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HABITAT RESTORATION PROJECT

Fact sheet

2

Heathland creation for wildlife

Lowland heathland is typified by open, relatively treeless landscapes in which the vegetation is dominated by heather and grasses, and occurs on mineral soils which are typically acidic and nutrient-poor. Heathland is scarce and provides valuable wildlife habitat for a wide range of animals and plants, including rare species such as the marsh gentian, nightjar and sand lizard. Initiatives that increase the area of lowland heathland vegetation communities are likely to be of benefit to wildlife conservation. This fact sheet provides guidance on the creation of new areas of simple heathland vegetation on former agricultural land. The creation of acid grasslands is included in Fact Sheet 4 in this series.

Where to create lowland heathland vegetation

- On arable fields or improved grasslands which have a past history of heathland, especially those which have been farmed less intensively.
- On land adjacent to existing areas of semi-natural heathland.
- On sites which link two or more existing blocks of heathland.
- On non-heathland sites where soil conditions and other factors permit.

Sites which extend or link heaths are likely to have the greatest benefit for wildlife conservation. Larger sites allow more flexibility for management and reduce the possibility of local extinctions of species. The establishment of new areas of heathland vegetation adjacent to existing sites also maximises the opportunity for colonisation by heathland species, which may have poor powers of dispersal.

Planning heathland habitat creation schemes

When considering a heathland creation scheme, it is essential to carry out a Site Suitability Survey to assess the suitability of the proposed land. It must be stressed that attempts at heathland creation on inappropriate sites or on sites without adequate ground preparation are unlikely to succeed. The Site Suitability Survey should consider the following factors:

- Past agricultural management (cultivation, grazing, fertiliser inputs, liming, drainage etc).
- Existing vegetation (remnant heathland species may be present, or there may be seeds buried in the soil).
- Soils (check soil nutrient status, including nitrogen, phosphorus, potassium and calcium levels, as well as pH).

- Physical condition (slope and topography).

- Archaeological interest. Appropriate advice should be sought prior to starting any work if the site has features of archaeological interest.

Sites with remnant heathland vegetation should be restored instead of being considered for heathland creation.

Soil condition and reduction of soil fertility

The condition of the soil in terms of plant nutrient levels (particularly nitrogen and phosphorus) and pH is likely to be the most serious obstacle to creating heathland vegetation on former agricultural land. Too fertile a soil will encourage vigorous plants and prevent heathland species from establishing. If possible, the nutrient levels and acidity of the proposed site should be compared with those of a nearby heath in order to determine the desired nutrient status and pH. If the fertility and pH of the site are low, habitat creation can proceed straight away. If, as is likely, nutrient levels are too high, measures will be needed to reduce soil fertility. There are three main methods available for reducing soil nutrient levels.

- Growing crops (such as barley), perhaps with limited inputs of nitrogen fertiliser, and removing the nutrients with the harvested crop. Several years of cropping may be required to achieve significant reductions in nutrient levels.

- Deep ploughing to bury the topsoil and bring nutrient-poor layers of soil to the surface.

- Topsoil stripping (to remove the most fertile layers of soil) and removal of the stripped material from site. It may be possible to sell the topsoil to offset some of the costs of habitat creation.

Which method is most appropriate will depend on the conditions at each site, and it is recommended that specialist advice is sought.

Establishment of heathland vegetation

Once soil conditions are satisfactory, the main options for establishment of heathland vegetation are as follows:

- **Natural regeneration from the soil seed bank**
  This would normally be the preferred option, but is only possible in favourable cases where a viable seed bank is still present. This is unlikely in areas of improved grassland or arable, except in cases where conversion from heathland has only recently occurred.

- **Seeding of the site with material from nearby heaths**
  Heather cuttings forage harvested in October or November or plant litter from an existing heathland site can be spread over the new area. For acid grassland species, material forage harvested at seeding time can be spread on the receptor site. Cut material will also act as a mulch, aiding the establishment of vegetation.

- **Use of commercial seed**
  Where there is no local source of material, it may be possible to establish heathland vegetation using commercially available seed. However, care must be taken to ensure that all seed used is of native species and of British origin.

Wherever possible, it is best to aim towards re-creating a semi-natural community of the type found locally.

Initial aftercare

Management will be especially important during the first few years as vegetation cover develops. Careful control will be needed to prevent overgrazing which may damage or kill heather plants. There may also be a need to control certain weed species if these become too prevalent in the vegetation.

Long-term management

Once established, the heathland vegetation will need to be managed by low-intensity grazing by livestock and the cutting or controlled burning of small plots on a long (e.g. 15-20 year) rotation. The vegetation which develops will depend on the particular conditions of the site, and future management will need to be flexible to take account of the constraints and opportunities for wildlife which this presents.

Sources of further information on heathland creation and management

Andrews, J. and Rebane, M. 1994. Farming and Wildlife: A Practical Management Handbook. RSPB, Sandy. 358pp.

Chadwick, L. 1982. In Search of Heathland. Dobson, London and Durham. 217pp.

Free, A. and Kitson, M.T. (Eds.). 1992. Heathland Habitat Creation. Proceedings of the Seminar on Heathland Habitat Creation, Sizewell Power Station, January 1992. Suffolk Wildlife Trust/Nuclear Electric. 78pp.

Gimingham, C.H. 1972. Ecology of Heathlands. Chapman and Hall, London. 266pp.

Gimingham, C.H. 1992. The Lowland Heathland Management Handbook. English Nature Science No.8. English Nature, Peterborough. 201pp.

Michael, N. 1993. The Lowland Heathland Management Booklet. English Nature Science No.11. English Nature, Peterborough. 40pp.

Michael, N. 1996. How to Select Land Which is Suitable for the Re-creation of Lowland Heathland. A Guidance Note for Conservation Advisors and Landowners. English Nature, Peterborough. 4pp.

Parker, D.M. 1995. Habitat Creation - A Critical Guide. English Nature Science No. 21. English Nature, Peterborough. 190pp.

Putwain, P.D. and Rae, P.A.S. 1988. Heathland Restoration: A Handbook of Techniques. University of Liverpool Environmental Advisory Unit/British Gas. British Gas, Southampton. 160pp.

Webb, N.R. 1986. Heathlands. Collins New Naturalist No.72. Collins, London. 223pp.

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Bibliography

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Habitat creation bibliography: heathland

Andrews, J. and Rebane, M. 1994. *Farming and Wildlife: A Practical Management Handbook*. R.S.P.B., Sandy. 358pp.

Handbook providing guidance on the management, restoration and creation of wildlife habitats on farmland in the UK. The first chapter deals with surveying the wildlife interest of farms and making wildlife management decisions. The remaining chapters cover the major wildlife habitats found on farms (arable land, pasture and meadow, lowland heath, hill and rough grazing, machair, farm woodland, hedgerows, farm trees and scrub, waterbodies and other wetlands, farm buildings and walls). For each habitat there are sections on wildlife requirements and effects of farm management, options for conservation management, prescriptions for the management, enhancement and creation of the habitat, references and further reading, and case studies of the implementation of wildlife conservation on farms. Also included are key features on selected species and numerous tables summarizing aspects of wildlife assessment and conservation management. (*Although the sections on habitat creation are relatively brief, this is nonetheless an invaluable source of information for those undertaking or advising on habitat creation on farmland*).

Armstrong, P.H. 1973. Changes in the Land Use of the Suffolk Sandlings: A Study in the Disintegration of an Ecosystem. *Geography*, **58**, 1-8.

Article documenting the decline of heathland in east Suffolk, and explaining the effects that the reduction in sheep grazing, and technological and economic changes in arable farming, have had in hastening this decline. (*Source of general background information on heathland loss and fragmentation*).

Chadwick, L. 1982. *In Search of Heathland*. Dobson, London and Durham. 217pp.

General text on the social and natural history of heathland in southern Britain, though mainly concentrating on the Sandlings heaths of east Suffolk and in particular a study area adjacent to the author's home. The history and natural history of heathland in Suffolk are covered in Parts I and II respectively. Part III describes visits to heathland areas in Norfolk, Surrey, Dorset, Cornwall and the New Forest. (*Good general account of heathlands. Contains data on loss and fragmentation of heathland*).

Countryside Commission/English Nature/Suffolk Coast and Heaths Project. (Undated). *Farming to Conserve the Suffolk Coast and Heaths. A Guide to Grants and Advice*. 12pp.

Booklet prepared primarily for farmers and land managers in the Suffolk Coast and Heaths AONB (and adjacent areas). Contains guidance on how to conserve and enhance the landscape and wildlife of the area, and lists the main sources of grants available to assist in this process. Three main landscape areas are recognised (sandlings, valley floodplains and valley slopes), for which conservation aims, including habitat creation, are listed. There are brief sections on how to achieve these aims, and on selection of priority sites for implementation. Contact addresses for further advice are included. (*Although specific to Suffolk, this booklet has a format which could readily be adapted for use in other parts of England*).

English Nature. 1993. *English Nature's National Lowland Heathland Programme*. English Nature, Peterborough. 6pp.

Booklet providing general information on heathland in England, including its distribution and conservation importance and the need for continuing management. The aims of the National Lowland Heathland Programme are also set out.

English Nature. 1994. *Managing Lowland Heaths for Wildlife*. English Nature, Peterborough.

A3 sheet providing a brief introduction to heathland. The leaflet describes the wildlife value of heathland and outlines the types of management activities needed to maintain the habitat. (*Useful for landowners as a first introduction to heathland management*).

Environmental Advisory Unit. 1988. *Heathland Restoration: A Handbook of Techniques*. British Gas, Southampton. 160pp.

A detailed review of techniques available for the restoration of heathland areas affected by quarrying, pipeline installation, erosion and other factors. Introductory sections describe the main types of heathland and give a

brief overview of heathland soils. Subsequent chapters review the types of disturbance affecting heathland and moorland, provide details of the main restoration techniques (turfing, use of seed/litter, topsoiling, transplanting etc), and give guidance on initial aftercare and long-term management. (*Concentrates on the restoration of existing heathland sites rather than the creation of new areas of heathland, but contains much useful information applicable to new habitat creation projects*).

Evans, C., Marrs, R. and Welch, G. 1993. The Restoration of Heathland on Arable Farmland at Minsmere RSPB Nature Reserve. *RSPB Conservation Review*, 7, 80-84.

Case study of the attempt by the RSPB to restore 158 ha of arable land at Minsmere to heathland and acid grassland. The paper highlights the differences in soil fertility and pH between the arable land and existing areas of nearby heathland, and describes the techniques being used to alter the soil chemistry to enable re-establishment of heathland vegetation. (*Useful summary of the work carried out at this high profile site*).

Farrell, L. 1993. *Lowland Heathland: The Extent of Habitat Change*. English Nature Science No. 12. English Nature, Peterborough. 71pp.

A 1987 Nature Conservancy Council report, updated by English Nature in 1992. The report contains introductory sections on the distribution, origin and history of heathland in lowland Britain. The main part of the text documents historical changes in the extent of the main heathland districts, including Breckland, the Suffolk Sandlings, the Surrey heaths, Hampshire, the Dorset heaths and the Lizard. Contains summary tables of the areas of heathland in each district, and map sequences showing the progressive fragmentation of heathland sites over time. Also included is a brief summary of the status of British heathland in a European context, and a table outlining current threats to heathland. (*Key source of information summarising the current extent of heathland, as well as past losses and fragmentation*).

Firbank, L.G., Arnold, H.R., Eversham, B.C., Mountford, J.O., Radford, G.L., Telfer, M.G., Treweek, J.R., Webb, N.R.C. and Wells, T.C.E. 1993. *Managing Set-aside Land for Wildlife*. ITE Research Publication No. 7. HMSO, London. 146pp.

Report detailing management recommendations for set-aside land which will benefit wildlife. Introductory sections consider the conservation priorities on set-aside farmland as well as the potential for wildlife enhancement. These are followed by a series of management options for rotational set-aside (e.g. management for arable weeds and birds), non-rotational set-aside (e.g. enhanced field margins, natural regeneration) and longer-term restoration on set-aside land (e.g. creation of calcareous grassland and heathland). (*Good appraisal of the various options for set-aside, though partly out of date due to changes in the set-aside regulations*).

FitzGerald, C., Martin, M. and Auld, M. 1985. *The Sandlings Project. Report of the Sandlings Project 1983-1985*. The Sandlings Group. 49pp.

Report describing the work of the Sandlings Project to restore heathland sites in east Suffolk during the period 1983-1985. Topics covered include the history of the sandlings heathland, the loss and fragmentation of heathland sites, the establishment and organisation of the project group, and details of the management work undertaken. (*Deals with management and restoration of existing heathland rather than the creation of new sites, though some of the restoration techniques described are applicable to habitat creation schemes*).

Free, A. and Kitson, M.T. 1992. *Heathland Habitat Creation*. Proceedings of the Seminar on Heathland Habitat Creation, Sizewell Power Station, January 1992. Suffolk Wildlife Trust/Nuclear Electric. 78pp.

Proceedings of a seminar aimed at pooling existing information on heathland re-creation projects, and reviewing the practicalities and techniques available. The 10 papers deal primarily with sites in East Anglia, although the methodologies discussed are likely to be applicable to many areas of Britain. The majority of papers relate to the creation of heathland on arable land, and address topics such as how to reduce soil fertility and successfully establish vegetation.

Gimingham, C.H. 1972. *Ecology of Heathlands*. Chapman and Hall, London. 266pp.

Gimingham, C.H. 1992. *The Lowland Heathland Management Handbook*. English Nature Science No. 8. English Nature, Peterborough. 201pp.

Comprehensive guide to the management of lowland heathland where wildlife conservation is the primary objective. Contains detailed information on types of heathland vegetation, requirements for and objectives of management, management techniques (cutting and mowing, burning, grazing, control of unwanted species), the management requirements of particular species, monitoring of heathland sites and heathland restoration. There are also case studies outlining the management practices at ten sites throughout the U.K. The bibliography contains a comprehensive list of references on heathland management. (*Covers similar ground, but in much more detail, to the lowland heathland management booklet*).

Michael, N. 1996a. *The Lowland Heathland Management Booklet. Version 2.0.* English Nature Science No.11. English Nature, Peterborough. 40pp.

A concise guide, aimed at non-specialists, to the objectives and techniques of managing lowland heath for nature conservation. Contains sections on the types of lowland heath in England, heather management, control of invasive plant species, grazing management, management for fauna and the management of specific heathland types. There is also a short section on the restoration and re-creation of dry heath. (*Valuable reference for anyone involved in the on-going management of newly created areas of heathland*).

Michael, N. 1996b. *Lowland Heathland: Wildlife Value and Conservation Status.* English Nature Research Report No. 188. English Nature, Peterborough. 13pp.

Report produced as part of English Nature's National Lowland Heathland Programme, providing a compendium of information on the distribution, extent and conservation status of lowland heathland in England. Contains information on heathland on National Nature Reserves, the extent of different types of heathland in each county and the proportion designated as SSSI, as well as monitoring guidelines for lowland heathland sites. (*Good source of summary statistics on England's heathland resource*).

Michael, N. 1996c. *How to Select Land Which is Suitable for the Re-creation of Lowland Heathland.* A Guidance Note for Conservation Advisors and Landowners. English Nature, Peterborough. 4pp.

Leaflet in which the main feature is a flowchart for choosing land which is most likely to be easily converted back to lowland heathland. Also included are brief notes on the importance of heathland for wildlife, reasons for re-creating heathland and methods of heathland re-creation, as well as sources of further information. (*Flowchart will be particularly useful for identifying sites for heathland creation*).

Parker, D.M. 1995. *Habitat Creation - A Critical Guide.* English Nature Science No. 21. English Nature, Peterborough. 190pp.

Report examining the potential and actual problems of habitat creation in Britain, and presenting guidance on best practice in the planning, construction and management of habitat creation projects. The report draws on information obtained from a survey and review of 150 habitat creation projects throughout the UK. A general chapter on habitat creation planning is followed by chapters on grassland, woodland and scrub, heathland and moorland, peatlands and urban sites. Within each chapter there are sections on semi-natural habitat types, initial site survey and planning, preparation of a project plan and the setting of objectives, methods of habitat creation, and monitoring and long-term management. The report includes 26 case studies of habitat creation projects in the UK. (*Essential reading for anyone undertaking or advising on any significant habitat creation project*).

Penny Anderson Associates. 1993. *Roads and Nature Conservation: Guidance on Impacts, Mitigation and Enhancement.* Report for English Nature. English Nature, Peterborough. 80pp.

Document outlining the main impacts of road schemes on wildlife, and providing guidance on the most appropriate measures to mitigate these impacts. Includes some data on the loss and fragmentation of semi-natural habitats. Section 9 covers habitat creation, and addresses key issues including selection of habitat type, sowing versus natural regeneration, soil type, species selection, ground preparation and management. There are brief sections on creation of woodland, grassland, heathland and wetland habitats, and on habitat creation for butterflies and amphibians. Guideline costs for habitat creation are also given. (*Although written in relation to road schemes, much of the information given will be of value to habitat creation schemes on agricultural land*).

Rackham, O. 1986. *The History of the Countryside.* J.M.Dent and Sons Ltd., London. 445pp.

Detailed historical ecology of the British countryside. The emphasis is on woodland and trees, though a number of other habitats are also covered, including heaths, moors, grassland, ponds, marshes, fens and rivers. (*Excellent introduction to wildlife habitats in a historical context*).

Royal Society for the Protection of Birds. 1994. *Farming and Wildlife: Lowland Heaths.* RSPB, Sandy. (Leaflet).

Leaflet summarising chapter 4 of Farming and Wildlife: A Practical Management Handbook. A brief account of the importance of lowland heath for wildlife is followed by recommendations for conservation management. A section outlining the main options for re-creation of heathland for wildlife is also included, as well as potential sources of financial incentives. (*Good, concise document which gets the main points across effectively - suitable for direct distribution to farmers*).

Tubbs, C.R. 1985. *The Decline and Present Status of the English Lowland Heaths and their Vertebrates.* Focus on Nature Conservation No. 11. Nature Conservancy Council, Peterborough. 20pp.

Report detailing the chronology and extent of loss of lowland heathland in England and the causes of this decline. Data on the status of vertebrates associated with heathland (birds and herpetofauna) is also included. (*More up-to-date information is available in more recent publications on heathland*).

Webb, N.R. 1986. *Heathlands*. Collins New Naturalist No.72. Collins, London. 223pp.

General text on the heathlands of southern Britain, providing a good introduction to the subject and describing much of the recent work on the ecology of heathland. Topics covered include the influence of soil, climate and geology, the effects of human activity on the development of heathland, and the characteristics of different heathland areas throughout Britain. In addition there are extensive sections on the flora and fauna of heathland. Chapters 4, 5 and 12 contain useful statistics on the extent of loss and fragmentation of the habitat. Chapter 12 contains a brief review of techniques for the restoration/re-creation of heathland. (*Excellent as an introduction to the habitat*).

Webb, N.R. 1990. Changes on the Heathlands of Dorset, England, Between 1978 and 1987. *Biological Conservation*, **51**, 273-286.

Paper presenting the results of heathland surveys in Dorset. In the nine year period between surveys the area of heathland decreased by 5%, mainly due to conversion to farmland and development. (*Useful source of information on recent heathland habitat loss*).

Woodrow, W., Symes, N. and Auld, M. 1996. *RSPB Dorset Heathland Project, 1989-1995. A Management Case Study.* RSPB, Sandy. 94pp.

Report describing the work of the RSPB Dorset Heathland Project between 1989 and 1995. The project was aimed primarily at increasing the area of sustainable open heath, and was targeted so as to maximise the reduction in fragmentation of heathland sites. Topics covered by the report include a review of heathlands in the area, the requirements of key species, establishment and planning of the project, techniques for heathland management, and site survey and monitoring. Also included are case studies for selected sites. (*Deals with restoration and management rather than heathland creation*).

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Fact sheet

3

Woodland creation for wildlife

New woodlands composed of native tree and shrub species have the potential for reversing the damage from losses of woodland which have occurred in recent decades. Woodland creation schemes are likely to be of most value for wildlife conservation if they encourage the establishment of whole communities of native trees, shrubs and ground flora appropriate to a particular site, and this approach has been adopted in the preparation of this fact sheet.

Where to create new native woodland

- On sites adjacent to existing areas of semi-natural woodland.
- On sites which link existing woodland blocks, or which reduce the distance between existing woodlands.
- On sites adjacent to other wildlife-rich habitats such as hedges and ponds.
- At sites where new woodland will complement the existing landscape character.

Creation of new woodlands adjacent to existing woods and hedgerows will increase the potential for natural colonisation of the site by native plant and animal species. However, new woodlands should not be established on sites which already have significant wildlife value, or where it would increase the fragmentation of other semi-natural habitats.

Planning woodland habitat creation schemes

A Site Suitability Survey of the proposed woodland creation site and adjacent land should be carried out during the early stages of planning. This should include a wildlife survey, together with an assessment of topography, soils, and past management history. Information from the survey will enable an assessment of the existing wildlife interest and whether woodland creation is appropriate to the site. It will also assist in setting realistic objectives for the habitat creation project.

Soil condition and reduction of soil fertility

Arable sites and improved pastures will have disturbed soil profiles and are likely to have high levels of plant nutrients resulting from past applications of inorganic fertiliser. High soil fertility will not hamper the development of trees and shrubs, but will encourage the growth of competitive weed species at the expense of desirable woodland floor species. If the soil fertility of the site is high, consider reducing plant nutrient levels by one of the following methods:

- Topsoil stripping (to remove the most fertile layers of soil) and removal of the material from site. This method has an immediate effect, and it may be possible to offset the cost through sale of the topsoil. It also has the added advantage of removing the seed bank of non-woodland species.
- Deep ploughing (e.g. to a depth of 1m) to dilute the topsoil with less fertile subsoil.

Specialist advice should be taken as to which method is appropriate for a particular site.

On sites where the ground is level, it may be appropriate to use machinery to create some minor topographical variations (and so increase habitat diversity) in the landform prior to planting. For sites which have no history of recent cultivation it is probably best to leave the soil undisturbed prior to woodland establishment.

Woodland design

The objective should be to create, over time, a woodland comprising a tree canopy, shrub layer and ground flora of native species, rather than just a plantation of trees. The selection of the woodland type to create should be appropriate for the soils of the proposed site, and should reflect the types of semi-natural woodlands present in the locality. Guidance on suitable species of trees and shrubs to plant in different parts of England is given in Rodwell and Patterson (1994) and further information, on a Natural Areas basis, in Kirby and Reid (1997). Local conservation organisations or woodland initiatives may also be able to advise on suitable woodland types for particular regions of the country (Sinclair (1995) may be of use). The precise design of the new woodland will of course depend on the characteristics of each site, but the following general principles apply:

- New woodlands should be a minimum of 2 hectares in area, and preferably larger than 5 hectares, although extensions to existing woods are likely to be of significant wildlife value whatever their size.
- Include open areas (20% of the wood area) within the design, such as interconnected glades (minimum of 25m across) and rides of irregular shape.
- Consider leaving some additional open areas to provide scope for natural colonisation, which will help give the wood a more natural character and allow for a varied age structure to develop.
- Take account of local variations in soil conditions (e.g. alkalinity/acidity and wetness) when deciding where to plant particular species.
- Provide a sinuous edge to the wood to benefit both wildlife and landscape.

Where there are good seed sources available (for example, the site is adjacent to established semi-natural woodland) and no particular time constraints, consider allowing the wood to develop by natural colonisation

Selection of tree and shrub species

- Plant only locally native species of trees and shrubs.
- Generally it is best to restrict planting to species which are already present in semi-natural woodlands in the locality of the proposed woodland creation scheme.
- Preferably use planting stock of local origin (e.g. by collection and propagation of seed from nearby woods and hedges). This is especially important adjacent to ancient semi-natural woodlands. Where this is not possible, ensure that plants originate from British stock.
- Avoid planting rarer species such as small-leaved lime, wild service tree or box. If they occur locally, they may in time establish by natural colonisation.

Planting patterns

- Aim to create diversity within the woodland in terms of species composition and the relative proportions of trees and shrubs.
- Match the species choice and planting pattern to the soil and topography of the site.
- Plant clumps (ranging from single trees to stands 50m or more wide) of either single species or well-matched species.
- Vary the clump size, and leave open spaces of varying size (7m to 20m) between

clumps.
- Vary the spacing within clumps to give a more natural appearance (e.g. between 1.5m and 5m).
- Closer spacing of plants may lead to more rapid development of the tree canopy and help to shade out weed species, but will necessitate thinning at a later stage.
- Plant whips (0.6-1.2m high) for best results. Guidance on planting methods and protection from grazing is given in Brooks (1980) and other publications.

Species composition and planting design may be influenced by other management objectives for the woodland (e.g. recreation or timber production).

Establishment of ground vegetation

Establishment of a typical woodland ground flora that mimics a chosen woodland type is likely to be the most difficult aspect of woodland creation. This is particularly true on nutrient-rich farmland, where the high soil fertility encourages the growth of rank vegetation at the expense of desired plant species. If the site is adjacent to existing woodland, some natural colonisation of woodland plants may occur, although many species are very poor colonisers and the process is likely to be slow. Where direct action is taken to introduce woodland plants, it is best to delay until the tree canopy causes sufficient shade to suppress competitive weed species, whilst still providing enough light for shade tolerant wild flowers. Woodland edge species, suitable for rides and glades, can be established at an earlier stage of woodland establishment. Methods which can be used to establish woodland ground flora include the following:

- Planting of seed, obtained either from commercial suppliers or collected locally.
- Direct planting of species raised in cultivation.

As with trees and shrubs, the plants used should be native species appropriate to the woodland type being created. Seed sources should be of British stock, and preferably obtained from local sources.

Aftercare

- Avoid the use of fertilisers except in cases where it is essential for the establishment of trees and shrubs (for example on reclaimed sites with highly disturbed soil profiles).
- Fence the new woodland to control grazing by rabbits, deer and livestock during the initial establishment period.
- Suppression of weeds will be required during the first few years to reduce competition with the planted trees and shrubs. This can be achieved by spot treatment with herbicides around the base of each plant, or by the application of a low fertility mulch such as bark chippings.
- Selective thinning may be required if the planting density has allowed for failures, or in order to encourage the establishment of desired tree or shrub species.

Long-term management

The requirements for long term management will depend on the wildlife conservation and other objectives for the site. Options for future management include:

- Introduction of coppice management.
- Selective felling of timber trees, followed by replanting or natural regeneration.
- Rotational mowing to maintain open rides and glades.
- Control of invasive, non-native species of plants, such as sycamore and rhododendron.

Sources of further information on woodland creation and management

Brooks, A. 1980. Woodlands. A Practical Handbook. British Trust for Conservation Volunteers, Wallingford. 173pp.

Ferris-Kaan, R. (Ed.). 1995. The Ecology of Woodland Creation. John Wiley and Sons, Chichester. 244pp.

Kirby, K. J. and Reid, C. M. 1997. Preliminary Nature Conservation Objectives for Natural Areas; Woodland and Forestry. Peterborough, English Nature (Research Report No. 239).

Peterken, G.F. 1993. Woodland Conservation and Management. 2nd Edition. Chapman and Hall, London. 374pp.

Rackham, O. 1976. Trees and Woodland in the British Landscape. J.M.Dent, London. 234pp.

Rodwell, J.S. and Patterson, G.S. 1994. Creating New Native Woodlands. Forestry Commission Bulletin No. 112. HMSO, London. 74pp.

Sinclair, G. 1995. Woodlands Initiative Register. National Small Woods Association, Preston Capes, Northamptonshire.
Soutar, R.G. and Peterken, G.F. 1989. Regional Lists of Native Trees and Shrubs for use in Afforestation Schemes. Arboricultural Journal, 13, 33-43.

Watkins, C. 1991. Nature Conservation and the New Lowland Forests. NCC, Peterborough.

Williamson, D.R. 1992. Establishing Farm Woodlands. Forestry Commission Handbook 8. HMSO, London.

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Bibliography 3

Habitat creation bibliography: woodland

Andrews, J. and Rebane, M. 1994. *Farming and Wildlife: A Practical Management Handbook.* R.S.P.B., Sandy. 358pp.

Handbook providing guidance on the management, restoration and creation of wildlife habitats on farmland in the UK. The first chapter deals with surveying the wildlife interest of farms and making wildlife management decisions. The remaining chapters cover the major wildlife habitats found on farms (arable land, pasture and meadows, lowland heath, hill and rough grazing, machair, farm woodland, hedgerows, farm trees and scrub, waterbodies and other wetlands, farm buildings and walls). For each habitat there are sections on wildlife requirements and effects of farm management, options for conservation management, prescriptions for the management, enhancement and creation of the habitat, references and further reading, and case studies of the implementation of wildlife conservation on farms. Also included are key features on selected species and numerous tables summarizing aspects of wildlife assessment and conservation management. (*Although the sections on habitat creation are relatively brief, this is nonetheless an invaluable source of information for those undertaking or advising on habitat creation on farmland*).

Baines, C. and Smart, J. 1984. *A Guide to Habitat Creation.* Greater London Council Ecology Handbook No. 2. GLC, London. 44pp.

General guide to the creation and management of wildlife habitats in an urban context. Grasslands, woodlands, wetlands and wastelands are each covered in separate chapters. Appendices include a list of suppliers of native wild flower seed from British sources, and a general list of plant species suitable for establishment in newly-created habitats. (*Good general guide, though more detailed and recent publications are now available for each of the habitats covered*).

Beckett, K. and Beckett, G. 1979. *Planting Native Trees and Shrubs.* Jarrold. 64pp.

Comprehensive guide to 60 species of native trees and shrubs. Introductory sections give advice on planting and aftercare, and for each species there are details of propagation methods, natural habitat and a list of other species with which it is commonly found. Also included are distribution maps for each species. *(Good general guide to Britain's native tree and shrub species).*

Brooks, A. 1988. *Woodlands. A Practical Handbook.* British Trust for Conservation Volunteers, Wallingford. 173pp.

Comprehensive guide to woodland conservation and management. Contains general sections on woodland structure and succession, as well as detailed information on tree planting, including choice of species, supply and propagation, site preparation, planting design, planting methods and post-planting care. (*Useful source of practical advice on woodland conservation and management*).

British Trust for Conservation Volunteers. 1991. *Trees and Aftercare. A Practical Handbook.* BTCV, Wallingford. 160pp.

Contains sections on planting in rural and urban locations, planting design, seed collection, planting and early care, and aftercare and maintenance. (*Contains much information of use to those undertaking woodland habitat creation*).

Buckley, G.P. (Ed.). 1989. *Biological Habitat Reconstruction.* Belhaven Press, London. 363pp.

Technical publication containing contributions from a wide range of authors with an interest in habitat reconstruction. The book aims to discuss the assumptions and ecological principles behind habitat reconstruction, a term used to embrace habitat creation, habitat transplantation and habitat enhancement/ diversification. Section 5 of the book deals specifically with habitat creation (papers include creating habitats on farmland and the feasibility of woodland reconstruction), although much of the information in other sections of the book is also relevant. (*Contains much useful information, particularly on the philosophy and principles of habitat creation, but likely to be of limited practical use for those planning and implementing habitat creation schemes*).

Countryside Commission/Forestry Commission. 1996. *Woodland Creation: Needs and Opportunities in the English Countryside*. Joint CoCo/FC discussion paper. 20pp.

Discussion paper aimed at developing the debate on the proposals of the 1995 Government White Paper, Rural England, which set a target of doubling England's woodland cover over the next 50 years. Paper addresses a number of issues including why new woods are needed, what types of woodland are needed and where new woodlands should be sited. Contains opportunities maps identifying areas with potential for creation of woodland on agricultural land, and the potential for new woodland in English Nature's different Natural Areas. (*Only relevant to those interested in national woodland strategy*).

Ecological Parks Trust. 1981. *New Life for Old Space: A Guide to Handbooks and Leaflets Covering the Principles and Methods of Converting Small Urban Sites into Nature Areas in Britain*. Ecological Parks Trust, London. 7pp.

Lists publications/leaflets covering urban wasteland projects, design principles, woodland creation, creation of herb-rich swards, pond creation and attracting fauna. (*Many of the information sources listed have been superseded by more recent publications. The strong urban bias reduces its applicability to habitat creation on agricultural land*).

English Nature. 1996. *English Woodland and Nature Conservation*. English Nature, Peterborough. 8pp.

Booklet describing the extent, distribution and origin of woodland in England, and outlining the wildlife conservation value of the various woodland types. Other topics covered include options for managing woodland, threats to woodland conservation, and a consideration of the main opportunities which exist for woodland conservation. Contains a list of organisations which can be contacted for further information. (*Useful general booklet for distribution to farmers/land managers, even though woodland creation is only touched on*).

Farming and Wildlife Advisory Group. (Undated). *Trees, Woodlands and Scrub*. FWAG, Kenilworth. (*Booklet*).

Farming and Wildlife Advisory Group. 1996. *Using Native Material*. FWAG, Kenilworth.

Technical Information Sheet highlighting the need not only to use native species of trees, shrubs and wild flowers when undertaking new planting projects, but also to ensure that the seed/plants are derived from native stock, preferably from the local area. Lists reasons for using native material, and suggests natural regeneration should be the preferred option wherever possible. (*Useful as background information when considering habitat creation projects*).

Farming and Wildlife Advisory Group. 1996. *Tree Planting*. FWAG, Kenilworth.

Technical Information Sheet on the planting of copses, woods and hedgerow/parkland trees. Covers planting design, species choice, ground preparation, handling of stock and planting techniques, protection from grazing and weed control.

Ferris-Kaan, R. (Ed.). 1995. *The Ecology of Woodland Creation*. John Wiley and Sons, Chichester. 244pp.

A collection of papers covering different aspects of woodland creation, including planning and design, the use of vegetation classification systems as an aid to woodland creation, planting versus natural regeneration, and the introduction of plants to the field layer. (*Probably too technical to be of direct use to those undertaking woodland habitat creation projects*).

Hamilton, E. 1985. *Tree Planting*. The Woodland Trust, Grantham. 16pp.

Booklet produced by the Woodland Trust to provide general information and advice to anyone planning a tree planting project on open ground. Topics covered include sources of grants and advice, where to plant trees, choice of species to plant, project planning, and preparation, planting and aftercare. Also included is a table listing native tree and shrub species and their natural range. (*Good general booklet on tree planting, but contains some information, for example on rates of grant aid, which is badly out of date*).

Kirby, K.J. 1992. Ancient Woodland: A Re-creatable Resource? *Tree News*, Summer 1992. 3pp.

Article detailing the nature conservation importance of ancient, semi-natural woodland, before going on to consider the extent to which newly created woodlands can be made to mimic conditions within ancient woods. Topics discussed include the siting of new woods, ground preparation (nutrient reduction, modification of topography etc.), selection of tree and shrub species, planting densities and patterns, introduction and establishment of ground flora, and the need for continuing management. Contains a table of simple species mixes of trees, shrubs and ground flora for new woods on different soil types. (*Good background information for anyone wanting to create new woodlands with greater wildlife interest than the average farm woodland*).

Ministry of Agriculture, Fisheries and Food. 1992. *The Farm Woodland Premium Scheme; Rules and Procedures.* MAFF, London. 26pp.

Booklet outlining the rules, procedures and levels of payment of the FWPS, a scheme designed to encourage the creation of new woodlands on agricultural land (*primarily arable land and improved grasslands*).

Parker, D.M. 1995. *Habitat Creation - A Critical Guide.* English Nature Science No. 21. English Nature, Peterborough. 190pp.

Report examining the potential and actual problems of habitat creation in Britain, and presenting guidance on best practice in the planning, construction and management of habitat creation projects. The report draws on information obtained from a survey and review of 150 habitat creation projects throughout the UK. A general chapter on habitat creation planning is followed by chapters on grassland, woodland and scrub, heathland and moorland, peatlands and urban sites. Within each chapter there are sections on semi-natural habitat types, initial site survey and planning, preparation of a project plan and the setting of objectives, methods of habitat creation, and monitoring and long-term management. The report includes 26 case studies of habitat creation projects in the UK. (*Essential reading for anyone undertaking or advising on any significant habitat creation project*).

Penny Anderson Associates. 1993. *Roads and Nature Conservation: Guidance on Impacts, Mitigation and Enhancement.* Report for English Nature. English Nature, Peterborough. 80pp.

Document outlining the main impacts of road schemes on wildlife, and providing guidance on the most appropriate measures to mitigate these impacts. Includes some data on the loss and fragmentation of semi-natural habitats. Section 9 covers habitat creation, and addresses key issues including selection of habitat type, sowing versus natural regeneration, soil type, species selection, ground preparation and management. There are brief sections on creation of woodland, grassland, heathland and wetland habitats, and on habitat creation for butterflies and amphibians. Guideline costs for habitat creation are also given. (*Although written in relation to road schemes, much of the information given will be of value to habitat creation schemes on agricultural land*).

Peterken, G.F. 1993. *Woodland Conservation and Management.* 2nd Edition. Chapman and Hall, London. 374pp.

Peterken, G.F. and Allison, H. 1989. *Woods, Trees and Hedges: A Review of Changes in the British Countryside.* NCC Focus on Nature Conservation No. 22. Nature Conservancy Council, Peterborough. 65pp.

Report providing detailed information on the losses of woodland and hedges in different regions of Britain. (*Excellent source of background information on habitat loss*).

Rackham, O. 1976 (revised 1990). *Trees and Woodlands in the British Landscape.* J.M.Dent, London. 234pp.

Treatise detailing the historical ecology of Britain's woodland and hedgerows (as well as the trees of meadows, commons and parks) from pre-history to the present day. The final chapter reviews recent developments in the conservation of ancient woodland and considers prospects for the future. (*Excellent account of the historical, landscape and wildlife importance of our woodland resource*).

Rackham, O. 1986. *The History of the Countryside.* J.M.Dent and Sons Ltd., London. 445pp.

Detailed historical ecology of the British countryside. The emphasis is on woodland and trees, though a number of other habitats are also covered, including heaths, moors, grassland, ponds, marshes, fens and rivers. (*Excellent introduction to wildlife habitats in a historical context*).

Rodwell, J.S. and Patterson, G.S. 1994. *Creating New Native Woodlands.* Forestry Commission Bulletin No. 112. HMSO, London. 74pp.

A comprehensive guide to the creation and management of new areas of woodland made up of communities of native tree and shrub species appropriate to the site. The booklet is divided into four main sections: Section 1 describes the main types of semi-natural woodland in Britain and how they are influenced by climate, soils and management. Section 2 provides general guidance on methods for the design and early management of new native woodlands (e.g. species choice, planting patterns, ground preparation, use of herbicides). Sections 3 and 4 present detailed design prescriptions for new woodlands modelled on the main NVC woodland types in Britain. The prescriptions include lists of recommended trees and shrubs, as well as lists of ground flora species to encourage. (*Essential reference source for those creating new woodlands which attempt to mimic semi-natural woodland communities*).

Royal Society for the Protection of Birds. 1994. *Farming and Wildlife: Farm Woods.* RSPB, Sandy. (Leaflet).

Leaflet summarising chapter 7 of Farming and Wildlife: A Practical Management Handbook. Although dealing primarily with existing woodlands, much of the information contained would be useful for those considering the planting of new areas of woodland. Topics covered include the importance of farm woods for wildlife, and management practices to benefit wildlife. There is also a list of key points for establishing new woodlands, and details of the various incentive schemes available. (*Document suitable for direct distribution to farmers, but contains only limited information on woodland creation*).

Soutar, R.G. and Peterken, G.F. 1989. Regional Lists of Native Trees and Shrubs for use in Afforestation Schemes. *Arboricultural Journal*, **13**, 33-43.

Paper giving lists of native tree and shrub species suitable for planting in 10 zones dividing England, Scotland and Wales. Aimed primarily at assisting those planting new areas of woodland under the Woodland Grant Scheme. Contains a useful table matching site conditions with species. (*Useful for species selection for woodland habitat creation schemes*).

Watkins, C. 1991. *Nature Conservation and the New Lowland Forests.* NCC, Peterborough. 74pp.

Williamson, D.R. 1992. *Establishing Farm Woodlands.* Forestry Commission Handbook 8. HMSO, London. 42pp.

Contains practical guidance, based on three years of trials on farms in southern England, to establishing woodlands on fertile arable and improved grassland sites. Includes sections on tree planting opportunities on farms, where to plant, soils and other factors affecting establishment, management during the establishment phase and weed and vegetation control. There is also a short section on establishing woodland for conservation. (*This booklet is not aimed at the creation of semi-natural woodlands and so is less useful than some other publications. Despite this, much of the information, particularly the section on soil and site factors, will be of value in the planning of woodland creation schemes for conservation*).