<i>Heracleum mantegazzianum</i>
Indian balsam	<i>Impatiens glandulifera</i>
Knotweed, giant	<i>Fallopia sachalinensis</i>
Knotweed, hybrid	<i>Fallopia x bohemica</i>
Knotweed, Japanese	<i>Fallopia japonica</i>
Montbretias	<i>Crocsmia</i> spp
Russian vine	<i>Fallopia baldschuanica</i>
Winter heliotrope	<i>Petasites fragrans</i>

Hedgerow BAP Targets and 'Favourable Condition' Attributes

The UK Biodiversity Action Plan (BAP) for hedgerows incorporates a number of targets shown in the table below.

Target Number	Description
T1	Maintain the net extent of hedgerows across the UK.
T2	Maintain the overall number of individual, isolated hedgerow trees (estimated by CS 2000 to be 1.8 million in Great Britain in 1998) and the net number of isolated veteran trees (to be estimated for the first time by CS 2007).
T3	Ensure that between 2005 and 2010 hedgerows remain, on average, at least as rich in native woody species.
T4	Achieve 'favourable condition' of 243,000 km (35%) of hedgerows by 2010 and 348,000 km (50%) by 2015. (Target does not include Northern Ireland.)
T5	Reverse the unfavourable condition of over-managed hedgerows across the UK by reducing the proportion of land managers who trim most of their hedges annually to 60% by 2010 (applicable to England only).
T6	Halt further decline in the condition of herbaceous hedgerow flora in Great Britain by 2010 (and improve their condition by 2015). (Target does not include Northern Ireland.)
T7	Improve the condition of the hedgerow tree population by increasing numbers of young trees (1-4 years) in Great Britain to 40,000 by 2010 and 80,000 by 2015. (Target does not include Northern Ireland.)
T8	Achieve a net increase in the length of hedgerows of an average of 800 km per year in Great Britain to 2010 and 2015 (Target does include Northern Ireland.)

Target 4 relates to the proportion of hedgerows to be in a 'favourable condition'.

Hedgerow BAP Targets and Favourable Condition Attributes

The Steering Group for the UK Biodiversity Action Plan for Hedgerows has agreed the following attributes as defining favourable condition. The Essential Assessments in the Field Survey Form will allow the relevant information on all these attributes to be collected.

Attribute (section of recording form)	Threshold (sub-section of recording form)	Method
To be in 'favourable condition' a hedgerow must meet all the thresholds listed below.		
9 – Undisturbed ground & perennial herbaceous vegetation cover	9a – Undisturbed ground (At least 2m)	Estimate average width of undisturbed (uncultivated) ground from the centre-line of the hedgerow. Automatically favourable if borders grassland.
	9b – Herbaceous vegetation (At least 1m)	Estimate average width of perennial herbaceous vegetation between the centre-line of the hedgerow and adjacent disturbed ground.
10 – Nutrient enrichment	No suitable thresholds have been developed, but should be less than 20% combined cover of nettles, cleavers and docks	Estimate percentage cover of nettles, cleavers and docks within a 2m wide band alongside the hedgerow.
11 – Recently introduced, non-native species	11a – Non-native herbaceous species. (Maximum 10%)	Estimate cover of all non-native herbaceous species as percentage of area of 2m band extending from centre-line of hedgerow.
	11b – Non-native woody species. (Maximum 10%)	Estimate cover of all non-native woody species as percentage of area of vertical face of hedgerow.
13 – Size	13a – Height: (At least 1m)	Measure 'average' height excluding bank.
	13b – Width: (At least 1.5m)	Measure 'average' width at widest point of hedgerow canopy, shoot tip to shoot tip.
	Cross-sectional area: Minimum 3m ²	Take the 'average' height and width for the hedgerow, and multiply to give the cross-sectional area.

Appendix 9

Attribute (section of recording form)	Threshold (sub-section of recording form)	Method
To be in 'favourable condition' a hedgerow must meet all the thresholds listed below.		
14 – Integrity/continuity	14a – <10% gaps	Estimate total length of gaps present as a percentage of total hedgerow length or 30m section (as appropriate).
	14b – No gaps >5m wide	Record if any gaps > 5m wide excluding access points.
	14c – Base of canopy less than 0.5m above ground for shrubby hedgerows	Estimate 'average' height from the base of the hedgerow to the lowest leafy growth.

Veteran tree rule of thumb trunk diameters

These 'rules of thumb' collate the maximum trunk sizes recorded by Mitchell (1974) for each species and adapting categories of 'potentially interesting', 'valuable' and 'truly ancient' described by Read (2000) to relate to these maximum trunk sizes.

Species	Diameter at Breast Height (1.3m) in metres			
	Max diameter	Potentially interesting	Valuable	Truly ancient
<i>Acer campestre</i>	0.96	0.31	0.45	0.60
<i>Acer platanoides</i>	1.27	0.41	0.60	0.80
<i>Acer pseudoplatanus</i>	2.23	0.71	1.05	1.39
<i>Aesculus hippocastanum</i>	2.04	0.65	0.96	1.27
<i>Alnus glutinosa</i>	1.18	0.38	0.55	0.74
<i>Alnus incana</i>	0.64	0.20	0.30	0.40
<i>Arbutus unedo</i>	0.38	0.12	0.18	0.24
<i>Betula pendula</i>	0.96	0.31	0.45	0.60
<i>Betula pubescens</i>	0.96	0.31	0.45	0.60
<i>Buxus sempervirens</i>	0.25	0.08	0.12	0.16
<i>Carpinus betulus</i>	1.27	0.41	0.60	0.80
<i>Castanea sativa</i>	3.18	1.02	1.50	1.99
<i>Crataegus monogyna</i>	0.96	0.31	0.45	0.60
<i>Fagus sylvatica</i>	1.97	0.63	0.93	1.23
<i>Fraxinus excelsior</i>	1.91	0.61	0.90	1.19
<i>Ilex aquifolium</i>	0.57	0.18	0.27	0.36
<i>Juglans regia</i>	1.91	0.61	0.90	1.19
<i>Malus sylvestris</i>	0.96	0.31	0.45	0.60
<i>Mespilus germanica</i>	0.48	0.15	0.22	0.30
<i>Pinus sylvestris</i>	1.59	0.51	0.75	0.99
<i>Populus x canadensis var serotina</i>	1.91	0.61	0.90	1.19
<i>Populus alba</i>	0.64	0.20	0.30	0.40
<i>Populus nigra</i>	1.59	0.51	0.75	0.99
<i>Populus x canescens</i>	1.59	0.51	0.75	0.99
<i>Prunus avium</i>	1.43	0.46	0.67	0.90
<i>Pyrus pyraister</i>	0.64	0.20	0.30	0.40
<i>Quercus cerris</i>	2.55	0.82	1.20	1.59
<i>Quercus ilex</i>	1.37	0.44	0.64	0.86
<i>Quercus petraea</i>	2.83	0.91	1.33	1.77
<i>Quercus robur</i>	3.18	1.02	1.50	1.99
<i>Robinia pseudoacacia</i>	1.59	0.51	0.75	0.99
<i>Salix caprea</i>	1.27	0.41	0.60	0.80
<i>Salix fragilis</i>	1.11	0.36	0.52	0.70
<i>Sorbus aria agg</i>	0.60	0.19	0.28	0.38
<i>Sorbus aucuparia</i>	0.80	0.25	0.37	0.50

Appendix 10

Species	Diameter at Breast Height (1.3m) in metres			
	Max diameter	Potentially interesting	Valuable	Truly ancient
<i>Sorbus intermedia</i> agg	0.64	0.20	0.30	0.40
<i>Sorbus latifolia</i> agg	0.86	0.28	0.40	0.54
<i>Sorbus torminalis</i>	0.89	0.29	0.42	0.56
<i>Sorbus x thuringiaca</i>	0.48	0.15	0.22	0.30
<i>Sorbus x thuringiaca</i>	0.48	0.15	0.22	0.30
<i>Taxus baccata</i>	3.18	1.02	1.50	1.99
<i>Tilia cordata</i>	1.91	0.61	0.90	1.19
<i>Tilia platyphyllos</i>	1.85	0.59	0.87	1.15
<i>Tilia x europea</i>	2.23	0.71	1.05	1.39
<i>Ulmus glabra</i>	2.23	0.71	1.05	1.39
<i>Ulmus minor</i>	1.94	0.62	0.91	1.21
<i>Ulmus procera</i>	2.23	0.71	1.05	1.39
<i>Ulmus x hollandica</i>	1.59	0.51	0.75	0.99
<i>Ulmus x vegeta</i>	1.75	0.56	0.82	1.09

Status of woody species in hedgerows

Systematic name	Common name
Native¹¹	
<i>Acer campestre</i>	Field maple
<i>Alnus glutinosa</i>	Alder
<i>Berberis vulgaris</i>	Barberry
<i>Betula pendula</i>	Silver birch
<i>Betula pubescens</i>	Hairy birch
<i>Buxus sempervirens</i>	Box
<i>Carpinus betulus</i>	Hornbeam
<i>Cornus sanguinea</i>	Dogwood
<i>Corylus avellana</i>	Hazel
<i>Crataegus laevigata</i>	Midland hawthorn
<i>Crataegus monogyna</i>	Hawthorn
<i>Cytisus scoparius</i>	Broom
<i>Daphne laureola</i>	Spurge laurel
<i>Daphne mezereum</i>	Mezereon
<i>Euonymus europaeus</i>	Spindle
<i>Fagus sylvatica</i>	Beech
<i>Frangula alnus</i>	Alder buckthorn
<i>Fraxinus excelsior</i>	Ash
<i>Hippophae rhamnoides</i>	Sea buckthorn
<i>Ilex aquifolium</i>	Holly
<i>Juniperus communis</i>	Juniper
<i>Ligustrum vulgare</i>	Privet
<i>Malus sylvestris</i>	Crab apple
<i>Pinus sylvestris</i> ¹²	Scot's pine
<i>Populus nigra ssp betulifolia</i>	Black poplar
<i>Populus tremula</i>	Aspen
<i>Prunus avium</i>	Gean
<i>Prunus padus</i>	Bird-cherry
<i>Prunus spinosa</i>	Blackthorn

¹¹ Species that are native in part or all UK (see Defra/NE website for country lists).

¹² Scot's Pine is only regarded as native in northern Scotland, elsewhere it is classed as an archaeophyte.

Appendix 11

Systematic name	Common name
Native (continued)	
<i>Pyrus cordata</i>	Plymouth pear
<i>Quercus petraea</i>	Sessile oak
<i>Quercus robur</i>	Pedunculate oak
<i>Rhamnus cathartica</i>	Purging buckthorn
<i>Ribes alpinum</i>	Mountain currant
<i>Ribes rubrum</i>	Red currant
<i>Ribes spicatum</i>	Erect-spiked red-currant
<i>Rosa agrestis</i>	Small-leaved sweet briar
<i>Rosa arvensis</i>	Field rose
<i>Rosa caesia</i>	Hairy dog rose
<i>Rosa canina</i> agg.	Dog rose
<i>Rosa micrantha</i>	Small-flowered sweet briar
<i>Rosa mollis</i> agg.	Soft downy rose
<i>Rosa obtusifolia</i>	Round-leaved dog rose
<i>Rosa rubiginosa</i>	Sweet briar
<i>Rosa sherardii</i>	Sherard's downy rose
<i>Rosa stylosa</i>	Short-styled field rose
<i>Rosa tomentosa</i>	Harsh downy rose
<i>Rubus idaeus</i>	Raspberry
<i>Ruscus aculeatus</i>	Butcher's broom]
<i>Salix aurita</i>	Eared sallow
<i>Salix caprea</i>	Goat willow
<i>Salix cinerea</i>	Grey willow
<i>Salix myrsinifolia</i>	Dark-leaved willow
<i>Salix pentandra</i>	Bay willow
<i>Salix phylicifolia</i>	Tea-leaved willow
<i>Salix purpurea</i>	Purple osier
<i>Sambucus nigra</i>	Elder
<i>Sorbus aria</i> agg	Whitebeam
<i>Sorbus aucuparia</i>	Rowan
<i>Sorbus domestica</i>	Service-tree
<i>Sorbus intermedia</i> agg	Swedish whitebeam
<i>Sorbus latifolia</i> agg	Broadleaved whitebeam
<i>Sorbus torminalis</i>	Wild service tree
<i>Sorbus x thuringiaca</i>	(Whitebeam & Rowan hybrid)

Status of woody species in hedgerows

Systematic name	Common name
Native (continued)	
<i>Taxus baccata</i>	Yew
<i>Tilia cordata</i>	Small leaved lime
<i>Tilia platyphyllos</i>	Large-leaved lime
<i>Tilia x europea</i>	Common lime
<i>Ulex europaeus</i>	Gorse
<i>Ulex gallii</i>	Western gorse
<i>Ulex minor</i>	Dwarf gorse
<i>Ulmus x vegeta</i>	Huntingdon elm
<i>Ulmus glabra</i>	Wych elm
<i>Ulmus minor</i>	Smooth-leaved elm
<i>Ulmus plotii</i>	Plot's elm
<i>Ulmus procera</i>	English elm
<i>Ulmus x hollandica</i>	Dutch elm
<i>Viburnum lantana</i>	Wayfaring tree
<i>Viburnum opulus</i>	Guelder rose
Archaeophyte	
<i>Castanea sativa</i>	Sweet chestnut
<i>Malus domestica</i>	Apple
<i>Mespilus germanica</i>	Medlar
<i>Prunus cerasus</i>	Sour cherry
<i>Prunus domestica</i>	Plum, bullace etc
<i>Pyrus pyraeaster</i>	Pear
<i>Salix alba</i>	White willow
<i>Salix fragilis</i>	Crack willow
<i>Salix triandra</i>	Almond willow
<i>Salix viminalis</i>	Common osier

Appendix 11

Systematic name	Common name
Neophyte/native? – uncertain status	
<i>Acer pseudoplatanus</i>	Sycamore
<i>Ribes nigrum</i>	Black currant
Neophyte	
<i>Acer platanoides</i>	Norway maple
<i>Aesculus hippocastanum</i>	Horse-chestnut
<i>Alnus incarna</i>	Grey alder
<i>Arbutus unedo</i>	Strawberry tree
<i>Chamaecyparis lawsonii</i>	Lawson's cypress
<i>Cornus mas</i>	Cornellian cherry
<i>Cotoneaster microphyllus</i> agg.	Small leaved cotoneaster
<i>Euonymus japonicus</i>	Evergreen spindle
<i>Fuschia magellanica</i>	Fuschia
<i>Juglans regia</i>	Walnut
<i>Laburnum anagyroides</i>	Laburnum
<i>Larix decidua/ kaempferi/ hybrid</i>	Larch
<i>Ligustrum ovalifolium</i>	Garden privet
<i>Lycium barbarum</i>	Duke of Argyll's tea plant
<i>Mahonia aquifolium</i>	Oregon grape
<i>Pinus sitchensis</i>	Sitka spruce
<i>Pittosporum crassifolium/P. tenuifolium</i>	Pittosporum
<i>Populus alba</i>	White poplar
<i>Populus x canadensis var serotina</i>	Black Italian poplar
<i>Populus x canescens</i>	Grey poplar
<i>Prunus cerasifera</i>	Cherry plum
<i>Pseudotsuga menziesii</i>	Douglas fir
<i>Quercus cerris</i>	Turkey oak
<i>Quercus ilex</i>	Holm oak
<i>Rhododendron ponticum</i>	Rhododendron
<i>Ribes uva-crispa</i>	Gooseberry
<i>Robinia pseudoaccacia</i>	Locust
<i>Sambucus racemosa</i>	Red-berried elder
<i>Symphoricarpos alba</i>	Snowberry
<i>Syringa vulgaris</i>	Lilac
<i>Tamarix gallica</i>	Tamarisk

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