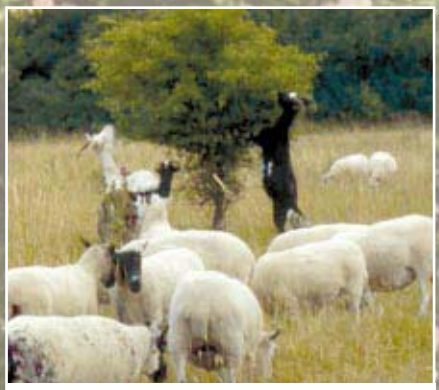
Enhance - increase extent

Enhance - improve quality



Maintain - grazing and browsing

Reduce - water inundation

Eliminate - grubbing out

The Scrub Management Handbook:

Guidance on the management of scrub on nature conservation sites

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The Scrub Management Handbook: Guidance on the management of scrub on nature conservation sites

A Handbook produced by FACT
(the Forum for the Application of Conservation Techniques).

Written for FACT under a contract from English Nature
with RSPB.

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Rebecca Isted, English Nature.

Incorporating English Nature's
Herbicide Handbook: Guidance on the use of herbicides on nature conservation sites.

Contents

Disclaimer

Background note: Understanding the ecology and value of scrub took a leap forward in the year 2000 with the publication of the Joint Nature Conservation Committee Report No 308: The nature conservation value of scrub in Britain. This provided the underpinning science that enabled FACT to proceed with its planned Handbook on the practice of managing scrub.

The Handbook: At the request of potential customers for this Handbook we have attempted to provide a 'one-stop-shop' for scrub managers, firstly by drawing heavily on the JNCC Report, incorporating extracts and summaries about scrub ecology and the value of scrub as appropriate, followed by the development of a framework to take forward the management of scrub. This has been done as carefully as possible to retain accuracy and context but we strongly advise readers to refer to the original JNCC Report for confirmation of context and for a greater level of detail than we could incorporate into this Handbook.

We would ask readers and managers to note that the contents of this Handbook have been drawn from a very wide range of sources and contributors representing an enormous diversity of experiences and views. Some of the information has been drawn from anecdotal observation. We have done our best to present a synopsis of scrub management techniques that are available to managers, set within a framework that moves from the ecology and value of scrub, through identification of objectives, assessment of environmental considerations, to the final selection of technique options. However, the ultimate decision as to which nature conservation features, objective(s) and technique(s) are selected must remain the decision of the local managers, drawing on whatever expertise they can secure, to meet the particular conditions and circumstances that exist on their particular sites.

Untimely use or inappropriate application of the techniques presented in this Handbook could lead to the harming of wildlife species, or, damage to nature conservation habitats rather than the intended benefits which we all want to see. Neither FACT, English Nature, RSPB authors or any members of the Steering Group accept any responsibility or liability for any damage to the environment or human health, or economic losses that might be alleged to have resulted from any explicit or implied recommendations in this Handbook.

We have provided a feedback form at the end of the Handbook as we hope that when a web version of this Handbook is made available on the FACT website before the end of 2003 that we can then continually refine and draw-out lessons that will enable further progress in defining and delivering 'best practice scrub management'.

The FACT Scrub Management Handbook Steering Group.
July 2003.

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Anyone else? We hope we have not missed you off the list - a sincere thank you to everyone who has helped in any way. It really has been quite a partnership project – it now remains to see if managers will find the Handbook useful. Any feedback will be welcomed using the feedback form at the end of the Handbook.

FACT
FORUM FOR THE APPLICATION OF CONSERVATION TECHNIQUES

ENGLISH NATURE

WOODLAND TRUST

Grazing Animals Project GAP

ENGLISH HERITAGE

RSPB

THE NATIONAL TRUST

A few tips for you from the Steering Group when considering managing scrub and using this Handbook

These points jumped out and hit us in the face during the drafting and final editing of this Handbook. We hope you may also find them helpful to peruse; they may appear obvious but can be overlooked:

A few points when considering managing scrub:

- Scrub does not stand still! There are only a few types of 'self-sustaining' climax scrub communities. In the rest, management will be required to prevent what you want from disappearing, and, what you don't want from taking over!

- The Handbook identifies five basic categories of scrub operations used to manage scrub: 'enhancement – increase extent', 'enhancement – increase quality', 'maintenance', 'reduction' and 'eradication'.

  Of these 'enhancement' of scrub is often thought to be relatively easy to achieve by simply standing back and letting nature take its course, but some species and communities (eg in the uplands) may be more difficult to 'enhance' due to grazing pressure or burning history. Also propagating, preparing a seedbed, weeding and watering can all be a challenge.

  'Maintenance' of scrub involves management that when done well can give real added value.

  By comparison 'reduction' and 'eradication' may be more difficult to achieve and they currently absorb huge amounts of resources, so the following bullets highlight ways of increasing the odds in your favour! Don't assume that 'cutting' necessarily equates with, or results in, reduction or eradication – it may not.

  Remember that preventing a problem is usually better than trying to cure it later!

- So, when **'reducing'** or **'eradicating'** scrub tackle it **early**:

  a) **early,** when shrub numbers are small, or even better to prevent colonisation happening in the first place! Identify what management, or lack of management, is occurring that is leading to the colonisation.

  b) **early,** to remove shrubs when they are still small (seedling/sapling stages of growth) and when they are still relatively easy to remove; but, consider waiting on some soil types (eg peaty heaths) for self-thinning to occur, bare ground to colonise (to prevent renewed germination) and stumps to be large enough to take herbicides.

  c) **early,** before the bushes threaten canopy closure, alteration of the plant communities and soil conditions underneath their branches. Once closure has happened the chances of re-establishing previous preferred plant communities will be greatly reduced.

  d) **early,** before the resources required to remove maturing scrub get too large. Disposal of arisings and other machinery costs increase as the size of the bushes increases!

- **When undertaking 'early' action to 'reduce' or 'eradicate' try to ensure that you remove the roots or treat the stumps so that re-growth does not occur!** In the period 1960 to 1980 lessons were learnt the hard way that where shrubs were only cut off near to ground level most would simply produce coppice re-growths that then needed further repeated management operations at regular intervals – the more you cut it the more it grew! With every cycle the number of shoots and stems gets greater and the roots and stumps get bigger – potentially storing up bigger management problems for the future.

- **Before taking the action to 'reduce' or 'eradicate' scrub ensure you have the ability to immediately put in place management to minimise and slow down its return** (e.g. grazing or browsing). Without such action it is likely you will quickly and repeatedly be returning to re-treat future re-infestations.

- Assess the various technique options against environmental and resource issues. Particularly re-assess whether you need to use a herbicide or are there alternative techniques. (This is relevant to Government's Pesticide Minimisation Policy and reducing environmental pollution). Herbicides may only be effective for a short time in conditions that are favourable to re-infestation.

Secondly, a few suggestions to help you get the best out of this handbook:

- Since forward planning and decision making are crucial if resources are not to be wasted make early referral to Figure 1.1 the 'decision making flow-chart' (located in Section 1.2). This presents the Steering Group's approach to determining objective setting and technique selection.

- Scan though the 'Contents' page to get an overview of the information in each Section.

- If you have a problem with a particular species of shrub note that the 48 'shrub species profiles' are listed in alphabetical order in Section 4.4.

- The 'management technique profiles' are in Section 5.

The Steering Group wishes you success in efficiently and effectively managing your 'scrub' for wildlife.

1. Introduction

Scrub is an important component of many of the UK Biodiversity Action Plan (BAP) Habitats and EU Priority Habitats. Consequently, it has a high priority for conservation in Britain and Ireland. It is also an important feature of the countryside; in addition to its high value for wildlife, it contributes to the natural beauty of the landscape. There is, however, another side to scrub; in some situations scrub can cause problems for the land manager, be they conservation managers or farmers, as some scrub types can be invasive.

In the recent past, conservation site managers and advisers have undervalued scrub, and the invasive characteristics of some scrub types in certain situations has given them a bad press. Open habitats such as downland and heathland have been through a period when they were under managed and many were colonised, and even over run by scrub. Scrub can become a threat to the conservation or heritage interest of the land; particularly on some priority open habitats, when it exceeds accepted limits. The uncontrolled encroachment of scrub onto some open habitats has often led to large-scale eradication programmes.

Today, however, there is a better understanding among land managers and advisers of the value of scrub communities as habitat for wildlife and of its place in ecosystems and landscapes. The scrub edge is of particular importance and careful management of scrub can deliver a balance of scrub and open habitat, alongside other interests. The critical factor is the need for long-term management to create and maintain the desired balance. This will also need to incorporate the requirements for conserving archaeology, historic landscape and provision of visitor access.

Scrub ecosystems are highly complex. A good grasp of ecological principles and management techniques is required in order to achieve appropriate conservation. This handbook is intended to provide a basis for that understanding; by describing the principles of scrub management, based on its ecology and its history, and by describing good practice approaches to its management.

1.1 Scope and structure of the handbook

The Scrub Management Handbook aims to bring together the relevant information required to manage scrub for the benefit of nature conservation. The information presented is a synthesis of current good practice and aims to provide advice for those who are under taking scrub management including land managers, advisors, landowners and contractors.

The Handbook presents information on the following key issues:

- Section 2. The conservation and historical value of scrub: summaries of relevant sections of the Joint Nature Conservation Committee's (JNCC) Report Number 308 on 'The nature conservation value of scrub in Britain'.

- Section 3. The importance of planning management and setting objectives: including a framework for integrating the requirements of conservation with other objectives including archaeology, landscape, access and safety. Also the decision-making process for the key stages of scrub management, including a quick reference flow chart.

- Section 4. Profiles of scrub communities (referenced from JNCC Report 308) followed by scrub species (shrub and tree) profiles: in terms of their conservation significance and their position in an ecosystem, appropriate methods for their management according to management objective and growth characteristics.

- Section 5. Management techniques: are described to enhance, maintain, reduce or eradicate scrub as appropriate. The full range of techniques are described, along with the advantages and limitations of each, from grazing and browsing through to manual and mechanical management. Herbicide control is summarised with the reader being referred to the 'Herbicide Handbook' which accompanies this Handbook.

- Section 6. The importance of monitoring: a rationale is provided, together with descriptions of techniques and their applications, focusing on key indicator groups of flora and fauna.

- Section 7. Case studies: illustrating key management issues discussed in the text.

- Section 8. Access to further information: key references are provided for each section, as well as a comprehensive bibliography. Key contacts are given, especially for practitioners undertaking techniques described, and also for those able to provide further advice, assistance or funding. Information is provided on determining management costs, accessing funding, and health and safety issues, as well as a glossary of terms.

This Handbook should be used in conjunction with JNCC 308 Report and other relevant FACT/GAP publications; the *Practical Solutions Handbook* and the *Breeds Profiles Handbook - a guide to the selection of livestock breeds for grazing wildlife sites*; also English Nature's *The Herbicide Handbook - Guidance on the use of Herbicides on Nature Conservation Sites*.

1.2 From evaluation to management techniques: a decision-making flow chart

The flow chart (Figure 1.1) describes the decision-making process through the key stages of scrub management, from survey and assessment of scrub communities and the consideration of priorities (in particular those determined by the Biodiversity Action Plan process), through the determination of management objectives and finally the identification of appropriate management techniques.

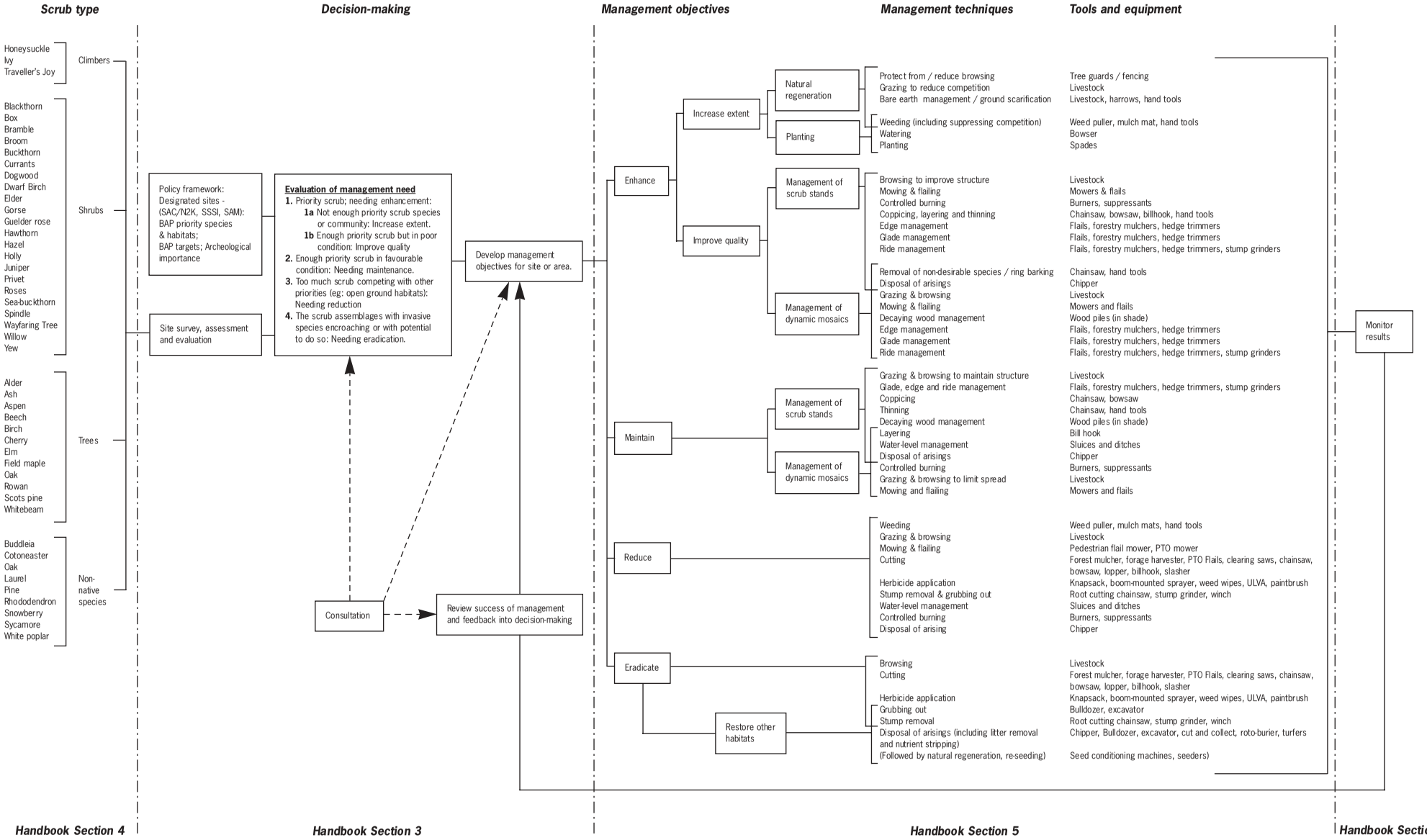
The decision-making process is a vital part of managing any natural resource. Scrub management can be complicated by the range of factors that need to be considered, including the relationship between the scrub and other habitats, species needs and other features such as archaeological heritage. Making the right choices, which will lead to the appropriate conservation of the scrub features, as well as conserving the other habitats, features and interests, is both critical and challenging. The evaluation (based on site surveys) of what is present is essential to making the right choices; extent, species composition and structural assessment are all important, as is the relationship between the scrub and other habitats or features. Table 1.1 lists the range of possible conclusions arrived at from a site assessment and the management objectives to address each. It is quite likely that more than one of these objectives will be applicable within a single site. These aspects are explored in Section 3: Planning for Management.

Table 1.1: Site assessment and comparative objectives.

	Evaluation of Site Assessment	Management objectives
1	There is not enough desired scrub: **1a** Not enough priority scrub (species or community). **1b** Enough priority scrub but it is in poor condition.	To enhance by: Increasing the extent of the priority scrub community. By improving its quality, structural diversity and age range.
2	There is enough priority scrub in favourable condition.	To maintain it in its present condition.
3	There is too much scrub, and it is competing with other priorities (eg open ground habitats).	To reduce its extent and provide a suitable balance between the scrub and other priority habitats.
4	The scrub assemblage consists of alien invasive species that have taken over, or have the potential to do so.	To eradicate the invasive scrub.

For each objective, there are a number of techniques that may be appropriate see Section 5 Management techniques. Monitoring the results of scrub management is essential and the findings should be fed back into the decision making process to refine and improve the ongoing management see Section 6 Monitoring.

Figure 1.1: Decision making flow chart



2. Summary digest of JNCC Report 308 The Nature Conservation Value of Scrub in Britain

2.1 Introduction

Report 308 was produced in association with English Nature (EN) Scottish Natural Heritage (SNH) and Countryside Council for Wales (CCW) and presented a summary knowledge of scrub ecology and conservation. Section two of our handbook provides a brief synthesis of key points, which are relevant to the practical management of scrub. Readers are recommended to refer to Report 308 for additional ecological and conservation information.

At the end of paragraphs in the following sections, italicised paranthesed references refer to the location in Report 308 of the original material from which the entry has been synthesised.

2.2 What is scrub?

Scrub is difficult to define; many scrub types are seral stages in succession from open habitat to woodland, while others can be part of the climax vegetation. A robust definition of scrub has to include both the characteristics of the vegetation itself and the thresholds that separate it from open habitat and woodland.

Scrub is most often described as being dominated by shrubs or bushes, though this may include young or small trees, and so height and growth form are used to separate scrub from woodland. For this handbook, the definition used is that in the JNCC Report 308 'The Nature Conservation Value of Scrub in Britain' (Mortimer *et al* 2000).

> 'Scrub includes all stages from the scattered bushes to closed canopy vegetation, dominated by locally native or non-native shrubs and tree saplings, usually less than 5 m tall, occasionally with a few scattered trees. This includes carr, scrub in the uplands and lowlands (including wood edge habitats), montane scrub and coastal scrub.'

This definition excludes dwarf shrub heaths with ericaceous shrubs, crowberry and dwarf gorse, planted stands of young trees and coppice regrowth. *[308:- 2.1 Definitions of scrub, p15]*

2.3 Conservation importance of scrub communities

Until recently, scrub has often been regarded as a problem to be addressed, with little consideration given to its nature conservation value. However, the importance of scrub communities for nature conservation is now increasingly being recognised.

The Nature Conservation Review (Ratcliffe 1977) includes a section on calcareous scrub, while passing mention is made to heathland, montane and upland scrub. A list of

Swanscombe Skull Site NNR, Kent. Peter Wakely/English Nature

Table 2.1: The classifying criteria for shrub of high nature conservation value.
(adapted from Mortimer *et al*, JNCC report 308, 2000 - 2.2.3.1 Classification of conservation value. P23)

Criteria	Reason
Species of shrub present	Dominant species of high conservation importance and rarity. Eg: Juniper, Box and Downy Willow.
Other species associated with scrub type	Scrub of low botanic interest may be valued for other species such as Nightingale in Blackthorn or lichens on coastal Hazel scrub.
Landscape element within an ecological unit	As a component of an important habitat mosaic, such as the species rich grassland and scrub vegetation of chalk downland or birch and willow at the edge of wet heaths and mires. At altitude, scrub occurs at the interface between woodland and montane heath, and on sheltered coasts, scrub and elfin woodland are part of a natural ecotone.

coastal, lowland grassland and heathland sites given by Ratcliffe as having scrub of conservation value can be found in Appendix 8.1. The 1989 Guidelines for Selection of Biological SSSIs, cites scrub as elements of woodland, grassland, heathland, fen and upland communities, as well as being important to birds and butterflies. Scrub is also included as an element of several UK Biodiversity Action Plans. However, it has not previously been widely considered as a habitat in its own right. *[308:- 1.1.1 Rationale, p13].*

Nonetheless, Juniper and Woolly Willow have Species Action Plans (SAPs) within the UK BAP and a number of Sites of Special Scientific Interest (SSSIs) are designated specifically for their scrub interest or where the presence of scrub is a significant contributory interest *[308:- 1.1.1 Rationale, p13].*

In addition, 25% of the current candidate Special Areas of Conservation (SACs) contain scrub habitats of conservation importance, as described in Annex I of the EU Habitats Directive. Examples of SACs with scrub types of nature conservation importance can be found in Appendix 8.2 *[308:- 3.1.4.3 Special Areas of Conservation (SAC's), p 38].*

Mortimer *et al* (2000) state that the classification of scrub for conservation should take account of the current conservation value of the stand and of the likely outcome of changes caused by succession. Table 2.1 outlines three reasons for scrub vegetation having high conservation value.

The UK BAP lists Broad Habitat classifications compatible with other national land and habitat classifications. Within each Broad Habitat type are a number of Priority Habitats representing distinct management units covering a range of vegetation mosaics including scrub *[308:- 2.2.2.1 Floristic and related classifications p18].* Scrub is an essential component of the grassland and heathland Priority Habitats, as well as being important for a number of priority bird and invertebrate species. Recent conservative estimates put 10% of terrestrial BAP Priority Species as believed to be associated with scrub *[308:- 1.1.1 Rationale, p13].* A table outlining the conservation value of scrub within the various BAP Priority Habitats can be found in Appendix 8.3.

In the European context, several British scrub habitats are listed in Annex I of the 1992 EU Habitats and Species Directive. This identifies these communities as having high conservation value, both in their own right and as a habitat for flora and fauna. In Britain, several habitats listed under this legislation have scrub as a component within a habitat mosaic or as an edge habitat. For example, the substantial conservation interest of areas such as the Chilterns, Morecambe Bay and North Downs is in part due to the diverse scrub communities present as a component within these areas. (Hopkins 1996) *[308:- 3.2.1 Vascular plants, p51].*

The conservation importance of scrub communities lies not only in the rarity of some of the community types, but also in the assemblage of other taxa they support. Rare or otherwise important species are not only associated with BAP scrub communities, but often occur in more widespread communities.

Table 2.2 indicates the number of rare or threatened plant, insect and bird species associated with scrub as listed in Mortimer *et al*, JNCC report 308, 2000.▶

Table 2.2: Rare and threatened taxa associated with scrub.
(adapted from Mortimer *et al*, JNCC report 308, 2000)

Taxa	Status	Number
Plants *[Table 3.2 pp 52-53]*	Nationally Scarce Near threatened Red Data Book UK Priority BAP BAP Conservation Concern	44 9 17 2 15
Insects *[Table 3.8 pp64*	RDB Rare RDB Vulnerable RDB Endangered BAP	139 55 96 62
Birds *[Table 3.5, p59]*	UK Priority BAP BAP Conservation Concern	13 26

2.4 Historical context and distribution

Scrub communities have been present throughout the British landscape since the last Ice Age, as a seral stage in the succession of many habitats. They replaced tundra as the climate warmed and before succession led to woodland becoming the dominant land cover. At that time scrub occurred at the interface between woodland and open habitats such as mountain pasture, coastal and wetland margins. During the Mesolithic period, between 8,000 and 4,000 years BC, large, wild herbivores roamed the landscape. Their browsing and grazing would have had an impact on scrub, possibly encouraging a mobile mosaic of woodland, scrub and open habitats to develop (Vera 2001). Hunter-gatherers cleared woodland to encourage these animals into glades and clearings, concentrating the effects of their browsing and thus suppressing the development of tree cover. The spread of human settlement and developments in tool use led to woodland clearance for agriculture, but scrub would have colonised wherever human or livestock intervention declined.

The distribution of scrub reflects changes in the management history of the countryside. Such change can take place over relatively short periods; between the two World Wars, some abandonment of agricultural land took place, leading to scrub expansion. Almost all of this was reversed by the self-sufficiency drive during the Second World War and the subsequent intensification of agriculture. Today scrub persists as the climax vegetation only where there are extremes of climate and dynamic physical processes, as follows:

- On unstable habitats such as coastal dunes, eroding cliffs, and mobile river floodplain sediments.
- Where extremes of climate, such as strong winds, salt spray zones, and cold temperatures prevent succession to woodland.
- At the interface with open habitats (dry grassland, heath and swamp), and woodland where soil type and hydrology may limit succession.

Upland and montane scrub would have been more extensive prior to the artificially high deer numbers, high sheep stocking densities and moorland burning which are now prevalent.

Open landscapes in the lowlands, such as heathland and calcareous grassland, were created by clearances of primeval woodland and maintained by sheep grazing, rabbit grazing and human activity. Over the last 100 years the human use of these open landscapes, for grazing livestock and gathering fuel, has declined leading to colonisation by scrub. Changes in agriculture have caused the reduction or disappearance of grazing livestock from much of this land and myxomatosis exterminated a large proportion of the rabbit population in the 1950's. Scrub expansion has also taken place in wetlands, resulting again from changes in traditional land use, especially toward the end of the 19th century with abandonment of reed and turf cutting.

In the uplands, grazing pressure has increased significantly leading to the loss and degradation of scrub communities on the moorland edge. However, a downturn in the economics of hill farming, potential changes in agricultural support systems away from headage payments to an increase in extensification schemes plus abandonment of lowland unimproved grasslands and hill farms could lead to a reduction in grazing pressure and an expansion of scrub.

At the same time, landscape-scale conservation projects are now restoring open land habitats like heathland and downland, so a redistribution of scrub is likely in some areas.

2.5 Current distribution

It is difficult to accurately assess the distribution of scrub types. Scrub is often an ephemeral transition between open habitats and woodland, its boundaries are frequently unclear and remote sensing techniques are unable to define or classify it. However, the Centre for Ecology and Hydrology (CEH) Countryside Information System (CIS) survey provides the most accurate indication of Britain's scrub cover (although they do include woodland understorey scrub in their analysis). The survey predicts the occurrence of 'shrub' in each 1km square based on its occurrence in similar squares from the 570 samples in the 1990 Countryside Survey (CS90), undertaken between 1987and 1988. The results show the distribution of scrub to be mostly on calcareous soils in southern England, around the southwestern coasts of England and Wales and on marginal land in the uplands throughout Great Britain. In addition, the distribution of important scrub types can be partially determined from SSSI data and from NVC scrub community distributions, though these do not give a complete picture *[308:- 3.1 Distribution and extent of scrub types in Britain p35].*

Scrub communities occur in most environmental conditions, other than where land is either under woodland or intensively managed. Changes in land management practice, particularly in lowland Britain since the Second World War, have led to the development of an intensely managed landscape with little space for unproductive land. Agricultural support grants encouraged the conversion of large areas of semi-natural habitats to productive farmland. In the process, much of the marginal land in both the lowlands and uplands, which did support scrub has been lost, leaving in its wake a modern presumption that the countryside should be 'tidy', which counts against the development or continuation of scrubby corners. Important scrub areas do, however, occur on temporarily neglected land that has been reserved for development, on abandoned industrial sites, or along the verges of transport systems. Here, mixed communities of native and non-native species grow alongside each other as a combination of secondary succession and landscape planting schemes. These areas are used by a number of species as links between fragmented habitats as well as feeding and breeding areas for small populations of mammals, birds and invertebrates *[308:- 4.1.1 The origins and sources of scrub, pp67-68].*

2.6 Biology & ecology of scrub

The three categories of successional scrub development described by Tansley (1939) are illustrated in Table 2.3.▶

Further, scrub development can be categorised as either primary or secondary succession. Primary succession is the early colonisation of bare habitats such as sand dunes that have not supported an ecological community before. Secondary succession occurs on land where for example grazing or fire have suppressed scrub or tree development, with secondary succession beginning when this limiting factor is removed.

Abandoned mineral workings provide one of the most widespread opportunities for primary succession, especially in lowland Britain. Natural primary succession is less common and more localised, examples occur on coastal shingle and in wet dune systems dominated by Eared and Creeping Willows, along with Bog Myrtle, and in fixed dunes dominated by Sea Buckthorn. As these age beyond the primary stages of development and into established stands of scrub, they become more diverse with Gorse, Broom and Bramble developing on more acidic dunes, or Blackthorn, Hawthorn, Elder and Privet on non-acidic soils. Landslips on cliffs and mobile alluvial deposits on upland rivers also create opportunities for primary scrub development. Examples of secondary succession occur on marginal lands where traditional land management has ceased; where farmland has been abandoned, or on downland, heathland, lowland unimproved grassland and grazing marshes, as well as mires and fens.

By comparison, mechanisms for the development of climax montane willow and juniper scrub communities are considered more complex and require precise conditions. Apart from the effects of climatic and physical features and any human impact, their success is influenced by the size of the stand and the proximity of male and female plants, in order to provide a viable seed source to maintain the stand *[308:- 4.1 Scrub dynamics, pp67-69].*

The factors and environmental conditions influencing the establishment of lowland seral scrub are illustrated in Table 2.4.▶

Table 2.3: Categories of scrub development.
(Adapted from Tansley, AG, (1939), *The British Islands and their Vegetation, Cambridge University Press*)

Scrub type	Description
Seral scrub	The most frequently encountered and familiar scrub type, usually developing as a succession from open grassland or heath, to woodland.
Sub-seral scrub	Scrub influenced primarily by human factor. This may include grazing, cutting or burning, which arrests establishment of trees but allows continuous growth of scrub. The most common stand types frequently include Hawthorn and Blackthorn as the main component.
Climax scrub	Deposition, natural climatic, altitudinal, geological and hydrological features are major influencing factors behind maintaining an indefinite scrub community and preventing tree growth. Rare remnant examples can be found chiefly on the coastal cliffs of the southwest, small islands on Scottish lochs and west Scotland coastal regions, the Scottish Highlands and parts of Wales and Cumbria.

Table 2.4: Factors and environmental conditions affecting scrub invasion.
(Adapted from Tansley, AG, (1939), *The British Islands and their Vegetation, Cambridge University Press* and from Mortimer *et al*, JNCC report 308, 2000 *4.1.2 Mechanisms of scrub invasion p68*)

Mechanism	Conditions
Succession by one species dependent on environmental conditions created by another (facilitation).	Early processes of succession promote the development of organic matter, which along with fixation of nitrogen through certain plants and atmospheric deposition encourages the establishment of primary succession scrub.
The success of a plant species against competition from another (tolerance).	The ability of later successional species to tolerate reduced light and nutrients of earlier colonists, eventually succeeding them as the dominant.
Slowing of the rate of succession to scrub (inhibition).	Relating to the longevity of individual species and levels of disturbance provide opportunities for succession. Rank grassland can suppress the rate of scrub encroachment unless disturbed by trampling and poaching by livestock or the effects of fire. Intensive grazing can have the same effect on young scrub, leading to eradication in extreme cases.
The effects caused by the ecology of the initial plant species present (floristic composition).	Fast-growing short-lived species are replaced by longer-lived, slower growing species. This might be the factor behind secondary succession where substantial seed sources are present.
The effects of birds and mammals on the spread of scrub (seed dispersal or predation).	The majority of shrubs produce fruits and are adapted for dispersal by birds, especially members of the thrush family. Mammals also help with some species. For example, it is believed Rabbits assist in the dispersal of hawthorn on clay soils (Tansley 1939). Species such as Bullfinch and some small mammals are seed predators and will affect the rate of succession and spatial distribution between stands of scrub.

The development of scrub from open stands toward closed canopy and on towards secondary woodland provides the opportunity for a valuable wildlife interest to develop. The physical structure, age and species composition influence the assemblage of plants and animals associated with the different scrub types, and these in turn have an impact on the scrub communities.

The structural stand types that represent seral and sub-seral succession are described as thicket scrub and woodland scrub (Tansley 1939). Thicket scrub often establishes with a cessation of management. Initially the percentage of grass and herbaceous plants to shrub is high, but as scrub cover increases, this replaces the field layer of herbaceous plants. For a period following canopy closure, the scrub remains impenetrable but in time develops into a stand of tall leggy plants with bare earth and leaf litter beneath. In the absence of any cutting or grazing, the dense thicket remains for some time, eventually turning to woodland as bushes die and provide a niche for trees to establish.

Woodland scrub allows the establishment of a core of trees growing amongst the scrub layer, which provide a nucleus of seed that encourages a rapid succession to woodland. While the ecological processes of woodland and thicket scrub are similar, the presence of trees increases structural diversity, creating a wider range of shade, which encourages an increase in ground flora and fauna. This is particularly evident at the interface of woodland edges, rides and glades.

On upland and lowland heath, much of the scrub regeneration comprises those tree species that will ultimately dominate and form the climax woodland. The structural phases of the development to woodland are simple by comparison to other types of lowland thicket and woodland scrub. The relatively low species composition associated with this type of scrub has low diversity of microhabitats and cast dense shade *[308:- 4.1.3 Structural dynamics of scrub development, p69-70].*

The distribution of shrubs within the habitat is influenced and affected in a number of ways. For example, the use of perches by birds, which deposit seeds via their gut, can lead to expansion from isolated bushes. Conversely, seed predation by small mammals may assist in creating open patches. The ecology of scrub and tree species will also influence distribution, for example: large trees cast shade and reduce scrub growth, whereas suckering species such as Blackthorn will increase the density of scrub.

The grazing of scrub by livestock or wild mammals such as deer and Rabbit influences the distribution and extent of scrub, slowing or preventing its expansion from the main core of regeneration, selecting for less palatable species and diversifying the structure of the stands. Dense, especially thorny, scrub at the margins of stands offers some protection to palatable species which are otherwise vulnerable to grazing. Edges are more complex and diverse than within the scrub stand, and are occupied by a wider range of plant and animal species. *[308:- 4.1.4 Spatial patterning, mosaics and edges, p70].*

The accumulation of leaf litter can affect the conservation of scrub. The breakdown of leaf litter releases nutrients that change the chemistry of the soil and increase the organic content. Between them, these can make it difficult to change closed canopy scrub to open habitat, for example, species-rich grassland. Opening the structure by coppicing can stimulate excess regeneration from cut stumps and creates a flush of highly dominant species which prevent more varied communities from developing. This is likely to be a lengthy process (years, possibly decades) unless intervention techniques are adopted such as litter stripping. *[308:- 4.1.5 Environmental changes associated with scrub development, p71].*

2.6.1 Plant communities

There is a wide range of scrub communities. Scrub develops on open habitats, in response to the removal of an ecological restraint (eg grazing or burning), and occurs as scattered plants in an open grassland or heathland community. As the scrub continues to develop it takes over from the host community and so can be considered as a community in its own right. In those scarce conditions where scrub is part of the climax vegetation type, it forms distinct communities.

A number of scrub communities occur on relatively stable, open ground with good fertility and moisture availability. These constitute the majority of scrub cover in Britain. In areas with harsher environmental conditions, the plant communities tend to be specialised to suit those conditions.

Table 2.5: Environmental conditions and effects on community composition/structure.

Factor	Effect
High wind exposure	Stunted growth, usually away from prevailing wind.
Salt spray	Salt intolerant species absent; stunted growth, usually away from prevailing wind.
Grazing	Unpalatable species dominate. Palatable species often with a distinct browse-line.
Water-logging	Water-logging resistant species dominate.
Very free draining soils	Drought resistant species dominate.
Cold climate	Frost sensitive species are absent.
Nutrient impoverished soils	Many species excluded.
pH	Species composition of scrub and herbaceous flora modified.

2.6.1.1 Community classification

The National Vegetation Classification (NVC) is a standardised method used to describe vegetation communities in Britain. It classifies vegetation communities by their species composition and the most frequent associations, each of which is given a reference code and name, eg W16 Oak-Silver Birch-Wavy-hair Grass woodland. Scrub communities are described where they are distinct from woodland types, but some of the woodland communities also occur as scrub in certain situations (for instance in the early stages of development, or in hostile conditions). NVC describes five scrub and two under-scrub communities. Open habitats may contain scrub, but despite the presence of the scrub may still classify as open habitat; for example, birch scrub on dry heathland can fall within the heath community when the balance of all its components species are taken into account. Only when the scrub develops to such an extent that the ground flora is altered will it re-classify as woodland, in this case, W16 Oak-Silver Birch-Wavy-hair Grass woodland.

A description of all major NVC scrub communities and listing of their typical scrub species can be found in Appendix 8.4.

2.6.1.2 Summary of communities

The most ubiquitous scrub communities in lowland Britain are W21 Hawthorn-Ivy scrub and W24 Bramble-Yorkshire Fog underscrub. They are most commonly associated with disturbed or abandoned ground, including derelict land, embankments and spoil heaps. They also feature in grasslands where the constraint on scrub development (mowing or grazing) has been removed, as well as at the woodland edge. These are communities commonly associated with man's use of the landscape, but in some circumstances they are capable of developing naturally; for example, W21 occurs on natural landslips or cliffs.

W24 Bramble-Yorkshire Fog underscrub community is characteristic of abandoned farmland and a common feature of reserved building land, road verges and embankments, and is a familiar urban and sub-urban habitat. Where it is not disturbed by cutting or grubbing-up, W24 will, on neutral and base rich soils, often develop into the W21 Hawthorn-Ivy community, and into W23 Gorse-Bramble scrub on acid soils.

The W22 Blackthorn-Bramble community is similar to W21 described above, although it favours moist, deep, rich soils. It too is a widespread and commonly occurring scrub type, and occurs in similar broad habitats to W21. It frequently develops in rank, unmanaged neutral grassland, and is tolerant of some exposure on sea cliffs where other woody species cannot survive. In these locations it can be the climax vegetation.

There are three NVC scrub communities which are dominated by single woody species; W13 Yew wood, and W19 Juniper wood, SD18 Sea Buckthorn scrub. However, even these are not entirely pure stands as other woody components only occur at low frequency.

2.7 Value for wildlife

Scrub provides an important habitat for many species. This section provides an overview of the value of scrub for key groups of fauna and flora. It is important to develop an understanding of the uses of all the niches provided by scrub before undertaking any management. This is further illustrated in Section 3: Planning for management and Section 6: Survey and monitoring.

2.7.1 Plants

Scrub communities themselves are not always valuable for plants as many are early successional and ephemeral habitats. Generally, plants of value are associated with scrub margins or open scrub. In some cases, scrub can be a distinct problem for botanical conservation where it invades onto species-rich plant communities. However, scrub can be an important habitat for epiphytes, especially in the mild, moist climate of coastal northern and western Britain. The Hazel scrub of northwest Scotland is particularly important, for bryophytes as well as supporting a number of lichens endemic to Britain. Wet scrub is an important habitat for a number of Sphagnum species, as is Elder in some locations. Mature scrub is particularly important for epiphyte communities. Ecological continuity and stability is of key importance for maintaining these communities *[308:- 3.2.2 Lower plants, p56].*

Closed scrub often casts a heavy shade, uses much of the surface soil moisture and nutrients, and so limits the species richness of the ground flora communities. However, some scrub-grass mosaics, in particular the mixed scrub communities associated with chalk and limestone, are important for their rich plant life. This includes taller species such as Bloody Crane's Bill, Goldilocks Aster and Meadow Rue that are susceptible to grazing pressure but are afforded some protection by the scrub. Other scrub types that are associated with herb rich flora are the Hazel and montane willow communities.

There are a number of factors determining the species richness and composition of the ground flora; site management – present and historic, the proximity of potential colonists and successional stage of the scrub. Scrub cover in excess of 50% begins to shade the associated ground flora leading to the eventual loss of that community. Some of the affected species have long seed viability, but for most species the seed bank deteriorates quickly under the closed canopy *[308:- 4.2.1.2 Ground flora, p72].* Table 2.6, lists a selection of scarce herbaceous plants and their association with scrub.▶

Bloody cranesbill. Allan Drewitt/English Nature

Table 2.6: Scarce herbaceous plants and their uses of scrub habitat.
NSc = Nationally Scarce, N.Th = Near threatened, Vul = Vulnerable.
(adapted from: Mortimer *et al*, JNCC report 308, 2000. *Table 3.2 pp 52-53*).

Species	Status	Use of scrub habitats
Man Orchid	NSc	Found only at the edge of scrub on calcareous soils. Cannot tolerate heavy shade or heavy grazing.
Baneberry	NSc	Shaded sites on calcareous soils in northern England. Tolerates shade, but not competition.
Italian Lords-and-Ladies	None	In woods and scrub on the south coast.
Lesser Hairy Brome	NSc	Woodland species, sometimes found in scrub.
Hedge Bindweed	None	Frequent climber over low scrub.
Spreading Bellflower	NSc	Requires open conditions, so cannot survive under dense scrub. Possibly found at the edge of scrub.
Fibrous Tussock Sedge	NSc	Fen species, sometimes found in carr, but scrub invasion creates unsuitable habitat for it.
Fingered Sedge	NSc	Open woods and scree on limestone soils. Requires some shade, but disappears if it becomes too shaded.
Elongated Sedge	NSc	In Alder and willow carr subject to winter flooding.
Coral Root Orchid	NSc	In Alder and willow carr and birch woods.
Dark-red Helleborine	NSc	On limestone in moderately shaded situations.
Narrow-lipped Helleborine	NSc	On open stony ground beneath birch in Scotland and northern England. Intolerant of heavy shade in these situations.
Green-flowered Helleborine	NSc	In birch scrub, usually on sandy soils, and in riverside willow carr.
Chiltern Gentian	NSc	Does occur amongst open scrub on chalk, but prefers sheltered grassland sites with little competition.
Stinking Hellebore	NSc	In open areas amongst scrub on chalk and calcareous clays.
Marsh Pea	NSc	In some fens with scrub.
Purple Gromwell	N.Th	Amongst dwarf scrub on coastal cliffs. Also at woodland edge.
Common Cow-wheat	None	Under scrub on acidic soils.
Bastard Balm	NSc	In light shade in hedgebanks and scrubby areas in the southwest.
Lady Orchid	NSc	In woods and scrub on chalky soils in Kent and rarely elsewhere.
Ivy Broomrape	NSc	Parasitic on Ivy in sheltered areas, usually near the coast.

Table 2.6: Cont...

Species	Status	Use of scrub habitats
Greater Broomrape	NSc	Parasitic on gorse and broom scrub.
Bladderseed	Vul	Open birch and gorse scrub in Devon and Cornwall.
Narrow-leaved Lungwort	NSc	Scrub provides protection from grazing. Occurs in Dorset, Hampshire and Isle of Wight.
Suffolk Lungwort	Vul	Scrub provides protection from grazing.
Round-leaved Wintergreen	NSc	Often under willows, in fens and dune slacks.
Small-leaved Sweet-briar	NSc	In open scrub on calcareous grassland.
Balm-leaved Figwort	NSc	In scrubby margins and hedgerows in southwest England. Possibly alien.
Marsh Fern	NSc	In fens, and under carr.
Bithynian Vetch	NSc	Sometimes found scrambling over hedges and bushes.
Yellow Vetch	NSc	Found in open areas at the edge of Blackthorn scrub on cliffs.

2.7.2 Invertebrates

The composition of plant species, rates of succession, physical and age structure as well as spatial distribution ll combine to influence the number and variety of invertebrate species found using scrub. Many insect and mite species feed on shrubs and many more on the associated lichens, algae and fungi of the bark and wood. These provide food for a host of other predatory insects, which all in turn provide food for birds, insectivorous mammals, reptiles and amphibians.

Most insects associated with scrub specialise in the decaying wood component. The majority of the adults of these species disperse in spring and early summer for other phases of their life cycle. To meet their needs, they rely on the close proximity of suitable sources of nectar and pollen, which enable them to gain the energy and proteins to help in their reproduction. A key element in this process is the maintenance of a diverse mosaic, with a well-structured interface between scrub and other open habitats, with suitable basking and mating areas, as well as shelter and shade with high humidity and clear flight lines to sources of nectar.

For early flying insects, Hawthorn is perhaps the most important scrub species, even for those insects specialising in decaying wood. The ecology of many of these species has adapted to coincide with the peak time of flowering. Other shrubs with important nectar sources are Holly, Guelder Rose and Bramble, as well as herbs such as Hogweed, Angelica, Ragwort and Thistle. Some wood specialist insects visit the flowers not just for nectar, but also to prey on others feeding on the nectar.

The number of plant feeding insects is related to the size and abundance of each plant as well as its geographic spread. For example, shrub families with no other or few representatives such as Holly, Box and Yew have few associated insects. These species also have toughened leaves and high levels of chemical deterrent. The provenance of a shrub species also has an effect on the number of insect species recorded. For example, five of the eight genera of shrub with fewer than 30-recorded insect species are introduced. *[308:- 3.2.4 Invertebrates, p60]*

A third of the 2,219 insect and mite species that have been found feeding on 31 species of woody shrub in Britain are genus specific (Ward and Spalding, 1993). Of these, butterflies are most frequently recorded, followed by true bugs, bees, wasps and ants, and two-winged flies. Most insects are specific to plant families, but relatively few are specific to a genus, and even fewer are species specific. There is no correlation between the total number of species found on each genus and the number that are specific to it.

Some shrub species, such as Juniper, which occupy a wide range of habitat types over a wide geographic range can have a high proportion of genus specific insects associated with them (41% for Juniper). The Maple, Willow and Rose families are also widely distributed, and they have relatively high proportions of genus specific species (31%, 29% and 20% respectively). The insects feeding on these genera are mainly those that feed externally on the plant, these include gall midges and mites, leaf mining micro-moths and aphids. Introduced shrubs generally have no genus specific insect species associated with them, only Tamarisk of the four non-native species has any genus specific species associated with it. *[308:- 3.2.5 Specificity of insects to the shrub genus, p60]*

Chequered skipper. Roger Key/English Nature

2.7.2.1 The effects of succession, structure and spacing

Certain insect communities are associated with certain successional stages of scrub. For example, some only associate with specific stages of growth in a shrub species, some with scrub clearance and others with herbaceous plant species composition. Not all species that use scrub use it all the time, some will feed on nectar from flowering shrubs while their larvae feed on herbaceous species, others will use it for the egg and early lar*val stage before moving to other species [308:- 4.2.2.3 Invertebrates, 76].*

Many invertebrate species have quite precise niche requirements and maintaining a varied mosaic of large and small shrubs with a range of age and structure will ensure that as many niches as possible are available. A diverse structure means there are more places in which insects can feed and lay eggs as well as find shelter from predators and to over winter. The removal of all of a particular resource from a site at once, for example clearing all small pines from a heath, can cause local extinctions. *[308:- 4.2.3.1 Invertebrates, p79]*

Many insects use different habitat types to complete each stage of their life cycle. In addition, some species have restricted dispersal abilities and need all the necessary resources (food plants, micro-climate, egg laying sites) within a short distance to fulfil their needs. This means that a range of age, structure and shrub species occurring within a small area is more beneficial than a large uniform block of single species and age. *[308:- 4.2.4.1 Invertebrates, p80]*

The wider assemblage of shrub species and habitats in which scrub is present are important in determining the species and abundance of invertebrates using the scrub. One of the most important factors is the interface between habitats that provides a wide range and abundance of food plants and microclimates and so tends to attract more species.

The invertebrates associated with scrub systems may be allocated to a series of guilds. There may be little association between species in each guild (ie no community) but, nevertheless, they share an association with scrub systems.

Pollen/nectar guild: Flowering shrubs are very important in spring for social and solitary bees and for adults of other species which emerge from hibernation.

Leaf-feeding guild: Many species have larvae which eat the leaves of shrubs and other plants of scrub systems. These include leaf-miners, gall formers and leaf rolling species.

Stem-nesting guild: Associated with holes in woody growth. These may be the exit burrows of beetles which feed within the woody growth or the soft pith or core of twigs such as elder or bramble. Such tunnels are colonised by solitary wasps which use them as nests, eg Crossocerus spp.

Structure Guild: Many invertebrates use scrub because of the structural features which it provides. The growth form and age class structure is the most important factor, eg Spiders, beetles of exposed riverine sediments (river shingle beds).

Shelter Guild: Scrub provides shelter from wind and rain and shade from excessive sunlight. There is a guild of species which require the conditions which scrub provides, eg Duke of Burgundy Fritillary butterfly.

Foraging Guild: Some species forage for their prey on scrub but do not eat the scrub plants themselves, eg the Narrow-headed Ant (Formica exsecta) nests in open heathland but forages on birch scrub.

Table 2.7 lists some important invertebrate species and their use of scrub habitats. ▶

Table 2.7: Insects of conservation importance and their use of scrub habitats.
Local = Local, RDB1 = RDB1 (See Insect RDB for details - RDB1 is the most threatened, RDB4 is the least threatened),
Na = Nationally Scarce Category A (thought to be present in 16-30 10-km squares),
Nb = Nationally Scarce Category B (thought to be present in 31-100 10-km squares),
Most of the species in the table are very rare - RDB1 and RDB2 will be very rare, RDB3 more widespread but still rare.
(adapted from: Mortimer *et al*, JNCC report 308, 2000 *Table 3.10 pp65*).

Species	Status		Use of scrub habitats
	BAP	RDB	
Pearl-bordered Fritillary	Y	Local	Scattered scrub, woodland clearings/edge. Widespread, but rapidly declining.
Chequered Skipper	Y	RDB4	Scattered scrub and grassland, woodland clearings/edge. Western Scotland only.
New Forest Cicada	Y	pRDB1	Open scrub, woodland edge. Perhaps extinct, one site in New Forest.
Hazel Pot Beetle	Y	RDB1 Cat. 1	Birch scrub on heathland. Formerly widespread, now known from only three counties.
Ten-spotted Pot Beetle	Y	RDB2	Willow and birch scrub in Sphagnum bogs. Highlands and West Midlands mosses.
A leaf beetle *C. nitidulus*	Y	RDB1 Cat. 1	Birch and hazel in downland scrub.
Dingy Mocha	Y	RDB3	Heathland willow scrub in Dorset and New Forest only.
A hoverfly *Doros profuges*	Y	RDB2	Downland scrub. Widespread but rare.
Southern Wood Ant	Y	Reg. notable	Scrub. Widespread in southern Britain.
A weevil *Melanapion minimum*	Y	p RDB3	Willow carr. Known from scattered sites in southern Britain, but lost from many of these.
Cousin German	Y	RDB3	Birch scrub. Scottish Highlands.
Square-spotted Clay	Y	Nb	Scrub patches. Widespread, but declining.
Barred Tooth-striped Moth	Y	Na	Downland scrub with wild privet. Widespread but local.
Black Hairstreak		RDB4	Blackthorn scrub. South Midlands.
White-spotted Pinion	Y	Na	Elm scrub to breed and Bramble scrub to nectar. Widespread but very local.
Juniper Carpet		Nb	Juniper scrub in the Scottish Highlands and locally elsewhere.
A jewel beetle sp.			Burrows into old hawthorn stems. Depends which species.
Barberry Carpet moth	Y	RDB1	Barberry.

Table 2.7: Cont...

Species	Status		Use of scrub habitats
	BAP	RDB	
Scarce Vapourer moth		RDB2	Various shrub species. Hedgerows, woodland edge.
Small Eggar moth			Various shrub species. Larva in dense silken web.
Small Ermine moths			Several species. Each host-shrub specific. Larvae in silken webs.
Pale Shining Brown moth	Y		Grassland scrub.
Duke of Burgundy Fritillary butterfly			Grassland scrub.
Narrow-headed Ant	Y		Sparse birch scrub on Heathland.
Dark Bush Cricket			Bramble patches, hedgerows.
Speckled Bush Cricket			Rank grassland & scrub.
Great Green Bush Cricket			Rank grassland & scrub.
Oak Bush Cricket			Rank grassland & scrub.
Dusky Cockroach			Heathland and grassland scrub.
Short-winged Earwig			Woodland edge scrub.
Lesne's Earwig			Chalk scrub.

2.7.3 Reptiles and amphibians

There is relatively little information about the value of scrub habitats to amphibians and reptiles. However, a knowledge of the ecology of reptiles and amphibians can point to appropriate features for them. Suitable scrub provides foraging opportunities, as well as refuge and basking areas and winter hibernacula. Scrub encroachment is cited as a threat for Sand Lizard, a Priority UK BAP Species. Dense scrub immediately around the southern margin of ponds can be a problem for amphibians (Great Crested Newts in particular) as it increases shade levels. However, overzealous clearance of scrub is seen as being equally damaging. While scrub invasion threatens several species of reptile and amphibian, especially on heathland sites, maintenance of a good structural mosaic of scrub is of high importance and the impact of any management needs to be taken into consideration. The positioning and type of scrub can be important; scrub-grassland or scrub-heathland interfaces with a southerly aspect are especially valuable for reptiles, as they provide good basking sites close to dense cover. Uniform, dense scrub across an entire site is undesirable *[308:- 3.2.5 Reptiles and amphibians, p66].*
See Table 2.8.

Common toad. Roger Key/English Nature

Table 2.8: Reptiles and amphibians and their use of scrub habitats.
EC Annex numbers relate to the Directive of Natural Habitats and of Wild Fauna and Flora 1992; Annex IIa requires the designation of Special Areas of Conservation for the species, Annex IVa requires strict protection of the species.
Bern Convention (The Convention on the Conservation of European Wildlife and Natural Habitats) species listed in Appendix III are regulated from exploitation; certain means of capture or killing are banned.
WCA: (Wildlife and Countryside Act 1981) Schedule 5 gives species special protection against killing, injuring or taking an animal, damaging, destroying or obstructing its place of shelter and selling or offering for sale.
(Adapted from Gent A.H. & Gibson S.D. eds, (1998) *Herpetofauna worker's manual*. Peterborough, JNCC – *Chapter 6 Habitats and their management pp61-69*).

Species	Status	Use of scrub habitat
Adder	Bern Convention Appendix III; WCA Schedule 5	Light patchy scrub on open sunny south facing banks, adjacent to vegetation mosaics with bare ground, tussocks, short grass and dense scrub. Dense humid scrub linking other suitable moist summer and drier wintering areas, with good layers of leaf litter for burrowing. Decaying wood for cover, hibernation and basking.
Common Lizard	Bern Convention Appendix III; WCA Schedule 5	Open sunny south facing banks, with adjacent varied vegetation mosaics of bare ground, tussocks, short grass and well-broken scrub. Dense humid scrub linking to other wetland areas and with good layers of leaf litter for burrowing. Decaying wood for cover, hibernation and basking.
Common Toad	Bern Convention Appendix III; WCA Schedule 5	Open sunny south facing edges to ponds and banks, with adjacent varied vegetation mosaics of bare ground, rough grassland and patchy scrub giving up to 5% shading of the pond surface. Dense humid scrub linking to other wetland areas and with good layers of leaf litter for burrowing. Decaying wood for cover, hibernation and basking.

Table 2.8: Cont...

Species	Status	Use of scrub habitat
Grass Snake	Bern Convention Appendix III; WCA Schedule 5	Open sunny south facing edges to banks, with adjacent varied vegetation mosaics of bare ground, rough grassland and patchy scrub, linking to ponds and other riparian features with light to dappled of the edges. Dense humid scrub with good layers of leaf litter for burrowing and rough grassland edges, linking to other suitable areas. Decaying wood for cover, hibernation and basking.
Great Crested Newt	EC Annex IIa, IVa; Bern Convention Appendix III; WCA Schedule 5	Open sunny south facing edges to ponds and banks, with adjacent varied vegetation mosaics of bare ground, rough grassland and patchy scrub giving up to 5% shading of the pond surface. Dense humid scrub linking to other wetland areas and with good layers of leaf litter for burrowing. Decaying wood for cover, hibernation and basking.
Natterjack Toad	EC Annex IVa; Bern Convention Appendix III; WCA Schedule 5	Prefers open habitat without extensive scrub, save for small isolated dense bushes. Large isolated mature bushes, cut down during clearance, part lifted to expose the root ball and left, may provide a useful hibernacula.
Palmate Newt	Bern Convention Appendix III; WCA Schedule 5	Open sunny south facing edges to ponds and banks, with adjacent varied vegetation mosaics of bare ground, tussocks, short grass and scrub. Dense humid scrub linking to other wetland areas and with good layers of leaf litter for burrowing. Decaying wood for cover, hibernation and basking.
Sand Lizard	EC Annex IVa; Bern Convention Appendix III; WCA Schedule 5	Light patchy scrub above open sunny south facing banks, adjacent to vegetation mosaics with bare ground, tussocks, short grass and dense patches of humid scrub with good layers of leaf litter for burrowing. Decaying wood for cover and basking.
Slow Worm	Bern Convention Appendix III; WCA Schedule 5	Dense humid scrub with good layers of leaf litter for burrowing. Decaying wood for cover, hibernation and basking.
Smooth Newt	Bern Convention Appendix III; WCA Schedule 5	Sunny south facing edges to ponds and banks, with adjacent varied vegetation mosaic of bare ground, tussocks, short grass and scrub. Dense humid scrub linking to other wetland areas and with good layers of leaf litter for burrowing. Decaying wood for cover, hibernation and basking. Seems to prefer heavier shade and marginal vegetation than Palmate Newt.
Smooth Snake	EC Annex IVa; Bern Convention Appendix III; WCA Schedule 5	Light patchy scrub on open sunny south facing banks, adjacent to mature vegetation mosaics with bare ground, tussocks, short grass and dense humid scrub, with good layers of leaf litter for burrowing. Decaying wood for cover, hibernation and basking.

2.7.4 Birds

Scrub is an important habitat for a number of breeding and wintering bird species. There are 39 species of conservation concern associated with scrub habitats of which 28 species nest in scrub. Scrub is also used by birds as a safe roost site and as a source of invertebrates or berries as food. A survey of 39 sites containing a minimum of 50% scrub cover recorded 89 different species. The most abundant breeding species were Willow Warbler, Wren, Blackbird, Dunnock, Yellowhammer and Linnet. *[308:- 3.2.3 Birds, p56]*

The use of scrub by birds is highly complex but tends to be determined by vegetation structure rather than species composition. The number of species using scrub is likely to be higher in areas with a greater diversity of structure. As different shrub species have different growth forms, structural variation will tend to occur in stands of mixed species and bird species richness is likely to be greater.

Mixed species stands will support a wider range of invertebrates, and produce a greater variety of fruits, hence they provide more opportunities for feeding. Most fruit eating birds will feed on a range of shrub species but can often show preferences decided by the availability of other supplies of berries in the area. Seasonal availability of fruits means that few birds are entirely reliant on one species alone. Many species of birds have a mutually beneficial relationship as seed dispersers of shrub seeds. However, some birds eat seeds and so deplete the seed resource. Invertebrate biomass is also important and some scrub species support a higher biomass of invertebrates than others *[308:- 4.2.1.4 Birds, p73].*

2.7.4.1 The effects of succession, structure and spacing on birds

The structure of the scrub influences which species are likely to use it. Different species are adapted to the different stages in its growth, from pioneer bushes through to the point where it develops into woodland. For example, Whitethroats and Yellowhammers use low, scattered bushes, whereas Blackcaps and Garden Warblers are associated with the near woodland scrub stages. *[308:- 4.2.3.2 Birds, p79]*

Greater species richness is found in mosaics of varying age, where birds benefit from the structural diversity. In some cases, birds will hold territories around widely separated patches of scrub. Certain species, such as Black Grouse and Cetti's Warbler, appear to use areas where scrub is only a small proportion of the habitat mosaic. Birds such as Blackbird and Song Thrush, which feed in shorter vegetation but nest in thick cover, use an intimate mosaic of grassland and scrub.

As well as being an important breeding habitat scrub is an important source of food for autumn passage migrants and winter visitors. For some of these birds, scrub provides only part of a resource but is important none the less for maintaining survival and productivity. Certain raptor species prey on thrushes, starlings and finches that habitually aggregate in scrub to roost in winter. Some, such as Long-eared Owl, also roost and breed in scrub themselves. [308:- 4.2.4.2 Birds, p80]

Table 2.9 lists a selection of key bird species and the use they make of scrub.

Nightjar. Kev Wilson/Lincolnshire Wildlife Trust

Table 2.9: Selection of key bird species and their use of scrub.
BoCC: Birds of Conservation Concern 2002-2007. Red: Globally threatened, or recent rapid decline in population or range, or a recent historic decline showing no recovery. Amber: Unfavourable European conservation status, moderate recent range decline, recent recovery following historic population decline, rare breeder, or internationally important or localised populations. Green: Species that fill none of above criteria. BAP: Biodiversity Action Plan. PBAP: Priority BAP species with a recovery plan. (adapted from: Mortimer *et al*, JNCC report 308, 2000 Table 3.5 p59).

	Status		
Species	**BoCC**	**BAP**	**Use of scrub habitats**
Black Grouse	Red	PBAP	Upland open birch and Juniper scrub for breeding, wintering and feeding.
Bullfinch	Red	PBAP	Lowland mixed scrub, especially with Hawthorn and Blackthorn, used for nesting, feeding and as a winter roost.
Cirl Bunting	Red	PBAP	Nests and roosts in lowland scrub (SW England only).
Corn Bunting	Red	PBAP	Roosts in lowland mixed scrub and wet scrub.
Grasshopper Warbler	Red		Nests in wet scrub, coastal dune scrub, lowland Hawthorn and Blackthorn.
Linnet	Red	PBAP	Nests and roosts in Gorse scrub, mixed scrub and coastal dune scrub.
Marsh Warbler	Red	PBAP	Uses the edges of Hawthorn and wet scrub in which to breed.
Nightjar	Red	PBAP	Forages over lowland mixed scrub and wetland scrub.
Reed Bunting	Red	PBAP	Uses lowland Hawthorn and Blackthorn mixed scrub, wet scrub and coastal scrub in which to nest and feed in and as a winter roost.
Song Thrush	Red	PBAP	Uses a range of scrub types for nesting, feeding and roosting, including lowland mixed scrub, upland scrub, wet scrub and coastal dune scrub.
Tree Sparrow	Red	PBAP	Winter roosts in lowland mixed scrub, especially Hawthorn and Blackthorn.
Turtle Dove	Red	PBAP	Nests in lowland mixed scrub, especially hawthorn and blackthorn, and willow carr. Feeds in open weedy habitat.
Willow Tit	Red		Uses mature damp scrub, especially with birch, willow or Alder, year round.
Yellowhammer	Red		Uses Gorse, lowland mixed scrub and coastal dune scrub in which to nest and feed in and as a winter roost.
Dunnock	Amber		Resident in mixed scrub and coastal dune scrub and sometimes in scrub on lowland heathland.

Table 2.9: Cont...

Species	Status		Use of scrub habitats
	BoCC	BAP	
Fieldfare	Amber		Feeds on berries and roosts in mixed scrub and coastal dune scrub during the winter.
Firecrest	Amber		Breeds in lowland mixed and conifer scrub. Winters in lowland mixed scrub, and coastal scrub.
Goldcrest	Amber		Mainly mixed scrub, occasionally breeding, mostly as a winter feeding and roosting habitat.
Merlin	Amber		Roosts in and hunts over upland (summer), lowland heathland and coastal dune scrub (winter).
Nightingale	Amber		Nests in dense mixed scrub, usually with Hawthorn, Blackthorn and or Bramble.
Redwing	Amber		Feeds on berries and roosts in mixed scrub and coastal dune scrub during the winter.
Stonechat	Amber		Uses upland scrub, especially Hawthorn, Gorse on lowland heathland, and coastal scrub for breeding. Uses coastal scrub in winter.
Willow Warbler	Amber		Breeds in open lowland mixed scrub, upland scrub, and coastal scrub.
Blackcap	Green		Breeds usually in tall open mixed scrub, and sometimes winters.
Cetti's Warbler	Green		Resident in wet land edge scrub, especially Bramble.
Chiffchaff	Green		Breeds in a variety of lowland, upland and coastal scrub.
Dartford Warbler	Green		Resident mainly on lowland heathland with gorse scrub. Also occasionally breeds in gorse, Hawthorn and Blackthorn on coasts and downs.
Garden Warbler	Green		Breeds in tall lowland scrub with dense ground cover.
Greenfinch	Green		Resident in a range of lowland and upland mixed scrub, and in coastal dune scrub.
Lesser Whitethroat	Green		Breeds in early successional thorn and Bramble scrub, also in coastal dune scrub.
Long-eared Owl	Green		Breeds in mixed scrub, especially thorns, and in wet scrub. Roosts and hunts roosting birds in mixed thorn scrub in the winter.
Sedge Warbler	Green		Uses wet scrub, coastal dune scrub, sometimes lowland Hawthorn and Blackthorn mixed scrub for nesting.

2.7.5 Mammals

Scrub provides good feeding, denning and refuge to a variety of mammals. Most British species are primarily woodland dwellers and find the scrub interface of the woodland edge of great value. Badger, Fox, Rabbit and deer species make use of scrub where woodland is sparse. For small mammals especially, patches of scrub with a diverse structure and tall, herbaceous swards growing around the edge are particularly good for feeding, shelter and breeding. Good scrub structure is valuable for Dormice, which use continuous cover scrub, especially on the woodland edge. Bats will feed along the sheltered edges of well-structured rides and glades among scrub stands, where nectar-rich plants and warm microclimates attract high numbers of invertebrates.
In autumn certain scrub species, especially the rosaceae, produce prolific fruits. These are important in the diets of a range of mammals, and for some help secure body condition prior to hibernation. In river plains, wet scrub can provide shelter for Otters, either to build their holts or to lie up during the day *[308:- 3.2.6 Mammals, p66]*.

Table 2.10: Selection of mammal species and their generalised use of scrub as a resource.

Species	Status	Use of scrub habitats
Hedgehog	Common	Favours areas where there is a mosaic of grassland, woodland, scrub and hedgerow. Uses scrub for daytime cover and hibernation sites, eg under bramble or brushwood.
Bat spp	Generally declining	When feeding, bats depend on habitat mosaics and habitat corridors that connect feeding and roosting areas. Mature, structured scrub may be beneficial in this respect.
Rabbit	Common and widespread	Uses low dense scrub as refuge cover to which to retreat from grassy feeding areas. The bark and shoots of many scrub and tree species are eaten, which may have detrimental or beneficial effects depending on circumstances. Avoids eating Elder.
Bank Vole	Common and widespread	Favours deciduous woodland and thick scrub. Climbing actively, it eats fruits, seeds and leaves of woody plants. May strip bark of Elder bushes.
Wood Mouse	Common and widespread	Favours woodland and scrub, living in runways below the litter but actively climbing to feed on fruits, nuts, buds and seedlings.
Dormice  Dormouse. John Robinson/English Nature	Local, mainly SE England	Favours species-rich scrub, hedgerow and woodland, especially with coppice. The diet is primarily fruit, nuts, flowers and buds; a diverse range of scrub is required to provide food through the seasons. Hazelnuts, acorns and chestnuts are important prior to hibernation. Honeysuckle bark is used in nest construction. An agile climber, spending most time above ground, connectivity of scrub is important.
Fox	Common and widespead	May use scrub for shelter and lying-up sites.
Badger	Common and widespread	Setts mostly located within woodland, scrub or hedgerows etc, usually close to grassland feeding areas. An omnivorous diet includes fruit and nuts.
Otter	Frequent in Scotland, Wales, N and W England. Local but increasing elsewhere	May use scrub adjacent or close to rivers etc for shelter and lying-up sites.
Deer	Most species increasing in numbers and distribution.	Most species favour dense scrub for shelter. Most will also eat fruit, nuts, bark, leaves and buds of shrubs and deciduous trees, causing variable levels of damage and often preventing regeneration. Holly is favoured by Red and Sika Deer, Bramble by Roe and Muntjac Deer, but all have a wide diet.

2.8 Value for people

2.8.1 Historic

Scrub has long been important to man as a source of food, fuel, animal fodder and as a source of material for thatching and dyeing. The earliest hunter-gatherers are likely to have used fruits from scrub for food and its wood for tool making. Since then the uses continued to develop until many were replaced during the industrial revolution. Some species had such a value that they were actively cultivated (Gorse on lowland heathland for example), managed and protected to ensure a continual yield of particularly prized species. Developments in technology meant that many past uses for the products provided by scrub have been all but lost.

While it is not clear how much cultivation took place, the range of important uses for scrub suggests that these species would have been too important to the local community to be left to disappear. Some of the historic uses for certain species of scrub remain today, while others have been revived because of the increasing interest in sustainable uses of local natural resources.

2.8.2 Current

Scrub is a feature of many landscapes in Britain, adding to their visual appeal. This is also true in urban settings, where the presence of scrub softens the impact of urban dereliction or acts to screen industrial buildings and transport corridors. However, public opinion towards scrub is ambivalent. On the one hand some can perceive it as symbolising neglect and untidiness, while on the other it is valued for high densities of songbirds, its attractiveness to butterflies and the colourful displays of flowers, foliage and fruits. One of the great challenges is to raise public awareness and understanding of the value of scrub and the need to manage it. Better interpretation of its traditional uses and value for wildlife and the landscape will help to achieve this.

Some of the past and current uses of scrub are listed in Table 2.11 below.

Table 2.11: Past and present uses for a selection of scrub species.

Species	Use
Alder	Charcoal for making gunpowder. Past and present use in basketry.
Birch	Bobbins and cotton reels, firewood, brooms and roofing thatch. Current localised use for brooms. Turnery and making bobbins and cotton reels. Bark and wood used in waterproofing and tanning. Wine, fermented from sap, believed to have medicinal properties. Young leaves are a diuretic.
Blackthorn	Walking sticks. Herbal properties. Ancestral stock for domestic fruit. Past and present use of fruits in wines and to flavour gin and leaves for flavouring.
Bramble (Blackberry)	Making dyes, medicinal properties, and spiritual uses. A wide range of uses for the fruits still exists.
Elder	Past and present medicinal and culinary use of the flowers and fruits.
Gorse	Fuel in kilns and ovens, animal fodder. Current localised use for thatch in Western Isles.
Hawthorn	Walking sticks, tool handles, turnery and stock proofing. Past and present use of leaves for flavouring.
Hazel	Past and present use for walking sticks, hurdles, thatching spars, basketry, charcoal, rustic furniture.
Juniper	Charcoal was used for making gunpowder and smoking meats. Strong, durable wood was used to make small items such as pencils. The berries are used to distil oil, flavour game food and gin. Has herbal and medicinal properties.
Spindle	Used for skewers and toothpicks. Currently used in basketry.
Willow	Used in charcoal making and has medicinal purposes, it includes the active ingredient in aspirin. Currently used in floristry, basketry, charcoal, garden furniture, sculptures and erosion protection.
Wych Elm	Making bows, furniture and threshing floors. Currently used in basketry.

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3. Planning for management

The following section aims to introduce management planning but is not intended to be a stand-alone management-planning guide. There is a range of detailed guides available, for example from Countryside Council for Wales or Countryside Agency.

Management of scrub needs careful planning, especially where it has to be integrated with other habitats and features of interest. Management planning ensures that decisions are based on a full audit and evaluation of all management issues, including the conservation interest, landscape, archaeology, amenity value and access as well as health & safety.

The management plan should set priorities and SMART objectives* and describe how these will be achieved. It is important to monitor the impact of the work and review plans in light of the monitoring results. A management plan is a useful framework for consultation with statutory agencies (essential for SSSI and scheduled monuments) as well as local interest groups and taxonomic specialists. See Tables 3.1 & 3.2.

(*SMART Objectives - *Specific, Measurable, Achievable, Relevant, Timebound).*

Table 3.1: Summary of the decision making process.

Carry out site audit & evaluation ▶	Of items in table 3.2,
▼	
Define the management issues	
▼	
Develop management objectives	
▼	
Agree management objectives in consultation ▶	Statutory Conservation Agencies (for SSSI & Scheduled Monuments) Other statutory consultees Species experts User groups
▼	
Develop actions to implement objectives, prioritise & develop timetable	
▼	
Consult on draft plan, amend as needed & gain approval ▶	Statutory Conservation Agencies (for SSSI & Scheduled Monuments) Other statutory consultees Species experts User groups
▼	
Implement plan	
▼	
Monitor impact of management	
▼	
Review & revise plan in light of monitoring results	

Table 3.2: Issues for consideration in a management plan.

Site citation features	*Landscape character*
Species present	*Archaeology*
Priority species with potential for colonisation	*Historical features*
Species requirements	*Designed landscape*
Position in an ecological unit	*Public safety*
Dynamics of the vegetation communities	*Health and Safety*
Soils	*Fire prevention*
Climate	*Neighbouring land uses*

3.1 Developing a management plan

First a full **audit** (site survey and desk study) is required, including the aspects listed in Table 3.2. It is very useful to include the findings of the audit in the introductory sections of the plan as this informs the **rationale and the vision** behind decision-making. It is important to identify the direction of any changes that may be occurring. The **management issues** are identified from an **evaluation** of the audit and the management **objectives** will be developed to address these issues. It is important that those undertaking the site management are involved in the discussions at this stage to ensure the required **actions** (or operations) are practical and achievable. When agreed these actions should be included in a **work programme** covering the duration of the plan and indicate who has responsibility for delivery of specific actions. The whole document should be written in clear, concise, non technical language that all users will be able to understand.

3.1.1 Key issues for audit

3.1.1.1 Current and potential wildlife value

Existing wildlife interest (especially that which is cited for designation of SSSI) needs to be identified, mapped and its status understood in order to make management choices that will conserve rather than damage the interest. A realistic assessment of the potential wildlife value that might be expected after management will help to set targets. These can be used to judge the success or otherwise of the management.

3.1.1.2 Cultural and amenity value

Conservation of the **archaeological** and **historical heritage** is important and is a legal requirement for scheduled ancient monuments. Ancient monuments (scheduled or not) should be mapped (in an annexe) along with other features of historic value such as designed landscape, to ensure that damaging operations are avoided.

The impact that scrub has on the **landscape** needs to be assessed. This impact will depend on the nature and character of the landscape, so reference should be made to relevant local landscape assessments. The Countryside Agency's Countryside Character Area Initiative (www.countryside.gov.uk/cci/) and English Nature's Natural Areas (www.english-nature.org.uk/science/natural/na_search.asp) provide indicators of the character of each local area.

It is often the case that scrubland has open access for the public, either by right or *de facto*. The CRoW Act 2000 requires that access be provided to for example downland, heathland and common land. However, high levels of unmanaged public access can lead to problems with erosion, disturbance to wildlife or vandalism (eg setting fire to scrub stands); all will need to be considered in the plan. Maps of pressure points, sensitive areas and where there is existing damage will illustrate where action is required.

3.1.1.3 Countryside and Rights of Way Act 2000 - implications for management in England and Wales

In England and Wales, management of land within Sites of Special Scientific Interest (SSSIs) is covered by the Countryside and Rights of Way Act (CRoW) 2000. A list of Operations Likely to Damage (OLDs) the features of interest is issued for each SSSI. Consent or, in the case of statutory undertakers, assent is required from English Nature, CCW and before any OLD may be carried out. However, because some OLDs are beneficial to conservation (eg grazing, burning and turfing), a conservation management plan which is agreed with EN or CCW will serve to clarify objectives and reduce the need to seek English Nature's consent/assent for matters relating to the positive management of the site. OLDs not covered by the management plan will still require English Nature's permission.

With the implementation of the CRoW Act, EN or CCW will issue to every owner and occupant a brief statement of its views about the management of the SSSI. These Views About Management (VAM) will provide a simple view about the positive management of the features of interest. However, they will not, on their own, provide the basis for a management plan. A search of records will ensure that all designations are identified and their implications for management options evaluated.

The Multi-Agency Geographic Information for the Countryside (MAGIC) website: www.magic.gov.uk identifies the location of and the extent of most statutory designations.

3.1.2 Resource constraints and funding sources

When planning management, it is essential to consider the availability of resources; ie how much labour, equipment and budget is available. This will help to ensure that the objectives can be realistically achieved within the timescales available. Priorities will be determined in light of the resources available to achieve them.

3.1.3 Evaluating the results of the audit

The evaluation should identify the issues, constraints and opportunities that apply to the management of the site. It will also assess the overall importance/priority of each interest. The management objectives stem from this analysis; this may be summarised for scrub habitats and the relationship that they have with other habitats as in Table 3.3.

Table 3.3: Evaluating management issues and objectives.

Management issues	Examples of objectives
Threats to the site	To prevent loss of open habitats to scrub invasion. To eradicate invasive scrub from important habitats. To prevent, or reverse, nutrient enrichment that would lead to community change. To manage vandalism in order to prevent loss or reduction in quality of scrub habitat. To manage scrub communities to off set the effects of climate change.
Managing succession	To manage, where necessary, to interrupt succession. To maintain an agreed balance between scrub and open habitats. To use rotational management regimes.
Managing species assemblages	To manage the site in a way that takes account of the different growth characteristics, and minimises the potential for one or more species to dominate.
Rare shrub species	To integrate specific measures for their conservation into plans for wider scrub communities and other associated habitats.
Managing wildlife interest	To manage scrub and associated habitats to incorporate the features needed by the wildlife interest.
Managing archaeological and historical interest	To consult, and incorporate the advice of specialists into management operations.
Managing landscape interest	To consult, and incorporate the advice of specialists into management operations.
Managing local community interest, opinion and involvement	To communicate regularly with local populations to keep them informed of the management works and the longer-term vision on the site.

3.2 Objective setting

The evaluation determines the importance of the issues that need to be managed. From this a prioritised list is made and **objectives** are set to deliver them.

The objectives address not only the need to conserve (or control) the scrub communities, but also need to address the other interests such as archaeology, landscape, access and health and safety. It will be necessary, where statutory designations apply, to consult with appropriate statutory authorities. It will also be useful, even on non-designated sites, to consult a range of interest groups and relevant specialists in order to integrate the needs of users and conservation of the features.

Table 3.4: Typical constraints and opportunities for consideration in setting objectives.

Constraints	**Influencing factors**
Features of importance	Presence of rare species, archaeological features.
Legal constraints	Designations, wayleaves, Health and Safety requirements.
Geo physical	**Climate** influences the community composition and growth characteristics of scrub. North and south facing slopes may have distinctly different micro-climates. **Geology** influences the community composition and growth characteristics of scrub. **Hydrology** influences the community composition and growth characteristics of scrub.
People issues	Public access. Local opinion/awareness. Industrial or military use, influence the ability to access scrub for management. Farming practices.
Opportunities	
Funding	Grant aid and other funding sources.
Labour	Volunteers.

3.3 Actions and work programme

Actions, or operations, will be carried out to deliver the objectives. These are decided by reference to best practice guidance, the habitats ecology, health and safety practice and resources available. The actions chosen may not always be the cheapest or easiest option but they should achieve the objectives. In some cases, more than one operation will be needed.

A **work programme** will indicate which actions are to happen, and when, over the life of the plan.

Maps to identify features of interest, sensitive areas and where the planned operations are to take place are essential.

Further reading

Countryside Agency. (1998) *Site Management Planning - a Guide.*

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