6. Survey and monitoring

Survey and monitoring are essential components of good management.

'Survey' is the recording of qualitative or quantitative biological data using easily repeatable standardised techniques over a restricted period without preconception of the results.

'Monitoring' is the comparison of repeated surveys. It is critically important that initial (baseline) surveys are done to a standard, described method and that the results are fully documented so that they can be repeated.

Baseline information should be gathered to inform management decisions and ongoing monitoring is needed to continuously refine management techniques. This is especially important on sites designated for nature conservation. In England and Wales, targets have been set to ensure that SSSIs are in, or moving towards, favourable condition. It is the responsibility of the statutory nature conservation body to assess whether this is the case by monitoring the designated interest. However, this represents the minimum required and in most cases more detailed monitoring would inform management decisions. Any additional survey and monitoring needs to be carefully planned to ensure it will deliver the required information in a usable form and collected in a cost-effective way.

Survey and monitoring techniques must be objective, repeatable and provide the information required. Survey and monitoring takes time, can require a significant level of expertise and has cost implications (especially if the work is contracted out), so proposals need to be made in light of resources and skills available.

The amount of survey and monitoring needs to be balanced with the resources needed to manage the scrub. It is good practice to delay the start of management until baseline surveys can be completed and plans developed. However, where resources are limited, monitoring can be limited to essentials, providing information only on the condition of the key interest of the site.

Surveying

Surveys of the scrub itself give information on extent, species composition and structure, and are essential for planning management. By using standard, repeatable techniques for the initial surveys, they become the baseline against which further monitoring is done.

Surveys of species associated with scrub provide information on their distribution and status, which is essential when planning management. Many scrub dependent species are now rare, due to loss and fragmentation of their preferred scrub habitat. Management decisions made without regard to rare species could damage or extinguish them; for example, eradication of willow scrub to prevent succession on a wet heath could cause the local loss of the rare Dingy Mocha moth.

It is theoretically possible to survey everything within the scrub community but this would take a great deal of time and money. It is therefore important to carefully plan a survey programme so that the information gathered will be of practical use. For sites with statutory designations (SSSI, Scheduled Monument etc), there are legal requirements to monitor the designated interest. This might be certain species of importance or the balance of communities, including changes in the extent of scrub. Even on non-designated sites it may be important to record changes in scrub distribution, structure and dependent species.

Scrub regeneration monitoring. John Bacon/English Nature

Monitoring
Monitoring shows change: for example rate of spread of scrub, rates of senescence or succession. Monitoring requires an ongoing commitment of resource, so, as part of the management planning process, the priority areas and species will need to be determined, as will the frequency at which they should be covered in order to identify where problems occur with enough time to take action to rectify them. If resources allow, more in depth monitoring is to be encouraged. Demands on staff or budgetary resources may be supplemented by experts who are willing to volunteer their time.

Monitoring selected groups or species is partly an exercise in risk management to avoid any adverse impact to the species. However, there may be significant species on the site that are not recorded and opportunities should be taken to get a comprehensive species list.

What follows is an outline of survey and monitoring, setting objectives, suggesting basic requirements, and outlining methodologies for some of the surveys. These concentrate on those that are relatively cheap and simple.

6.1 Setting objectives for Survey and Monitoring

There should be a clear objective for each survey, stating why it is necessary. Otherwise there is a risk that surveying will be done for its own sake and have no real value. Surveys are carried out for many specific reasons – these fall into four main categories;

- to assess the extent of scrub communities; needed to inform decisions about control of invasive species, or increasing the extent of threatened communities,
- to assess the structure of scrub stands; to identify the need for diversifying structural mosaics,
- to assess the species composition of scrub stands; to identify community type(s) and so make appropriate decisions for its conservation or control,
- to assess the presence of species using the scrub; to identify key species to be maintained or enhanced, or possibly to identify pests and so plan for their eradication,

The generic objective for monitoring is to assess any changes in the above parameters.

Survey and monitoring informs the site manager of the status and trends in the parameters being measured. This information is used to determine management, so it is necessary to evaluate the results carefully so that appropriate management decisions are made. It is a good idea to determine limits for the various parameters being monitored, which trigger management action. For example, the extent of a scrub stand might be stated as being no more than (eg) 20% of the land cover of a site, if it exceeds this, then reduction would be implemented.

Some limits will be set by the Statutory Conservation Agency (SCA), when determining favourable condition criteria for nationally designated sites (SSSIs in England, Wales and Scotland and ASSIs in Northern Ireland). Others will need to be set at a site level, but guidance should be available from the conservation agencies or experts in the relevant fields.

Survey and monitoring objectives must be achievable, so it is important to assess them against the resources and expertise available. Amateur naturalists often undertake ad hoc surveys, particularly on sites with open access, and can provide excellent data. Local biological record centres usually archive their data and can provide contact details of recorders. The National Biodiversity Network web site (www.nbn.org.uk) provides links to all of the Local Record Centres. Other sources of useful information are likely to include local bird clubs and other natural history societies, country Conservation Agencies and county Wildlife Trusts.

6.2 Vegetation

Understanding what scrub communities are present, their extent and their association with other habitats is fundamental to making appropriate management choices. The community type, age structure, condition and species present are also important. Basic vegetation surveys do not necessarily require high levels of botanical skill and experience. Simple surveys can effectively describe the conservation status of the habitat and its component species and indicate any management issues. Repeated surveys allow changes to be monitored, showing changes in vegetation in response to management.

6.2.1 Phase 1: mapping

Phase 1 is a relatively simple, standardised method for mapping broad vegetation communities that needs no specialist equipment and only basic botanical skills. Phase 1 defines scrub in broad terms; deciduous, mixed, coniferous or alien, but target notes are used to list dominant species. Phase 2, the NVC survey (see below), defines the precise vegetation community type.

Field surveys identify the habitat types and map them onto a 1:10,000 scale map using a standard colour scheme and alphanumeric habitat codes. Codes are used for dominant species and target notes are used to record specific features and information. The maps need to be as accurate as field conditions will allow. If field GPS (global positioning system) and a GIS (Geographic Information System) programmes are available, they can

greatly increase the precision and speed of the survey as community boundaries can be logged by the field GPS and data automatically transferred to GIS.

Phase 1 maps are very useful in management planning. For more detail on the methods and analysis of Phase 1 Survey read the JNCC Handbook for Phase 1 habitat survey. (JNCC 1993)

6.2.2 Phase 2: National Vegetation Classification (NVC)

The National Vegetation Classification system defines British vegetation communities based on their species composition. The companion handbooks (Rodwell 1991) describe habitat associations and successional stages of each community, giving pointers for their management. Survey requires a reasonable botanical knowledge and the amount of data that needs to be gathered can make the survey time consuming, though this depends on habitat complexity.

Homogeneous stands of vegetation are accurately mapped, and the relative abundance of species is recorded for a minimum of five sample quadrats in a stand. The size of quadrat varies depending on the species richness of the habitat; for dense scrub, with a relatively simple flora, 10 x 10 metres is usually used, and 50 x 50 metres for sparse scrub. Species abundance is assessed by eye and recorded using the Domin scale. Frequency tables are produced from the five quadrats, and the plant community type is derived by matching the frequency data to tables in the relevant volume of the NVC handbook. Computer programmes (eg MATCH or Tablefit) can be used to do the analysis. The NVC handbook (Rodwell 1991) gives further details.

6.2.3 Monitoring vegetation change

It is valuable to know about the changes in the extent and structure of the scrub and a number of techniques are available to do this. However, it can be very hard to monitor vegetation change within scrub stands because they can be dense and difficult to access. The ground flora is an important element of the scrub community for which monitoring methods are given in Sutherland (1996) and Goldsmith (1991).

6.2.3.1 Changes in scrub extent

The extent of scrub stands may be plotted using field GPS, and repeat surveys can be put in overlays on GIS for comparison. Alternatively, a series of permanent points can be marked (a metal peg driven in to ground level can be found with a metal detector, but is safe from interference or management operations) and the distance from the scrub edge measured at intervals and mapped.

6.2.3.2 Photographic monitoring

Fixed-point photography is a simple, cheap and quick means of monitoring change. Photographs are taken from exactly the same point at the same angle, in the same light conditions and at the same season, annually or at set frequencies. Comparisons will show trends at a macro scale. Fixed points must be carefully chosen – it is possible to miss many changes through poor selection – and to ensure the view from the camera is not obscured in later years as scrub grows taller.

Aerial photograph surveys (vertical or oblique) are usually flown by local authorities every 5 or 10 years. Paper or digital copies of selected photographs can be purchased. Digital copies are very useful, particularly when ortho-rectified (corrected for edge distortions), because they can be analysed very accurately using a GIS (Geographical Imaging System) computer programme, allowing precise assessment of areas.

6.2.3.3 Assessing scrub density

A 30 x 50 cm board, painted with 10 x 10 cm red (or black) and white squares, is placed at a predetermined height within the stand. Walk away from the board until the point where 50% of the board is obscured by vegetation. The distance to the board is divided into 1 to give an index of density (Bibby *et al* 1992; Fuller & Henderson 1992).

6.2.3.4 Scrub species diversity

Count and list the number of species in 20 x 20 m quadrats. The results for 20 quadrats can be averaged, or frequency tables can be produced.

6.3 Invertebrates

Changes in the presence and relative abundance of invertebrates can indicate changes in habitat quality; species occupy different niches at different stages of their lifecycles so their status is dependent on the range of habitat features. A selection of species, chosen for their ease of identification, their association with specific habitat features, or because of their biodiversity importance, can be used to indicate the habitat health. In addition, rare or restricted species are part of the interest of a site and monitoring is needed to assess their status and response to management.

Surveys are useful for assessing the assemblage of species present and identifying the presence of rare species. Many of the species that use scrub are difficult to identify, so expertise is essential.

Adult invertebrates are normally surveyed as they are usually far easier to find and identify than larvae. However, they often have short adult life stages and differing flight periods, so a monitoring strategy that samples throughout the season is needed to cover the flight periods of all target species.

Surveys should be repeated in similar conditions, at similar times of day and year to ensure data can be compared. Poor weather (high winds, cold, or heavy rain) should be avoided, as activity is suppressed. Note that short-term changes in abundance occur because of, for example, small-scale fluctuations in weather patterns, so longer-term trends will need to be evaluated as well.

A variety of techniques are available, varying from simple hand nets to complex mechanical apparatus and trapping systems. The most appropriate equipment and methodology for the survey or monitoring project should be decided in consultation with invertebrate ecologists and those undertaking the fieldwork.

Hand-collecting methods (eg beating trays, sweep nets) may be preferred where specific habitats need to be targeted. Target species can sometimes be identified in the field or specimens may need to be collected for subsequent identification. This can be very time consuming.

There are many trap designs but they are not all equally efficient at trapping particular target organisms. Light traps attract many night-flying insects but are only effective over a small area. Bait traps can be highly specific and can attract insects from a considerable distance. Some may attract only one sex of one species and, even then, only during the phase when they are receptive to the bait. Responses to baits may reflect the need for mating, feeding or nesting/oviposition but never the requirements of the whole lifecycle. A field of nectar-rich flowers is just as effective a lure as a sex-linked pheromone or a pile of fresh dung, albeit for different species. Pit-fall traps are effective in trapping the active soil-surface dwelling species but not sedentary species. However, they will also trap burrow-searching species (eg bumblebees) and, once the catch begins to decompose, they will attract carrion-searching species. Interception traps are much less selective and can be constructed to take everything moving along a given flight line. However, the origins of the species are not known and a slight change in trap positioning can result in a markedly different catch. Water-traps use colour to imitate flowers and water to trap the insects. Differently coloured traps in different positions will trap different species.

The following section gives a summary of the most commonly used techniques, which have been adapted from standard methods described fully in Goldsmith (1991) and Sutherland (1996).

Invertebrate collecting. John Bacon/English Nature

6.3.1 Transect searches, or 'Pollard' walks

Transect surveys provide information on the relative abundance of dispersed, easily visible species. They are repeated periodically throughout the flight season and rely on quick identification of species. Counts are made along a fixed route, searching for target species at a standardised pace. The search is done within a set distance from the observer; eg 2.5 m to either side of the observer for butterflies (the Pollard walk was originally devised for monitoring this taxon). Transects are usually subdivided into sections with boundaries at changes in vegetation types. The technique can be used to monitor a range of taxa that are easy to see and identify by eye.

6.3.2 Light traps

Many moths and other nocturnal insects are attracted to light. They can be trapped using a light trap consisting of a light mounted above a collecting box, with a funnel to draw the insects into the box. Egg boxes in the collecting box provide refuge for the insects, which can then be identified and counted in daylight before release. Expertise in moth identification is necessary, though good identification guides are available.

Light traps are commercially available and the choice of trap depends largely on the light source as this influences the scale of the catch. Mercury vapour bulbs are the most powerful, but require a portable generator to power them, which needs constant attention. Mercury vapour lights are very powerful and attract insects from up to a mile away, so are not appropriate for assessing distribution within a site. Less powerful, ultra-violet fluorescent bulbs can be run from 12volt[1] batteries, and if there is little risk of theft can be left to run all night.

Timed trapping, in the same location(s) at similar times of year can be used to assess relative abundances. Insects can be caught as they land on a white sheet illuminated by the light source, and be kept to the end of the trapping session, and released once identified and counted.

[1]Tip: use a 12v caravan or boat battery, instead of a car battery; they are more expensive, but are designed to survive repeated discharging, whereas a car battery will eventually cease to hold charge.

6.3.3 Pitfall traps

Pitfall traps catch ground invertebrates that fall into them. The usual design is lethal as it contains water and a preservative, but live traps can be made incorporating a steep sided funnel to prevent escape (NB predatory invertebrates can affect results by eating part of the catch). The trap, a steep sided container, is sunk to ground level; a fixed cover prevents rain and non-target species (eg reptiles) entering. The contents are collected, identified and quantified after a set period. The timing and location of traps, their design, size and type of catching agent used will influence the make up of the catch. If catches are to be compared between parts of a site or over time then the techniques will have to be standardised. Traps that are distributed regularly (eg on a grid) will provide the most useful data, but they could also be targeted to specific areas of interest. Where lethal pitfall trapping is planned, it will be necessary to have the required consents, and should only be done for specific research.

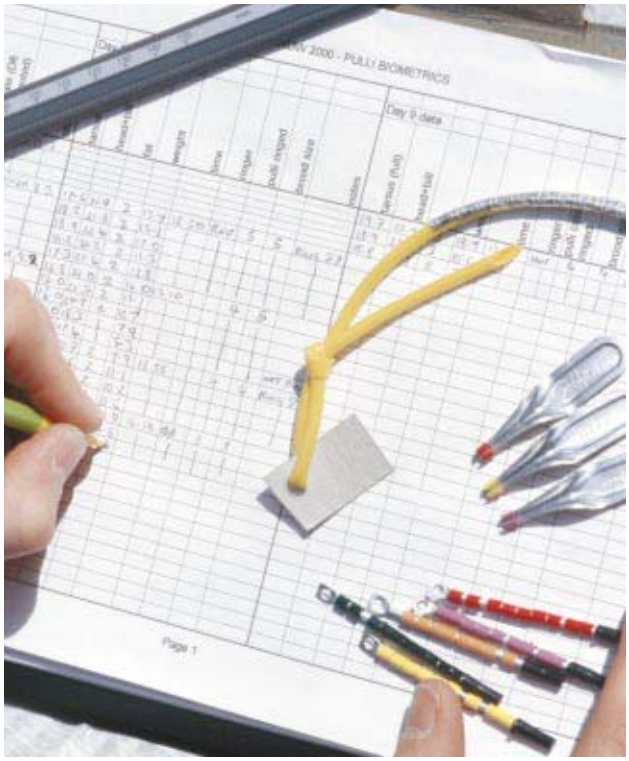
6.3.4 Direct searching

Looking in suitable areas, for example, among vegetation, under stones, logs and leaf litter, etc, can locate otherwise hard to find invertebrate species. When moving stones or logs to search it is important to replace them carefully.

- Pootering
  Suitable for searching in the litter layer or on the ground, this involves the live capture of small ground dwelling invertebrates for identification, using a 'pooter'; a suction tube with an attached collecting bottle. Timed searches, within fixed quadrats could be used to monitor species composition and relative abundance. It is time consuming and requires detailed identification expertise.

- Vegetation sweeping
  Used for collecting from non-rigid vegetation, eg grasses or soft shrubs, with a robust fine mesh net, sweeping takes invertebrates living within the vegetation. Repeating in set areas at set times will provide a broad indication of any changes in species number and composition. It is relatively quick to implement but requires detailed identification expertise.

- Foliage beating
  A simple technique to acquire samples from scrub stands. The branches are bashed, causing the invertebrates to fall out into a 'beating tray' (a pale cloth laid beneath the branch, which sags into the middle where the fallen insects collect). It can be used for relative abundance assessments if branches are beaten a standard number of times. It is relatively quick to implement but requires detailed identification expertise.



Bird survey technique. RSPB

6.4 Birds

Birds are relatively visible, vocal and easy to identify, making them among the easiest fauna to monitor. Most species hold territories and mapping these allows their breeding distribution and abundance to be assessed.

Identifying birds by their songs requires experience, but as birding is a popular pastime, volunteer surveyors can be sought through the local bird club network. Dense scrub is difficult to survey accurately and will require local knowledge and good quality maps. The techniques given here are suitable for scrub nesting species. They are described more fully in Bibby *et al* (2000), Gilbert *et al* (1998) and Sutherland (1996).

6.4.1 Common Bird Census (CBC) technique

The CBC is time consuming, but provides very detailed information about bird distributions and abundance in relation to habitat types and quality. The distribution of each species is mapped based on their territorial activity. Individuals of most species stay within their breeding territories, which are defended by song or display. This gives a relatively accurate assessment of population.

Up to ten site visits, each of 2–3 hours, are made during the breeding season, between March and July. Where time is limited, fewer visits may be used as long as this is standardised between years.

Visits are undertaken between dawn and 09:00 in good weather. Activity, particularly singing, is most intense in the first hour of sunrise and as scrub can support high densities of birds it can be better to start after this to reduce the confusion. All registrations are mapped on a suitably scaled site map, using standard BTO species and territorial behaviour codes. The visit data is transferred to species maps, from which the number and distribution of territories can be assessed.

6.4.2 Point Counts

Point counts assess relative abundance. They are less time consuming than BBS, requiring between 2–4 visits of 2–3 hours duration, and are easily repeatable. All the birds heard singing from each of a series of set points are recorded over a set period. The sample points are chosen either at random, or, for specific studies in clusters. If it is difficult to set up sample points in dense scrub, particularly if it is thorny, points may be located where feasible. It is important that the counts are conducted from the same place each year and for the same duration to ensure comparability.

6.4.3 Line transects

Line transects provide information on the relative abundance of species. Set routes through scrub habitat, which are divided into habitat based sections can provide relative abundance data if repeated to the same standard. Walking slowly, singing birds of each species are counted in each sector. This requires a similar number of visits to point counts.

6.5 Reptiles and Amphibians

Reptiles and amphibians are difficult to survey and monitor because they are hard to locate. Mapping of casual sightings provides some information on distribution, but it is better to have a methodical approach, which will provide more useful information.

Amphibians technique. Jim Foster/English Nature

6.5.1 Reptiles

Reptiles are relatively hard to survey because of their retiring habits. Surveys are best done during warm weather early in the day when they are basking and easiest to see. Basking is more prolonged in the spring and early autumn when the sun's angle is relatively low. Southeast facing slopes, banks and tumuli are favoured as they offer the greatest exposure to the sun in the morning. Search in sheltered areas of bare ground or short turf close to non-shading vegetation or debris, which offers a quick escape.

Reptile survey conditions
(Gent & Gibson 1998)

- April and May – the sun's low angle in the morning keeps temperatures cooler longer.
- Mid morning – 09:00 – 11:00 – before the sun's angle is too high.
- 10° – 17°C temperatures.
- Broken cloud or hazy conditions are better than full sun – reptiles do not achieve the required temperature so quickly.
- After a period of cool wet weather.
- Little or no wind.
- Snakes may be particularly visible in sultry or thundery conditions.

There are two relatively easy to undertake surveys for adult reptiles, but these only provide coarse relative abundance data because it is difficult to assess how many of the animals present are recorded or missed. It is important to avoid any wilful disturbance during reptile surveys, not least because of their legal protection.

6.5.1.1 Refuge grid

Reptiles are attracted to objects that offer cover and warmth. Pieces of corrugated metal roofing sheets are ideal refuges for basking. A grid of tin sheets can be laid out in suitable areas and the numbers of each species using them recorded. When the sheets are mapped and numbered, they can be used to monitor distribution patterns over time. Tins heat up rapidly in even relatively weak sunlight, so the animals will warm more quickly than in the open air and leave the basking area earlier.

NB. Adders are poisonous and will use tin sheets; they may be alarmed at the removal of the sheet, so care is required! Tins should not be used on public sites, as some species are vulnerable to collection. Furthermore, there is a health and safety issue if adders are present especially from children who may be tempted to investigate.

6.5.1.2 Transect walks

Transect walks can be used to survey and monitor species that use tins less frequently, such as Sand Lizard and Common Lizard. Walk a set route through potentially favourable habitat at the same (very slow) rate at the same time of day. Keep the sun behind the observer for better viewing, look 2–3 metres ahead and avoid shadows falling on potential basking areas. Experienced observers will see a lot more than a novice will. This will give a coarse estimate of relative abundance.

6.5.1.3 Hatchling searches

These are carried out in late summer and will confirm that the species is breeding.

Survey by species

Species	Conditions	Method
Common Lizard	9-18°C, from early March.	Transect walk.
Sand Lizard	10-18°C, April and May.	Transect walk.
Slow Worm	9-18°C, from early March.	Tin grid, or turning debris.
Grass Snake	12-20°C, from early April, become active early in the day.	Tin grid or transect walk.
Adder	8-16°C, from early March, low tolerance of high temperatures.	Transect walk or tin grid.
Smooth Snake	13-19°C, from early April.	Tin grid.

6.5.2 Amphibians

Amphibians are easier to survey than reptiles because their dependence on water for breeding makes them easier to find.

Newts can be surveyed by searching ponds after dark using a strong torch. Absolute counts over a known distance of pond edge can be compared year on year. Note that Palmate Newts can breed in very small water bodies, so even flooded wheel ruts should be investigated.

Natterjack Toads lay strings of eggs in shallow pools that are mostly devoid of vegetation, so their strings are easy to find, and absolute counts can be made. It is usual for females to lay a single spawn string. Adult males make loud distinctive noises, so their distribution can be mapped and some estimate of relative abundance made.

Common Toads lay eggs in deeper more vegetated ponds than do Natterjacks, so it is more practical to count the number of adults in the pond at the peak spawning period, which is 4 to 5 days after the animals first arrive.

For further information, see Gent and Gibson (1998).

6.6 Physical parameters

6.6.1 Soil pH and nutrient content

Soil chemistry influences the species composition of the scrub community. Sampling is particularly valuable for restoration projects. Soil can be collected from a range of plots, and sent for testing by ADAS for a relatively small fee. This includes analysis of pH, loss on ignition (organic matter content) and a range of minerals (eg calcium, potassium, nitrogen, phosphorus).

6.6.2 Climate data

Climate data is available from local meteorological offices, though site based recording of maximum and minimum temperatures and precipitation at the site will be more locally relevant.

6.7 Archaeological surveys

Scheduled Ancient Monuments have strict legal protection, making it an offence to carry out any work on them without Scheduled Monument Consent (SMC). Many restoration techniques that avoid scarifying or digging the surface are unlikely to damage the archaeological interest, but it is important to understand the whereabouts and significance of the interest and the impact that any management technique might have. Identifying and interpreting archaeology is a specialist field and experts will be used to carrying out field surveys and providing advice to the site management team. Consult relevant statutory agencies (EH, CADW, HS, EHS) for advice.

Archeology survey. John Bacon/English Nature

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7. Case studies

This section illustrates the practical application of some of the techniques described in this handbook, using real examples from a range of sites. These are not intended to show "ideal" management but rather to illustrate the practical solutions implemented by site managers, as well as highlighting some of the problems that they have encountered in managing scrub. The manager at each of the sites was asked to review management they had undertaken in order to deliver agreed objectives using a set of standard headings. These included their own critique of the results of using various techniques, their assessment of the lessons learnt and a look forward to their future plans in the light of that experience. We are grateful to them for being willing to reveal their thoughts in public!

Table 7.1: Summary of site-based case studies.

Issue	Ref	Site Name	Habitat	Objective	Species/scrub type
Managing habitat mosaics.	7.1	Arne	Lowland heathland	Enhance	Gorse to benefit heathland bird and invertebrate communities.
				Reduce	Birch from heathland communities.
				Eradicate	Rhododendron from wet heath and woodland communities.
	7.2	Martin Down	Lowland calcareous grassland	Maintain or enhance	Calcareous scrub communities.
				Reduce	Gorse, Privet & Dogwood from open calcareous grassland.
				Reduce	Gorse on calcareous grassland to reduce acidification of soils.
	7.3	Fenns, Whixall & Bettisfield Mosses	Lowland peat bog	Maintain	Willow carr scrub mosaic.
				Reduce	Extent of birch into peat bog.
				Eradicate	Invasive pine in peat bog.
	7.4	Wicken Fen	Reedbed/Fen	Enhance	Carr scrub communities.
				Maintain	Carr scrub communities.
				Reduce or eradicate	Carr scrub from open fen.

Table 7.1: Cont...

Issue	Ref	Site Name	Habitat	Objective	Species/scrub type
Comparative management of a scrub species for different objectives.	7.5a	Gibraltar Point	Coastal dunes	Maintain or enhance	Sea-buckthorn (native).
				Reduce	Restore dune slack, grey/yellow dune communities.
	7.5b	Ainsdale Dunes	Coastal dunes	Eradicate	Sea-buckthorn (non-native). Illustrating decision making processes and public consultation.
Managing a rare scrub species in different habitats.	7.6a	Moor House & Upper Teesdale	Upland acid grassland	Enhance and maintain	Juniper.
	7.6b	Old Winchester Hill	Lowland calcareous grassland	Enhance and maintain	Juniper.
Managing a rare scrub community.	7.7	Ben Lawers	Montane	Enhance Increase extent Maintain	Montane willow and scrub.
Managing scrub on a site with high archeological interest.	7.8	Hambledon Hill	Lowland calcareous grassland	Prevent encroachment	Archeological site illustrating organic scrub control.

7.1 Arne

Location: Wareham, Dorset. SY 972878

Status: SSSI, SPA, cSAC, AONB, Dorset Heritage Coast, Council of Europe Diploma site, proposed Biogenetic Reserve, proposed part Ramsar.

Site manager/owner: RSPB

Site description
This large and varied reserve totals 535 ha, two thirds of which is lowland heathland and valley mire. The remainder comprises salt marsh and mudflat, coniferous and deciduous woodland, neutral and acidic grassland, freshwater marsh, reed and freshwater pools. Arne has nationally important assemblages of plants, invertebrates and birds, including Dorset Heath, Brilliant Emerald Dragonfly and Dartford Warbler.

Issues
- Arne has nationally important populations of Dartford Warbler, which are reliant on European Gorse, especially for winter survival.

- Various species of pine have been extensively planted in the locality and self-sown seedlings continue to spread into the reserve's dry and humid lowland heath communities.

- Rhododendron has extensively colonised woodland and damp heathland.

Objectives
Overall, the objective is to maintain and enhance the heathland community mosaic, though the following objectives are specific to scrub:

- To maintain and enhance gorse scrub through rotational management and to incorporate it into the heathland communities.

- To prevent the encroachment of Scot's and other pines into the open heathland and to convert/restore pine plantations to heathland.

- To eradicate Rhododendron from open heathland and acidic woodland.

Arne NR. RSPB, Dorset Heathland Project

Methods
Up until the 1990s, heathland restoration at Arne was relatively small scale. Trees were removed from the prime areas of heath and heathland boundaries were gradually pushed back. As more resources became available, both financial and staff, larger scale restoration was undertaken and was mostly contracted out. Funding for these initiatives came from such sources as English Nature (WES), Landfill Tax (SITA Environmental Trust), Countryside Stewardship Scheme and Heritage Lottery Fund (Tomorrows Heathland Heritage project).

Scrub management has been included within a full 5-year management plan, but this provides broad area objectives rather than a detailed plan of working. The key problem species at Arne are pine and Rhododendron, whilst gorse is a beneficial species. Unlike some other heathland sites, pine rather than birch regeneration, is the major problem. The soils are generally too nutrient-poor for birch, which is present only in patches and is seen as a welcome addition to diversity. Where birch is present, it is generally just thinned to allow birch-heath to develop.

Pine
Both Maritime and Scot's Pine have been planted on the heath in the past. In order to restore favourable condition status, the current management programme aims to remove 2,500–4,000 pines annually until 2005. The Maritime Pine will be completely removed, but a very small proportion of Scot's Pine will be retained to meet both biological and landscape objectives.

Contractors remove larger blocks of pines and in the past, such contracts would provide a valuable income. However, the economics of forestry have changed and now, with timber values lower, the contractor's will both charge for the work and take the timber. Where long-established pine has been removed, there is often a need to remove the accumulated litter. On flatter land this can be 'vacuumed' up with specialised machinery, but on more difficult terrain it may be better to assess the level of regeneration of heathland plants before undertaking expensive work. On-site staff remove smaller blocks and scattered trees. Arisings have been sold in the past, either as timber or chipped material. However, this is time consuming for little income. Most arisings are now burnt on fire sites within cleared areas.

Pine regeneration from seedlings is a real problem. The aim is to tackle re-growth while it is small. After an area has been cleared, re-growth is checked every 5 years or so, with seedlings being pulled out and the remaining mature trees assessed and thinned as necessary. Where possible, pine regeneration is dealt with within the heather management cycle. With pines retained in the landscape, and pine plantations adjacent to the reserve, there will be a continual commitment to removing the regenerating seedlings.

Gorse
Gorse is maintained by rotational cutting for the benefit of Dartford Warblers and invertebrates. All clumps of gorse on the reserve have been mapped and are managed on a 15-year rotation, with around 0.5 ha cut each year.

Management is by hand, with chainsaws, by machine with a heavy-duty flail, or very occasionally by burning. Hand management is time consuming and unpleasant. The arisings are burnt on limited fire sites. Using a heavy flail is quick but leaves mulch on the ground. The gorse is able to grow through this but the mulch will further enrich the ground (gorse is found on the slightly richer ground). Where burning is used, a firebreak is cut all around.

Larger blocks of gorse are broken up to introduce structural diversity. Firebreaks may be cut through them to reduce risk and repeated mowing suppresses unwanted regeneration. A proportion of degenerate, collapsing gorse is retained, as it is beneficial for reptiles. The gorse was formerly cut only in March, in order to retain maximum winter habitat for Dartford Warblers. However, time and resources now dictate that work is spread over the period September to March.

Gorse management. RSPB, Dorset Heathland Project

Rabbits eat regenerating gorse; a small amount of grazing is welcomed as it increases the structural diversity of the stands. Re-growth is assessed on an individual plot basis, and where there is excessive grazing, protective fencing may be used.

Coppiced gorse and rabbit fencing.
RSPB, Dorset Heathland Project

In areas of heathland where there is no gorse, planting has taken place with the aim of enhancing and increasing Dartford Warbler territories. This has been achieved either by planting out potted seedlings, grown from seed in peat plugs, or by transplanting turfs with established seedlings, from areas of high regeneration. Both methods are successful, but if there are plenty of areas with regenerating gorse then transplanting is easier.

Most stands of gorse on the reserve are now in rotational management. This will allow more detailed mapping and assessment in the future, allowing a more focussed management regime to achieve an enhanced diversity of age structure.

Rhododendron
Rhododendron had formerly invaded areas of heathland and woodland. The aim is to eradicate Rhododendron from the reserve, with the exception of small areas acting as screening by the village. Around 10 ha of Rhododendron scrub has now been reduced to 1 ha and work is now largely remedial rather than major removal.

West Track rhododendron. Neil Gartshore, Brian Pickess/RSPB

A range of techniques have been used, largely depending on the terrain. Where sites are accessible, larger machines are used, both to flail the bushes and to pull cut stumps from the ground. The cost of clearance by contractors was around £2500 per ha. Arisings from the standing crop were burnt, while, in one area, the litter and roots scraped away to reveal the mineral soil were used to create a pathway through the area. Hand clearance by staff and volunteers, using chainsaws, was estimated as seven times more expensive. Any re-growth is allowed to develop for around 18 months before re-spraying with glyphosate in April/May.

Results
Extensive monitoring has been undertaken, including breeding bird, reptile and invertebrate surveys, while vegetation transects are repeated every 5 years. Although it is difficult to accurately judge results on a wide range of species, Dartford Warblers, one of the priority species, have increased significantly and Woodlarks have colonised the reserve.

Assessment/Lessons learned
- Disposal of arisings and long-term maintenance requirements are resource-demanding and require careful forward planning.
- Remove unwanted scrub at an early stage while it is small.
- With extensive scrub removal projects, take time to fully complete the work and maintain what has be gained.
- Continued assessment, monitoring and review of projects are important.

Modifications to future proposals/plans
- Most areas of scrub now fall within a programme of rotational management and the aim now is to take an objective approach to annual work assessments within the rotation and to refine future techniques.
- Extensive grazing is proposed - a 150 ha grazing unit has been constructed and a 200 ha unit is in preparation. Grazing will be by a mix of ponies and cattle at a density of one animal per 10 ha.
- The high local population of Sika Deer are resulting in over grazing of woodland, salt marsh and grass heath, a problem that will need resolving. They avoid the regenerating pine.

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Further reading/websites
Symes, N J. & **Day, J.** (2003) *A practical guide to the restoration and management of lowland heathland*, RSPB, Sandy
http://www.rspb.org.uk/reserves/arne/

7.2 Martin Down

Location: Fordingbridge, Hampshire SU 045190

Status: NNR, SSSI

Site manager/owner: Hampshire County Council/ English Nature

Site description
The reserve comprises a full range of downland habitats from bare chalk to woodland within its 342 ha and includes chalk downland, chalk heath and scrub, rich in many archeological features. The reserve supports important assemblages of flora and fauna associated with chalk down and scrub community mosaics, for example, Bastard Toadflax and Field Fleawort, Silver-spotted Skipper, Adonis Blue and Marsh Fritillary butterflies, Small Eggar moth, Grey Partridge, Linnet, Stonechat, Turtle Dove, Nightingale and Lesser Whitethroat.

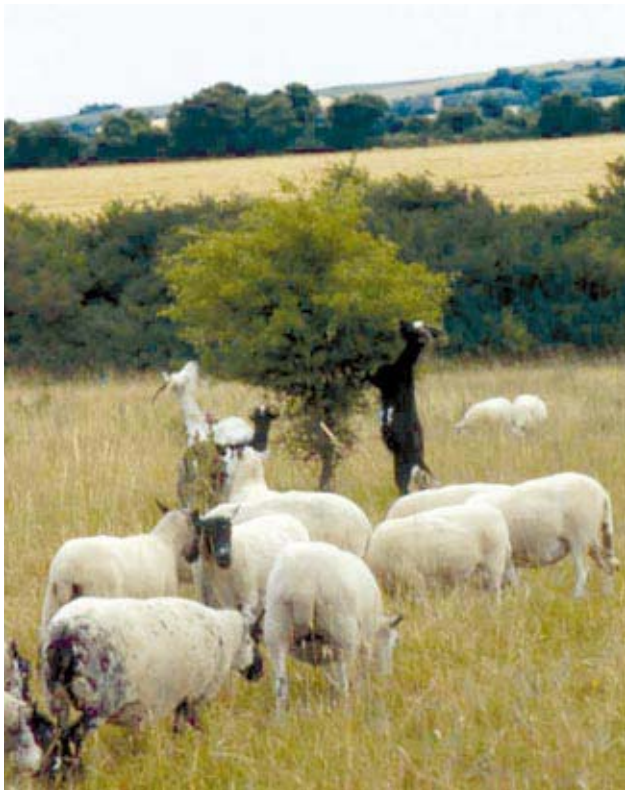
Issues
- Martin Down is a remnant of a once extensive tract of chalk downland, grazed heavily by sheep and Rabbits. Changes in land use and decimation of the Rabbit population, due to myxomatosis during the last century, has resulted in widespread scrub encroachment into open habitats and areas of archeological interest.

Objectives
- To protect all remaining unimproved chalk grassland by grazing, scrub management and weed control.

- To maintain a diverse range of scrub and secondary woodland by grazing and scrub management.

Methods
Martin Down supports a wide variety of shrub species, comprising the full range of woody species in the NVC W21 Hawthorn-Ivy community, including Wayfaring Tree, Dogwood and Privet. Gorse is a key species and some Juniper is also present. Due to the activities of berry-eating birds, such as thrushes, scrub development in herb rich grassland is an ongoing issue.

Scrub management work is included in a full 5-year management plan, which lays down precise management details but relies on annual assessment to determine the order of working. Consultation is undertaken with Hampshire County Council, English Heritage, a local advisory committee and national experts. The management methods used include grazing, cutting, herbicide (stump treatment and spot spraying) and removal with heavy machinery. The work is mainly contracted out and undertaken between September and January, using the following techniques:



Goats browsing scrub on Martin Down. Linda Smith/English Nature

- Scattered thorn scrub in grassland is cut with a clearing saw or chainsaw. The arisings are raked into clumps using pitchforks and loaded by tractor and grab into a trailer for removal and burning. Stumps are treated individually by painting with a suitable herbicide eg glyphosate. Where removal leaves a mass of small cut stumps on bare ground, the stumps can be sprayed with herbicide for better coverage.

- Privet and Dogwood are not amenable to stump treatment; large bushes can be cut and the re-growth sprayed. Scattered scrub in grassland is sprayed with glyphosate or triclopyr using a knapsack sprayer or hand-held lance from a tractor or quad-mounted spray tank. Care is taken to ensure glyphosate application

does not splash or drift as it kills all green plants it contacts. Splash or drift from triclopyr is less obvious but also kills a number of chalk downland herbs. It is yet to be assessed whether glyphosate or triclopyr is more damaging in the long term at reducing the floristic diversity of the sward.

- Scattered gorse scrub in grassland is sprayed with triclopyr. The plants are removed the following year with a cut-and-collect machine. Where spraying is not appropriate, shrubs are cut and removed; this requires follow-up treatment every one or two years.

- Large gorse is cut with a tractor-mounted circular saw blade (Ed:now available as a 'quad-saw' type), or chainsaw and the arisings removed with a tractor and grab. Re-growth is sprayed and removed as above.

- Large areas of scrub are cut using chainsaws and removed with a tractor and grab to be burnt. Either the stumps are treated or the re-growth sprayed with herbicide. Where there is no archeological interest, a 360-degree slew with a drott bucket or root forks can be used to uproot and burn large stands.

- Create structural diversity in gorse by dividing the stands and cutting a proportion each year using a tractor-mounted swipe (£600/ha). The mulched material is left on the ground, producing a rough mesotrophic grassland that regenerates to thick gorse.

- To manage scrub blocks to maintain variety and to prevent succession to woodland, cut areas of about 0.1 ha on a long rotation of about 20 years and allow to re-grow. Cut using chainsaws and burn the brash on site using a tractor and grab to remove the arisings to the fire site.

- Very high grazing pressure will prevent scrub encroachment but leaves the grassland with little structural diversity and few flowers present. Annual spring/summer sheep grazing will suppress seedlings, preventing them 'getting away' but will not kill them off completely. Grazing on a 3-year rotation will allow the development of a tall grassland with a deep litter layer within the sward providing good structure for invertebrates and small mammals, depending on the timing of grazing this habitat is generally slow to become invaded by scrub. An area of the down which has been left ungrazed for over 20 years has been slow to colonise with scrub probably due to the dense grass mat which leaves little bare ground for seedlings to colonise.

See outline costs for scrub management ▶

On Martin Down, grazing is contained within electric fence paddocks, which are moved on every few weeks. This maintains a good structural diversity of grassland throughout the site. Grass/scrub mosaics and scrub block edges are also grazed for structural diversity and to maintain the grassland element. Grazing is by a variety of hardy sheep breeds, including Hebrideans with which a small flock of feral goats run. The goats have a significant effect on the scrub by bark stripping and eating the leaves and shoots.

Results

The large size of the site has allowed the maintenance of a full and diverse range of scrub communities and mosaics. The results have not always been predictable and may vary depending on the local conditions. Therefore, techniques may have to vary to achieve the best results. Extensive monitoring is undertaken across the site, partly through English Nature's Condition Assessment criteria, with limits for scrub set for each management unit. Monitoring includes fixed point and aerial photography, bird censuses, three butterfly transects and individual species monitoring. Several key species are showing increasing populations. The short cut gorse has developed an understorey of violets and been very good for Dark Green Fritillary butterflies. The Small Eggar moth has increased; the caterpillars of this species spin their webs on the edge of a thick hedge and adjacent scattered scrub.

Assessment/Lessons learned

Calcareous scrub is an integral part of the downland ecosystem, as well as being an important feature in its own right. The scrub element is an essential part of the habitat for much of the wildlife on the down from birds and invertebrates to Adders and small mammals. Scrub provides shelter, food in the form of flowers, leaves and berries, nesting sites and much else. For instance, 85% of moth species recorded on the site depend on scrub at some point in their lifecycle.

- It is important, using the management planning process, to assess the needs of all wildlife and other site features in order to make a valued judgement regarding the balance between scrub and grassland.

- The option of managing scrub as part of a mosaic of downland habitats is a continuing process and does not mean simply clearing it. It requires a large investment of time, money and hard work, but the results in terms of biodiversity are well worth the effort.

- After much trialling with different methods of scrub management a variety of approaches are still needed to deal with different situations and to provide a variety of habitats

Outline costs for scrub management

Operation	Machinery/materials	Approximate cost/ha
Cut and remove scattered scrub from open grassland. Treat stumps with herbicide.	Clearing saws/chainsaws, tractor with grab and trailer. Various hand tools. Herbicide (glyphosate).	£200
Reduce or eradicate Privet and Dogwood - spray stump re-growth and regenerating scattered bushes.	Knapsack sprayer or hand held lance with tractor or quad mounted spray tank.	£600–£1500+ triclopyr significantly more expensive than glyphosate.
Spray scattered gorse, cut and collect dead bushes in the following year.	Herbicide and applicators. Cut and collect forager.	£1500 excluding spray treatment.
Cut and remove large Gorse. Spray re-growth, cut and collect dead bushes in the following year.	Tractor mounted blade or chainsaws. Herbicide and applicators. Cut and collect forager.	£1500, excluding spot treatment.
Restoration of open, species rich grassland from large blocks of continuous scrub.	Chainsaws, tractor and grab or 360-degree excavator with drott bucket or root forks.	£1500–£1800.
Create age and structural diversity in large stands of Gorse.	Tractor-mounted swipe.	£600
Maintain age and structural diversity in mixed scrub blocks. Prevent succession to woodland.	Chainsaws, tractor mounted grab.	£1800

Modifications to future proposals/plans

- Continue to develop new methods of management and to work on improving the environmental sustainability of those techniques.

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Further reading/websites

Gibbons, B., (1989) *Reserves Focus, Martin Down, Hampshire* British Wildlife, 1 (1) pp 41-43
Toynton, P., Cox, M., (1994), *Scrub management*, ENACT 2 (1), pp10-11, English Nature
http://www.english-nature.org.uk (follow the map links to Special Sites/National Nature reserves and look for site under Hampshire)

Winter sheep grazing on Martin Down. David Burton/English Nature

7.3 Fenn's, Whixall & Bettisfield Mosses

Location: near Whitchurch, Shropshire.
SJ 490360

Status: NNR, SSSI, cSAC, Ramsar

Site manager/owner: English Nature/Countryside Council for Wales

Site description
Fenn's, Whixall & Bettisfield Mosses is Britains' third largest lowland raised bog and one of the most southerly under restoration management. The Mosses cover 948 ha with the central NNR occupying 635 ha of this.

The site underwent near destruction by drainage for large-scale commercial peat extraction, forestry and agriculture, but is still of particular importance for its bryophytes, mire plants and invertebrate communities. Many of the important invertebrates are associated with scrub.

Issues
- Large-scale scrub invasion (primarily birch and pine) is a problem across much of the site. The resultant shading, accumulation of leaf litter and increased transpiration causes drying of the mire, loss of ground flora, invertebrates and birds.

- Marginal Alder/willow carr scrub originally surrounding the mire has largely disappeared through clearance for agriculture. Invertebrates that would originally have existed around the edges are reliant on the retention of scrub on the moss to ensure their survival. For example, the presence of some scrub provides shelter for invertebrates such as the White-faced Darter.

- The local community has become used to a woodland and scrub landscape, and want this to be retained. There is a misconception that woodland and scrub is more important than is actually the case in terms of flood control, and that scrub clearance increases the risk of local flooding. These issues of public perception are common to other rain-fed sites.

Objectives
- Enhance and maintain the wet scrub and carr communities in appropriate areas.

Fenn's, Whixall and Bettisfield Mosses NNR, re-wetting the peat.
J.L. Daniels/English Nature

- To increase the extent of the moss, reduce transpiration, shading and nutrient enrichment to within specified limits, by reducing or eradicating scrub from recently colonised areas.

- Prevent scrub and tree encroachment into the open moss habitat and raise water levels to near the sur face of the peat.

- Encourage sustainable public use of the site as long as this meets leasehold and health & safety requirements and does not compromise the sites conservation objectives.

Methods
A full five year management plan sets targets for different parts of the site and a desired endpoint for management in terms of acceptable levels of scrub cover (see table). Precise management details in terms of exact location, extent and time-scale for management events are not included in the plan. This is provided by a complimentary annual estate work plan, which provides the degree of flexibility required to respond to variations in available funding and weather conditions.

Targets for scrub size and cover vary according to location and accessibility. More scrub cover is allowed in relatively inaccessible areas to ensure that resources are targeted

in areas where management will be more effective and efficient. Upper and lower acceptable limits are set; management intervention takes place when upper limits are reached (if not before). Public access is managed through a system of channelling along cleared specific trackways across the bog and a series of waymarked trails around the site periphery. The nature of the ground conditions generally prevents public access in areas where scrub clearance is being carried out.

EN and CCW specialists are consulted on the habitat requirements of species of conservation interest and this information is used to inform the management regime. The Environment Agency is consulted on water management issues while the Forestry Commission issues felling licences for woodland clearance. The local community is involved through an active programme of public events and meetings and a dialogue is maintained with parish and community councils, partly through the local press. Local MPs and MEPs are invited to participate in special events held at the site.

Scrub Eradication

Pine

- Large areas (>40 ha) of dense trees and scrub: where access is possible, trees are felled and processed with a harvester and forwarder standing on brash mats. On areas where access is more difficult, trees are felled with chainsaws, and a high lead skyline is then used to remove the trees from a circular area onto a peripheral brash mat where they are processed by the harvester and forwarder.
- Isolated trees and large scrub: felled with chainsaws, picked up by an excavator with a timber grab or with tractors and trailers.
- 1–3 m high scrub: cut with brushcutters, removed as above.
- Seedlings: pulled by hand and left on site.

Birch

The primary method of birch control on areas where water level management is possible is via raising water levels to a point where the plants die off. A second generation of seedlings then grows up which must be controlled by mechanical or chemical methods. Control methods vary according to the density and size of the scrub and the quality of the ground flora.

- Scattered trees: cut with chainsaws; stumps treated with ammonium sulphate crystals.
- Tall scrub (2–3 m) over poor-quality ground flora: cut with a hydrocut sawhead on a power arm mounted on a 4-wheel-drive 100hp tractor. The scrub is cut at the base and either collected by an excavator with a timber grab or, if the excavator is not available, collected with a tractor-mounted buckrake. Re-growth is treated in one of three ways: it is re-cut and treated with glyphosate; sprayed from a tractor-mounted sprayer tank fitted with hand lances (or with knapsack sprayers if tractor access is not available); or with a tractor-mounted weed wipe.

Felling at Bettisfield, Fenn's, Whixall and Bettisfield Mosses NNR. J.L. Daniels/English Nature

Targets for scrub control on Fenn's, Whixall & Bettisfield Mosses

Rehabilitation area (where full water level management is possible)			
Area	**Target**	**Upper limit**	**Lower limit**
Central area and all primary (uncut) peat surfaces.	No pine. Birch scrub cover 5%. Birch scrub height <1.5m. Birch scrub in scattered clumps on accessible tracks.	Pine cover 1%. Birch scrub cover 10% scattered. Birch scrub height >2 m. Any large concentrated birch patches. Any trees except in shelter belts.	None (except shelter belts).
Peripheral inaccessible areas.	No pine. Birch cover 15%. Birch scrub height 0.1–3 m. Birch scrub in scattered clumps on accessible tracks. Birch tree cover £ 1%. Alder Buckthorn favoured (due to association with larvae of Brimstone butterfly).	Pine cover 1%. Birch scrub cover 30% scattered. Birch height >3 m. Any large concentrated patches.	Birch and Alder Buckthorn cover 5%.
Peripheral accessible areas.	No pine. Birch scrub cover 15%. Birch scrub height 0.1–3 m. Birch scrub scattered throughout but in clumps to create 'hotspots'. Birch tree cover £ 1%. Alder Buckthorn favoured.	Pine cover 1%. Birch scrub cover 30% scattered. Birch scrub height >3 m. Any large concentrated patches where ground flora is being affected.	Birch and Alder. Buckthorn cover 5%.
Non-rehabilitation areas (with water management limitations)			
Wet heath with scrub over peat cuttings.	No pine. Heath with 15% birch cover. Birch scrub height 0.1-3 m. Marginal denser boundary strip 50 m wide with birch cover 25%.	Pine cover 1%. Birch scrub cover 30% scattered. Birch scrub height >3 m. Birch trees 5%.	Not defined.
Dry heath with scrub.	Central open heath >100 m width. Birch scrub cover 15%. Birch scrub height 0.1-3 m. Open heath surrounded by 25 m bands of 25% scrub cover, in turn surrounded by 5–10 m bands of drain edge trees/scrub & heather Interconnecting glades between open heath areas on 25% of their margins.	Not defined.	Not defined.

- Tall scrub over good-quality ground flora is cut with brushcutters and chainsaws. Arisings are collected with an excavator/tractor/buckrake as above. Stumps are painted with glyphosate.

- Short dense scrub (1–2 m) over poor flora is weed wiped. Experiments with digging up plants and burning were abandoned, as the large peaty root-balls did not burn well.

- Short scattered scrub over good flora is treated with glyphosate sprayed from a tractor-mounted pesticide tank or from knapsack sprayers.

- Very short (<1 m) scrub over good flora is treated with fosamine-ammonium (a selective herbicide that acts only on broad-leaved shrubs) sprayed from a tractor-mounted tank or knapsack sprayer.

- Very short scrub over poor flora is sprayed with non-selective herbicide (glyphosate).

Arisings are disposed of in several ways. Brash mats from large-scale tree and scrub clearance can be pushed into the peat if heavy machinery is available. A wood-chipper was trialled but is no longer used, as it could only be used in very dry ground conditions, and was very time-consuming to operate. Burning is the primary means of disposing of arisings. The majority of the arisings is burned on waterlogged peat in winter. Ash and any logs remaining after burning are collected and removed. Arisings are occasionally used to make or improve tracks; brash is laid out along the track and covered with a layer of peat. Another means of disposal is to place the brash into large open peat cuttings. The branches provide a frame for colonisation by Sphagnum, thus accelerating regeneration, as well as reducing the effects of wind on the water surface which can blow floating moss to the edges of pools and thus inhibit regeneration.

The area cut per year has varied enormously during the years since the NNR was established in 1991, depending on available funding and ground/weather conditions. Around 500 ha of scrub has been cleared to date.

Scrub maintenance
The general principles of scrub maintenance are to:

- Cut out bigger scrub before it begins to affect mire ground flora.

- Favour particular species (ie Alder Buckthorn).

- Keep pathways clear.

- Prevent encroachment onto banks of canals and ditches.

- Methods for cutting and disposal of arisings are the same as for scrub eradication. The length of time between cuts depends on the size of scrub community desired, and varies according to factors which affect the speed of scrub growth (primarily water levels).

- Short bushy scrub (<3 m height) is cut when the scrub singles itself (ie when single stems arise from multi-stemmed stools). It can take between 2 years (in dry areas) to 20 years (in wet areas) for this to happen. Taller scrub is cut out in coups of around 50 m x 10 m, although precise size will vary depending on ground conditions and the need to avoid creating wind corridors. An area will be cut every 5 years or so, although not all the scrub will be cut if it is below the desired height.

- The area cut per year is small at present, as management until now has focussed primarily on scrub eradication, but will undoubtedly increase in the future.

Preventing scrub encroachment
A combination of techniques is used. A long-term goal is to reduce scrub seed sources through a programme of land acquisition and scrub clearance on land adjacent to the NNR. Water level management also reduces scrub encroachment; a high water level encourages a good cover of mire plants, which reduces available niches for scrub germination, and the increased humidity favours several species of plant feeding invertebrates, which inhibit the growth of native broadleaved scrub species. Burning is not currently carried out due to the potential impacts on invertebrate communities.

Other management methods used are the manual pulling of birch seedlings and applications of fosamine-ammonium on carpets of birch seedlings. Finally, grazing is used on fields that will ultimately be reverted to bog. Grazing regimes are established via management agreements with adjacent landowners. Light grazing is used from mid-May to mid-July at a density of 4 sheep or 1 cow/ha. From mid-July to end October, grazing densities are increased to 8 sheep or 2 cows/ha.

Staffing and costs
Four estate workers (three full-time and one part-time) are employed on the NNR, mainly using heavy machinery such as excavators. Volunteers from BTCV also work alongside the estate workers; around 500 man days/year of labour is currently used.

Contractors are used to carry out large scale removal of big trees/scrub, knapsack herbicide spraying and, in particularly sensitive areas or if funding is available, stump treatment. Herbicides are supplied by EN/CCW to avoid the possibility that contractors might skimp on herbicide use to keep their costs down.

Man days for scrub control

Birch height (m)	Birch cover (%)	Location	Management	Man days/ha
<1->3	11-30	Birch on good mire vegetation on wet areas inaccessible to plant.	Chainsaw/brushcut. Stump treatment. Spot treatment of re-growth.	6 (+ disposal)
1-3	>30	Tall birch on good vegetation.	Hydrocut, buckraked. Stumps recut and treated. Re-growth weed wiped 2 years later.	4 (cutting) 2 (wiping)
<1-3	>30	Dense tall birch on poor vegetation.	Hydrocut, buckraked, sprayed.	9
<1	21-30	Dense small birch on poor vegetation.	Weed wiped.	6
<1-3	11->30	Tall birch on good vegetation.	Brushcut, stump treatment. Re-growth tank sprayer 4 years later.	30 (cutting) 4 (spraying)

Costs of treatment vary considerably depending on the type of work being carried out. Total scrub removal costs around £2,000-£5,000/ha depending on ground conditions. Timber removal requiring contractors and large machinery costs around £3,500/ha, increasing to £6,000-£7,000/ha if the skyline is required.

Stump treatment costs vary from £200-£670 depending on scrub height and density, and on ground conditions.

Some examples of the numbers of man-days required for various kinds of birch clearance are provided above.

Monitoring

Monitoring is in place for mire vegetation (via subjective assessments and permanent quadrats), invertebrates and birds. Key invertebrate indicator species are chosen for monitoring (eg White-faced Darter, Large Heath Butterfly) to ensure resources are targeted towards important conservation features.

Results

Fenn's, Whixall & Bettisfield Mosses is currently undergoing a huge change, with large-scale scrub clearance focussing initially on eradication. In time, the focus will shift towards maintenance of remaining areas. Overall, the scrub control programme has been successful; the centre of the bog now has only scattered scrub, and pine woodland, which once covered Bettisfield Moss, has been completely removed. Bog vegetation is starting to regenerate in some areas. The success of bog restoration is measured mainly through presence (and amount) of Sphagnum (this demonstrates active peat formation) and the presence of key invertebrate indicator species.

Species that have measurably benefited are mire plant species such as Sphagnum, Bog Rosemary, Cranberry and lesser Bladderwort, invertebrates such as White-faced Darter and Large Heath, and bird species such as Curlew (which has increased from 6 to 23 breeding pairs in 10 years). A decline in bird species associated with scrub has been observed, although no species have been lost; they still occur in the remaining scrub areas, particularly around the margins of the site.

Assessment/Lessons learned

- It is important to be clear about the objectives of scrub clearance (i.e. whether scrub is to be cleared for bog restoration or maintained) on each area, and to think in the longer term about removing seed sources and raising water levels to minimise the encroachment problem.

- It is essential to clear scrub before the canopy closes and mire vegetation is impacted. It has been necessary therefore to concentrate on older, denser scrub rather than on smaller saplings. Past management on some sites focused on preventing encroachment at the expense of preventing succession from open to closed canopy scrub, resulting in the development of clear patches surrounded by dense scrub or woodland, with resultant loss of mire vegetation and an increased seed source for encroachment. Once canopy closure has been prevented priority can return to clearing shrubs whilst they are small.

- Pine encroachment has proved to be particularly difficult to control, as raising water levels does not kill existing trees, and seedlings are relatively herbicide tolerant. Reducing nearby seed sources is the long-term key to control.

- Results of clearance and prevention of re-growth were initially poor whilst techniques were being developed. Even if stump treatment was successful, intensive management is still required on newly cleared areas, as the ground disturbance stimulates the growth of a new generation of seedlings.

- The placing of cut scrub into open water to provide a framework for moss colonisation has proved to be a very important factor in the success of bog restoration.

- The management objectives have changed from a policy of complete eradication to one of control and maintenance in some areas once the extent to which many rare invertebrate species dependant on the presence of some scrub became apparent.

- Methods and efficiency have evolved and improved as new machinery becomes available and experience of various techniques increases and methods refined. Techniques have also evolved as clearance has progressed from areas where the ground flora is poor, and hence measures that are more drastic can be used, into areas where mire vegetation is still present.

Modifications to future proposals/plans

- Acquiring more land around the NNR to further the removal of scrub seed sources will be a priority. Scrub management will progress from the current 'rescue' eradication phase into one of scrub maintenance.

- Changes in methods will undoubtedly arise as knowledge of species' management requirements increases, and through the development of new machinery. Changes will also be forced by the imminent loss of fosamine-ammonium as an approved herbicide at the end of 2003.

- Other management changes that may be considered are the introduction of grazing on the mossland and the winter burning of arisings on very wet areas.

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Further reading/websites

Fojt, W (1994), T*he conservation of British fens*, British Wildlife 5 (6), pp 355-366

http://www.english-nature.org.uk (follow the map links to Special Sites/National Nature reserves and look for site under Shropshire)

7.4 Wicken Fen

Location: Soham, Cambridgeshire. TL562705

Status: NNR; SSSI; SAC, Ramsar

Site manager/owner: National Trust

Site description
The reserve of 525 ha includes 255 ha of important remnant East Anglian fen. Habitats comprise a mosaic of sedge and reed beds, fen meadow, dykes and pools, drier grassland, carr scrub and woodland. Newly acquired farmland will be restored to wetland. The site is noted for having communities of rare fenland plants and invertebrates.

Issues
The fen was traditionally managed by between 50–90 local villagers, each cutting a strip of fen annually.

- With the cessation of traditional management, wet carr scrub has encroached many parts of the reserve reducing the amount of open fen and reed to only 25% of the site, threatening the diversity of the flora and invertebrate fauna.

- However, wet carr scrub is an important community for wildlife. At Wicken Fen, it is known to be particularly important for fungi, invertebrates (notably diptera) and for breeding birds such as Long-eared Owl.

Objectives
The original objectives of the National Trust when purchasing the Fen were recently re-evaluated, with the conclusion that scrub carr, although valuable, had encroached too far into the site's characteristic open fen habitats. The following revised objectives are the basis of the current project:

- Remove 55 ha of scrub carr from recently colonised areas in order to increase the extent of the tall-herb fen habitats from the current 25% of the site to around 60%.

- Prevent the further encroachment of scrub carr into important tall herb fen habitats.

- Maintain and enhance the scrub carr community in appropriate areas to a maximum extent of 40% of the site.

Wicken fen NNR. Adrian Colston/National Trust

The Trust launched the Centenary Project in 2000 with the aim of meeting the above objectives. The four-year Project has received funding from the Heritage Lottery Fund (HLF).

Methods
Wide consultation on the project was undertaken, internally with the National Trust's conservation committee and local management committee and with agencies such as English Nature and the Forestry Commission. A good relationship with the local community has been developed.

Priority areas for scrub removal are set out within the five-year management plan. However, both the order and method of working has been adapted, due to the difficult, often wet, ground conditions. Work continues in priority areas when ground conditions allow but the fluctuating water levels tend to dictate which areas can be worked at any particular time.

It was originally decided that following scrub cutting, stumps would be pulled and removed mechanically.

Arisings were to be burnt in selected sites. However, the fluctuating water levels and resultant wet ground conditions, and the need for level, stable ground for future mowing of the fen communities, have forced a change of management method. Stumps are now cut flush to the ground and immediately treated with glyphosate. Stump grinding was also considered but rejected, again due to the difficult ground conditions.

The arisings are burnt on site but the volume to be dealt with has necessitated the use of adapted mobile metal 'burning trailers', so preventing nutrient-rich ash being left on the ground. A tracked excavator lifts the arisings into the trailers, but the rate of disposal is much slower than cutting. Around 15 ha of scrub will be cleared annually for four years.

Half of the treated area (Sedge Fen) will revert to traditional rotational fen mowing, which will prevent regeneration. The other half (Verrall's Fen) will be managed by extensive, all-year, grazing by Konik ponies. The grazing density is one animal per three hectares, with a total grazed area of 58 ha. The 'cleaning' of the ground has had to be comprehensive in the mown compartments, while some log piles have been left in the grazed area. Around 10–15% scrub regeneration will be tolerated in the grazed compartment.

The key scrub species present are various willows, birch, Alder Buckthorn and Buckthorn, the latter vigorously regenerating if allowed. Re-growth from the cut and treated stumps is variable, probably depending on the conditions each year, but may be up to 20%. Re-growth is treated again in the following summer. Re-growing saplings of Buckthorn, are spot-treated with chemical.

There is no current management plan for the remaining areas of carr at the end of the current project. However, some form of coppice rotation is envisaged. There is no established traditional management for the carr, as it has all developed through neglect of the sedge beds. As conditions have become wetter in recent years, the carr in the wettest compartments has receded as trees have died.

The HLF funding has enabled the employment of three contract staff who work alongside permanent staff and volunteers. Scrub removal now occupies around eight months of the working year, when conditions are suitable, with a daily team of up to nine people including 3–5 chainsaws. However, removal of the arisings dictates the speed of progress. The contract staff also have animal husbandry duties.

Results

As the project is only in its second year, full results are not yet available. However, early signs from extensive vegetation monitoring and breeding bird surveys are encouraging. Within Sedge Fen the key communities are those dominated by Saw Sedge Cladium mariscus and these will be monitored carefully.

Assessment/Lessons learned

- One of the key lessons is the need to establish working techniques that are applicable to the particular site. The ground conditions at Wicken Fen have proved particularly difficult but although the methods have changed to suit the site, the objectives have remained the same.

- The introduction of fen grazing is a new management method for this site. The effect of grazing on the mown fen communities is uncertain but the decision to graze was made on the understanding that current staff resources would not allow for the mowing of any additional areas beyond the current priority compartments. A baseline survey was undertaken before work commenced and the vegetation within the grazed areas will be carefully monitored for at least 10 years before making any decisions. With an ambitious wetland restoration scheme proposed for surrounding farmland areas, extensive grazing is seen as the only viable form of management.

Modifications to future proposals/plans

- The Centenary Project runs for four years, future proposals will be considered at the end of this period.

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Further reading/websites

Friday, L and **Colston A** (1999) Wicken Fen – *The restoration of a wetland nature reserve* British Wildlife 11 (1) pp 37-46
Walters, M (1994) Classic wildlife sites, *Wicken Fen Nature Reserve British Wildlife* 6 (1), pp 5-13
Fojt, W (1994), *The conservation of British fens*, British Wildlife 5 (6), pp 355-366
http://www.wicken.org.uk/

7.5a Gibraltar Point

Location: Skegness, Lincolnshire. TF556580

Status: NNR, SSSI, SAC, Ramsar, SPA

Site manager/owners: Majority owned by Lincolnshire County Council, the rest owned by East Lindsey District Council and Lincolnshire Wildlife Trust

Site description
The site comprises 430 ha of sand and mud seashore contiguous with The Wash. There are extensive sand dunes, salt marshes and additionally freshwater habitats.

The reserve consists of a series of almost parallel dune systems separated by salt marsh. The innermost dunes, or West Dunes, are believed to have built up over a period of 300 years.

The dune sand is mildly calcareous and where a fine turf has developed on the oldest dunes it has some of the characteristics of chalk downland.

Issues
- To enhance and perpetuate the internationally important coastal communities in line with the EC Habitats Directive and SAC designation. These are: humid dune slacks, embryonic shifting dunes, fixed dunes with herbaceous vegetation, shifting dunes with marram grass, dune scrub with Sea-buckthorn and Atlantic salt meadow.

- Dune slacks are the biggest conservation priority on the site, and the yellow and grey dunes are highly important. The yellow dunes are a mobile dune community with extensive areas of Marram Grass. The grey dunes represent a later successional stage of fixed dunes.

- The Sea-buckthorn Hippophae rhamnoides, which provides important food and cover for birds, is also of high conservation importance. Gibraltar Point is one of only two UK sites to achieve international recognition for its Sea-buckthorn community. Large areas of Sea-buckthorn are managed and protected from invasive non-native species, but when Sea-buckthorn encroaches onto the dune slacks it is removed. Elsewhere management aims to create a balance between scrub coverage and dune grassland.

Diverse age structure of sea buckthorn, Gibraltar point NNR. Kev Wilson/Lincolnshire Wildlife Trust

Objectives
- Working to achieve favourable conditions as a SAC site.

- Ensuring continuation of extent and age classes of Sea-buckthorn scrub community.

- Maintaining or restoring the extent of yellow and grey dunes and dune slacks.

Methods
Dune restoration
Prior to reintroduction of limited sheep grazing in the late 1980's rabbit grazing had maintained short dune turf communities and suppressed scrub colonisation to a certain extent in the absence of any other herbivores.

There are two components to the current restoration of the dunes:
1. Suppression of pioneer growth
2. Removal of established scrub

Suppression of pioneer growth involves selective brush cutting and hand pulling. Young growth can be tackled in any month. Maturing scrub is cleared in winter to avoid disturbing nesting birds.

Experimental trials with triclopyr have proved successful for follow-up treatment. Chemicals are not the preferred method for clearance though.

Removal of established scrub has involved the use of a tractor-mounted bush-hog and chainsaws. Cleared vegetation is burnt in pits. This work is carried out over successive winters.

Grazing by Hebridean sheep is currently practised with the use of temporary electric fencing. These browse the re-growth in the spring. Cattle are also used on the site to break up the scrub by trampling through it. There are some large, permanent enclosures but in recent years the grazing regime has been expanded primarily within electric fencing.

Maintaining the Sea-buckthorn scrub community:
Coppicing is carried out to regenerate Sea-buckthorn and diversify its age structure. Currently, 0.4 ha are coppiced per year on a twenty-year rotation. Within each block, 75% of scrub is coppiced.

Sycamore is removed when it enters stands of Sea-buckthorn; young saplings are hand pulled, mature trees are cut and stump treated.

Areas of dune scrub show succession to sallow, Salix caprea, canopy. A representative area of this community is retained, as this is the natural mature canopy for this community type. Elsewhere the spread of sallow into dune slack is undesirable.

Consultation
English Nature consent the five year management plan and advise favourable condition. This includes details of scrub management prescriptions in management compartments fine-tuned from EN contracted research by Dr Tom Dargie on favourable condition for Sea Buckthorn scrub. Lincolnshire Wildlife Trust also report to Lincolnshire County Council and East Lindsey District Council, from whom they lease the land. Advice will be sought from managers at the Sefton Coast, where techniques have been developed for scrub removal on dunes.

Results
Dune restoration:
Clearance of established Sea-buckthorn on the dunes has not immediately restored favourable conditions on the dunes; the nitrogen fixing abilities of Sea-buckthorn and the leaf litter produced enrich the substrate with nutrients. Consequently, ruderal species, such as nettle and Rosebay Willowherb have invaded the area, creating a need for further management intervention.

There has been no adverse public reaction to the current scrub clearance policy. Large-scale scrub clearance carried out in 1968 and again in 1971 did not result in any adverse reaction from the public. Nevertheless, the Trust followed up the clearance work with an article in their magazine explaining the reasons for the work.

Assessment/Lessons learned
- Large-scale scrub clearance does not always result in immediate success. Other limiting factors must be taken into account, in this instance, the ability of Sea-buckthorn to fix nitrogen in the soil means sustained follow-up treatment is required to combat the invasion of ruderal weeds into the habitat after clearance.

- If resources allow, seek to use methods that minimise the effort to remove scrub and amount of follow-up treatment and use of herbicides required, especially when carrying out eradication to restore open habitat.

- Although public reaction to large-scale scrub clearance has not been an issue at this site, informing people the reasons prior to and during the work makes good public relations and allays any fears and issues before they arise.

Modifications to future proposals/plans
Dune restoration - the removal of established scrub on the saltings ridge system, in the north of the site:
- This provides an opportunity to regain the transitional process from yellow dune to grey dune in this part of the site. A tractor-mounted grab will be used to pull out the whole plant including root system. The vegetation will be burnt. This will be done in winter. Removal of the whole scrub plant including root system will be quicker and more economical in the long term than cutting and stump treating; it negates the need for herbicides and follow-up treatment. Further, the disturbance to the ground helps to break up the leaf litter and brings sand to the surface, which assists by pioneer species.

- Ruderal invasion will be managed by intensive cutting in subsequent spring/summers.

- It is anticipated that large-scale clearance could result in negative public perception; explanatory display boards and leaflets are planned to inform the public about the work.

- The site is preparing for a return to extensive natural grazing regime over the dune landscape. Livestock grazing by Hebridean sheep and cattle on the site has produced beneficial results and there are plans to extend the permanent areas enclosed in stock fence

and to set up a rotational grazing system. Currently, the Trust grazes cattle from local farmers; but may be forced into acquiring its own herd of cattle to graze the various habitats in the future. Lincolnshire Wildlife Trust has its own Hebridean sheep flock. The aim is to manage the reserve under more natural and extensive regimes through livestock grazing.

Maintaining Sea-buckthorn

Investment will be made into researching the structure and associated biodiversity of the Sea-buckthorn. This will involve:

- Assessing coverage of established male and female blocks.
- Assessing extent and proportions of different age classes (young growth < 5 years old, mature growth >20 years old). Dated aerial photos will be used to assist with this.
- Further investigation of invertebrate surveys to assess value of Sea-buckthorn at various growth stages.
- An important component of the long-term enhancement of Sea-buckthorn stands involves the creation of scrub-grassland ecotones. This will be achieved and maintained by livestock.
- The scrub coppice programme is currently only carried out on a small scale and it is experimental, but there are plans to expand to blocks on the outer ridge system.

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Further reading/websites

Gibbons, B., (1996) *Reserves Focus, Gibraltar Point NNR, Lincolnshire* British Wildlife, 7 (3) pp 177-179
http://www.lincstrust.co.uk/reserves/gib/gib.html

Sea buckthorn coppice plot, Gibraltar point NNR. Kev Wilson/Lincolnshire Wildlife Trust

7.5b Ainsdale Dunes

Location: Merseyside, SD292102

Status: NNR, cSAC, SPA, Ramsar

Site manager/owner: English Nature

Site description
The Ainsdale Sand Dunes National Nature Reserve is of European importance because of the lime-rich sand dunes that support a unique flora and fauna. A complete successional range of habitats is present, from strandline vegetation through embryo dunes, marram dunes through to fixed dunes with numerous wet dune slacks. The reserve supports a large population of Natterjack Toad and a distinctive race of Sand Lizard. The total area of the reserve is 492 ha but approximately 140 ha of this is pine plantation. The pine plantation supports a healthy population of Red Squirrels.


Ainsdale sand dunes NNR

Issues
- Sea-buckthorn and pines have been introduced into the dune system and now cause serious encroachment problems that threaten the conservation interest of the open dune habitat.

- Public objection to large-scale scrub and pine clearance has been strong. While the extent of Sea-buckthorn clearance has been scaled down, there still remains some proposed large-scale clearance of pine in order to restore the dune system.

Objectives
- Work to achieve favourable condition of features of conservation interest at a cSAC site and to achieve BAP gain in relevant species and habitats.

- Working with local communities to achieve large-scale conservation goals, including scrub reduction.

- Working to gain public support to achieve conservation management objectives.

- Balancing different needs and priorities within the reserve.

Methods
At present, there are approximately 3–4 ha of Sea-buckthorn present on the site, and this is being cleared in small patches. Previously, approximately 6 ha of scrub were cleared per year but in recent years this has been reduced significantly.

Different methods to clear Sea-buckthorn have been employed according to the size of the stand:

1. Large stands (larger than 0.2 ha) using a four-wheel drive tractor with wide-gape grab.
2. Medium stands (up to 0.2 ha) using a chainsaw and then stump treated with glyphosate or triclopyr.
3. Small stands (suckers up to 2 cm diameter at base) using a brushcutter and the bushes are then either grubbed out by hand or treated with foliar spray of glyphosate or triclopyr in summer. The decision about which herbicide to use is based on the presence (or not) of other vegetation. If Sea-buckthorn is amongst mainly Marram Grass, triclopyr is used, as this does not kill grasses.
4. Very small stands (suckers up to 1 cm at base) using a foliar spray with glyphosate or triclopyr. Follow up treatment is carried out for at least two years.

Winter grazing by Herdwick sheep is used to prevent the spread of scrub. They graze from 1st October to 30th April. Sheep grazing will not tackle established stands; summer grazing would be needed for that. Pygmy goats or ponies may be introduced into a trial grazing plot to control scrub.

At present, around 25 man-hours per year are spent on scrub clearance. Previously (when 6 ha per year were cleared), man-hours spent on scrub clearance totalled 400–500.

When clearance of the frontal pine plantation and scrub began ten years ago, leaflets about the work were distributed to households in the areas of Ainsdale closest to the reserve, but not throughout the whole of the town, or Formby. Leaflets were also given to people who complained about the work or who expressed an interest. Past public reaction to scrub clearance at Ainsdale has been mild in comparison to reactions to clearance of the pine plantation. Very few people have specifically complained about the removal of Sea-buckthorn. However, scrub removal has been scaled down, and is now carried out in small patches; the scrub is thinned progressively so that clearance appears less drastic to the public.

An independent Environmental Impact Assessment will be carried out in 2003 to determine the best way to manage the site.

The public are kept informed and can access information about the management of the site through a variety of innovative schemes:

- The team have employed a Community Officer whose contact details are posted around the reserve.
- Newsletters providing information about work planned for, and currently being undertaken, at the site are distributed to every household in Ainsdale and Formby with the free local newspaper. This newsletter contains information about the dunes and the pine plantations thus providing a balanced representation of the two main habitat types at the reserve.
- Guided walks around the reserve.
- Display panels at local shows.
- English Nature appointed a team from the University of Liverpool to undertake an independent review of sand dune restoration at the reserve. As part of this, a questionnaire went out to all households in Ainsdale and Formby regarding their views on landscape, wildlife, management and information available about the reserve. Hundreds of copies have been circulated to local councillors and interested local people (eg civic societies, local opposition groups and herpetological groups).
- A study was also carried out by a university student regarding public relations and nature conservation at the Ainsdale NNR. The study identified 'early and frequent dialogue' as the most successful public relations method.

The following groups are consulted about the management of the reserve

Coastwatch (the local opposition group), Local councillors, Local MPs, Environment Agency, Local Authority, RSPB, Herpetological Group, Wildlife Trust, Local people

Results

Scrub clearance at the site has been very successful, due to foliar spraying for at least 2 years followed by sheep grazing. Scrub clearance has been scaled down to the removal of small patches and thinning of stands.

The felling of pinewood as part of the sand dune restoration was planned in four phases but after the second phase in 1996, English Nature responded to public concern by putting the felling programme on hold. The remaining approximately 17 ha of pinewood remains on the frontal dunes. English Nature is awaiting the outcome of the EIA to determine how the management of the reserve will go forward. The public concern at the felling of the pinewoods and resulting consultation and public relations work has resulted in increased costs to the English Nature team.

Assessment/Lessons learned

- The consultation and public relations work has demonstrated successful communication through a broad range of media. It has also proven the benefits of communicating and consulting in an inclusive way; sending the newsletter to every household via the free local newspaper has been a highly beneficial exercise.
- Any changes to management objectives will come because of recommendations made by the EIA.

Modifications to future proposals/plans

- The outcome of the EIA may result in patches of the final block of frontal pinewood remaining on the dunes with cleared patches around it, as opposed to total clearance and complete restoration of the frontal sand dunes.

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Further reading/websites

Roony, P. (1998) *A Thorny Problem*. Enact **6**: (1) pp 12-13.
Smith, P. (2000) *The Sefton Coast Sand Dunes, Merseyside*. British Wildlife **12** (1): pp 28-36.
www.english-nature.org.uk (follow the map links to Special Sites/National Nature reserves and look for site under Merseyside)
www.seftoncoast.org.uk

7.6a Moor House and Upper Teesdale

Location: Between Alston, Appleby and Middleton-in-Teesdale, County Durham NY799358

Status: NNR, SSSI, SAC, SPA,

Site Managers/owners: English Nature and various private owners

Site description
The site comprises 7,387 ha of geologically important carboniferous limestone, shale and sandstone deposits, quartz dolerite intrusion and landforms later influenced by glaciation and mining. The habitats present on site are a mosaic of hay meadows, limestone grassland, moorland, acid grassland, blanket peat bog to summit heath. There is a relict arctic-alpine flora and upland woodland and scrub, including possibly the largest extent of Juniper in England. The majority of the Juniper stands are found growing on heathland (over the igneous Whin Sill rock) and are of the NVC community W19 Juniper-Wood Sorrel community.

Issues
- The Juniper at Moor House – Upper Teesdale is threatened by current stock management regimes; over grazing by sheep suppresses regeneration. In addition, over grazing by Rabbits is an important issue at the site.

- The suppression of regeneration has led to the development of mature to old 'geriatric' stands; seed productivity in these stands is not poor, though the proportion of viable seed produced declines as stands continue to age.

- These issues threaten the long-term survival of Juniper across northern England. In places, Juniper has been lost due to fire and not regenerated as a result of heavy grazing pressure.

Objectives
- To maximise the area of Juniper scrub by reversing reductions in quality and extent.

- To identify the factors which are important in encouraging natural regeneration of Juniper.

- To prevent any further losses due to over grazing and physical damage.

Moor House and Upper Teesdale, Holwick juniper area.
Martin Furness/English Nature

- To restore Juniper to areas, or adjacent to areas, where losses have occurred.

- To protect propagated material or natural regeneration from grazing by Rabbits and domestic stock.

- To prescribe stock management regimes that is appropriate for the restoration and future management of this habitat.

- To prevent further losses due to accidental burning.

Methods
The work is set out in a five-year management plan. The plan sets out detailed management but retains a degree of flexibility to allow for unforeseeable management opportunities. The current management plan aims to restore the historical range of the Juniper. There are no known photos or documentation to guide the extent of the planting; the limits of current live or dead bushes are used to determine the area selected for planting.

The following people are consulted with regards to various aspects of the Juniper management:

- Tenant farmers and landowners.

- The Forestry Commission.

- PlantLife.

- Planting contractors and commercial nurseries.

Management Methods
Grazing regimes vary across the site. In some areas English Nature have negotiated a reduction in grazing densities of domestic stock while in other areas sheep have been excluded but heavy Rabbit grazing occurs. Some smaller areas have been fenced off using Rabbit-proof fencing to exclude grazing altogether, but this may encourage prolific vole populations.

At Holwick (NY 890280) the stocking regime (outside the exclosures) comprises 1.5 ewes/ha in summer (lambing to tupping); from 15th November to 15th December sheep are removed altogether for tupping and 1 ewe/ha are grazed for the rest of the winter (tupping to lambing). The site is grazed with Swaledales. Historically cattle and presumably also ponies had access to the Holwick area, although currently the landlord permits only sheep. The current grazing regime is not believed to be ideal.

At Cronkley (NY 864283) sheep are removed from the Juniper wood for 3–4 months in winter (December to March). Rabbits are present in high numbers.

At Raven Scar (NY 835293) and Black Sike (NY 833280) sheep are excluded altogether. Rabbits are present in low numbers at Raven Scar, but medium to high numbers occur at Black Sike.

At High Knott (NY 868288) sheep are excluded. Rabbit numbers are high.

At Dine Holme Scar (NY 865284) sheep have access to the Juniper but will be fenced out in 2004. Rabbit numbers are high. ▶

Results
Using contractors, site staff and volunteers to monitor survival of the planted seedlings assesses the project success. In one area, survival is up to 95% but is more generally around 60–70%. The present planting has increased the population by approximately 50% and is maintaining the current stand of mature to over mature bushes, but there is very little signs of natural regeneration (it is scored as unfavourable in English Nature condition assessment terms).

Other species should benefit from the restoration of Juniper at Upper Teesdale. Fruit-eating birds will benefit from the extra winter food supply provided by the Juniper and broadleaved berries. In addition, the shelter afforded by the bushes in the harsh upland winter benefits many bird species. The Black Grouse Recovery Project (being carried out at Moor House) recommends Juniper as a suitable shrub to plant for this species, along with the Rowan, Hawthorn and Birch.

Protecting planting from grazing by sheep and rabbits.
Martin Furness/English Nature

Assessment/Lessons learned
- The seedling planting has been successful, and trial and error has refined the techniques used. Cell-grown seedlings establish the best and are used in preference to cuttings, bare rooted stock or broad casting seed to germinate in situ. The 20 cm dia. x 0.6 m (meshed) tree guards are less susceptible to wind throw, give the seedlings enough room to grow and may increase the speed of acclimatisation, but solid guards may be useful on grassy sites. Mulch mats, which are supposed to suppress the growth of grasses inside the tree guard, have been less successful in reducing competition, especially on heathery sites, and wood-chip may be tried as an alternative in the future.

- Where fencing is used to manage grazing, consideration must be given to the impact of the fencing on birds. Some species of bird, including Black Grouse, are prone to collisions with stock fences, which can cause mortality. To maximise the visibility of the fence, the top wire is marked with metal plates, and fences are sited away from skylines.

- The current programme of seedling planting, although very successful, is not sustainable; it is very labour-intensive and does not solve the real long-term problem of over grazing which threatens the Juniper on the site.

Outline costs for scrub management

Area	Responsibility	Function	Condition/Lifespan	Description & Size	Maintenance
Black Sike.	English Nature.	Exclude sheep to protect plantings and Juniper woodland.	Installed in 2000.	8/91/30 Titan Stiffstay with two plain wires ring-clipped to top and bottom. Bird deflectors. Total boundary of fence 1,350 m.	Some snow damage expected.
Holwick Juniper. Experimental. Exclosures x 4.	English Nature.	Exclude sheep and rabbits to protect plantings and Juniper woodland experimental management.	Installed 1989 and still in fair condition.	1m high Rabbit netting ring clipped to 4 plain line wires with a further 2 line wires above. Rabbit netting height extension.	
High Force Juniper exclosure.	English Nature. (except western edge – Strathmore Estate)	Exclude sheep from north west corner of Holwick Juniper stand.	Erected in 1968, condition now very poor but still stockproof.	Standard stock netting with 2 plain wires above. Gated in Pennine Way. Length: EN 1,000 m, Strathmore 150 m.	Renew fence in next 5 years.
Holwick Juniper. Restoration Exclosures x 14.	English Nature.	Help restore ailing juniper stand and protect plantings.	Installed 1999.	1.2 m heavy gauge Rabbit netting, ring clipped to 5 line wires and turned out 300 mm and buried. Average size of plots 50 m x 30 m with access stile.	Some snow damage may occur. Digging by Rabbits.
High Knott.	Farm Tenant.	Exclude stock grazing to protect woodland and Juniper.	Wall in poor condition (600 m) but wall top netting (310 m) along top boundary renewed 1999.	Rough walled enclosure with wall top netting.	

- Conflict with the current agricultural regime is a major problem for the long term, sustainable future of Juniper at Upper Teesdale. English Nature must negotiate with around 30 landowners, many of whom graze domestic sheep on the reserve. The replacement of episodic grazing and poaching by native cattle and ponies with permanent sheep grazing is, together with presence of large numbers of Rabbits, thought to be a major reason for the lack of Juniper regeneration at the site. Domestic sheep crop the grass uniformly, whereas native types of cattle and ponies will tear at the grass in patches and being heavier can cut the sward with their hooves which may actually encourage germination of Juniper seedlings. A further problem is the occasional burning of Juniper as a consequence of adjacent heather burning for Red Grouse.

Modifications to future proposals/plans

- Future work aims to address the long-term issues of sustainability and over grazing. Although the current work programme is successful, it cannot be continued indefinitely given the high labour costs involved in planting and aftercare.

- The large number of Rabbits present needs to be drastically reduced, and the agricultural grazing regime needs to be amended to better suit Juniper; ideally, sheep should be replaced by small breeds of hardy native cattle or ponies. Exactly at what intensity and timing of grazing by these type of animals would result in favourable conditions for seedling germination needs to be determined by experimental manipulations. Also by reference to Vedal (1961). Discussions are ongoing with graziers to implement a grazing regime in accordance with these outline prescriptions on a section of the Juniper scrub.

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Further reading/websites

Barrett, J., (1997), *Regenerating Juniper*, Enact 5 (1)
Fitter, A.H., Jennings, R.D., (1975), *The effects of sheep grazing on the growth and survival of seedling junipers*, Journal of Applied Ecology, vol 12 (2), pp 637-642
Vedal, H (1961) *Natural regeneration in Juniper*. Proc. Bot Soc of British Isles. Vol 4 1960-1962, pp 146-148
http://www.english-nature.org.uk (follow the map links to Special Sites/National Nature reserves and look for site under Durham)

7.6b Old Winchester Hill (OWH)

Location: Near Warnford, Hampshire, SU641205

Status: NNR, SSSI, AONB, SAM no 56

Site Manager/owner: English Nature

Site description
The site comprises 63 ha of chalk downland and its associated flora and fauna, with an important mixed scrub community that includes Juniper. The hill is the site of a pre-Iron Age fort, and receives about 50,000 visitors a year.

The species of plant found are typical of chalk communities, and include various orchid and vetch species. The mosaic of scrub, chalk grassland and woodland edge also supports many important populations of butterflies and other invertebrates.

Part of the scrub community is 4 ha of Juniper scrub mostly situated on the south-facing slope. The bushes have a varied aged class due to varied grazing management over the past 100 years (Bacon, 1980). There are 14 of the 26 known invertebrate species present which depend on Juniper to complete their lifecycle. The bushes lower down the slope are much larger than those towards the top because the soil is deeper and conditions are less harsh.

Issues
- Juniper is nationally and locally threatened by changes in land use, suppressed regeneration caused by unsuitable grazing, fragmentation of habitat, poor seed productivity and seedling establishment.

- The site where Juniper occurs on OWH is also nationally important for a very rich plant and insect community so any increase in juniper bushes has to be balanced against smothering out the grassland communities. (Site notable for 30 to 40 chalk plants per sg m including 9 species of orchid and Round Headed Rampion (*Phyteuma tenerum*)); invertebrates (circa 30 species of butterflies including a large population of Chalk Hill Blues).

Old Winchester Hill NNR. Peter Wakely/English Nature

Objectives
- To maintain existing stands of Juniper in terms of both extent and health of bushes.

- To diversify the age structure of Juniper by encouraging/assisting establishment of seedlings.

- To maintain deciduous scrub communities at their current extent, by annual cutting and limited use of herbicide.

- To maintain current structural diversity, by rotational coppicing of permanent scrub blocks.

Methods
The management of the reserve is laid out in a management plan which is reviewed every five years. The plan utilises a combination of precise management in some areas with a generic approach used for other areas to allow flexibility within the life of the plan. The reserve is important for botanically rich chalk grassland, which is lost when scrub encroaches so the managers intervene to cut the mixed scrub according to the amount of cover over the chalk grassland. The main aim of the current plan with regards to Juniper is to create a strategy to maintain the stand and encourage recruitment.

The following experts were consulted to inform the decision-making regarding Juniper and grassland management: Jill Sutcliffe (English Nature), Miles King (PlantLife), Lena Ward (Juniper researcher), Tracey Williams (RSPB Chalk Grassland Officer). There was no public consultation.

Current management to maintain the existing stand involves cutting back the deciduous scrub that encroaches onto the Juniper lower down the hill, where the soil is deeper. Chainsaws and brushcutters are used and the cut material is burnt or stacked. Re-growth is prevented by stump treatment with herbicide or repeat cutting.

Grazing in the 1970's and 1980's was by sheep and cattle on a rotational system totalling the equivalent of 7 to 8 sheep per hectare to reduce the dominance of vigorous grasses. This had been successful so that by the 1990's grazing by sheep (Beulahs, Herdwicks and Easycares) was required for only six months during the autumn and winter; 100 sheep graze approximately 40 ha of grassland - a grazing density of only 2.5 sheep per ha.

Some Rabbit control is undertaken in the form of ferreting, carried out by a volunteer. This is done to try to keep Rabbit numbers at an acceptable level. This may help prevent losses of Juniper seedlings and also benefits invertebrates by increasing the number of flowers.

English Nature staff undertakes the majority of management work.

Results
Winter grazing by young cattle in the early 1970's had been observed to result in rubbing and barking damage to tall Juniper bushes leaving them with bare stems. Early summer grazing by sheep in the late 1970's had been observed to cause shoot tip and branch die-back from sheep rubbing themselves on bushes to remove wool. Once the lead and lateral shoots are damaged they do not seem to re-grow.

In the 1990's and more recently winter grazing by sheep does not appear to have had a negative effect on existing Juniper bushes and very little browsing damage is noted to the mature bushes and this period of grazing fits well with other botanical and invertebrate requirements. However it is known from trial work done in the 1980's (Bacon, 1985, *OWH Event Record Cards*) when numerous juniper seedling successfully germinated under a rotational grazing system(*) in the 1997 to 1985 period that sheep will graze off even 4 year old Juniper seedlings before they can become permanently established. (* A variation based on Vedal 1961: five years grazing to produce really short turf conditions followed by four years with no grazing to allow germination and establishment in short turf conditions). There is currently no programme in place to monitor recruitment of seedlings.

Autumn and winter grazing also allows the summer flower and butterfly spectacle to be enjoyed and appreciated by the visitors which in turn helps with wardening requirements on this well used recreational site.

The SSSI features are in favourable condition. English Heritage are consulted on the archaeological interest. The site has been damaged in the past, but not since it received NNR status in 1954.

Assessment/lessons learned
- Initial objectives for the Juniper stand have changed because of constraints imposed by other conservation features on the site. The negative impact of Juniper encroachment on the chalk grassland means that increasing the extent of the stand on the south-facing slope is not appropriate.

- Attempts to diversify the age structure and encourage recruitment by scarifying patches of ground around female plants on the earth works have been opposed by English Heritage due to the potential damage to the archaeological value of the site.

- Away from the hill fort rampart limited grazing in autumn by cattle would help create hoof marks where berries would germinate and seedlings establish. Cattle grazing would be less likely to result in snipping off of young juniper seedlings. Limited hoof marks would also provide hotter niches that would provide ovipositing sites for some of the important butterfly and invertebrate species.

Modifications to future proposals/plans
- The site managers plan to cut back Juniper which has grown over a permanent butterfly transect set up in the 1970's, so that monitoring of important chalk grassland species can continue.

- To achieve diversification of the age structure of the Juniper stand and to reduce shading of the chalk grassland by dense patches of old bushes, the site managers plan to remove some of the moribund older bushes and replant with seedlings. The seedlings will be grown from seeds or cuttings taken from bushes on the site in order to maintain local genetic integrity and will be cultivated in a local nursery.

- Further establishment on adjacent slopes of OWH which have fewer competing species of national importance is an option that should be considered.

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Further reading/websites

Bacon, J., (1980) *An integrated study of the principle habitat features and past management of the south facing slope of Old Winchester Hill Reserve.* NCC Senior Warden Thesis. English Nature
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Vedal, H., (1961) *Natural regeneration in Juniper*. Proc. Bot Soc of British Isles. Vol 4 1960-1962, pp 146-148
http://www.english-nature.org.uk (follow the map links to Special Sites/National Nature reserves and look for site under Hampshire)

7.7 Ben Lawers

Location: Killin, District of Stirling, formerly Perthshire. NN 57 32

Status: NNR, SSSI, cSAC

Site manager/owner: The National Trust for Scotland (NTS)

Site description
The site includes NTS property and areas designated as SSSI, NNR & cSAC, each with a different boundary. The NTS property is c4,000 ha and is over 9 miles long with 9 distinct mountains up to 1,214 m. The reserve is outstanding for its arctic-alpine flora, including vascular plants, bryophytes and lichens. Qualifying Natura 2000 habitats are montane willow scrub, eutrophic tall herbs, alpine calcareous grassland, high altitude flushes with slow water seepage and vegetation of crevices in lime-rich rock.

The montane willow scrub on the reserve is considered 'the second most widespread development of this habitat in the UK' (SNH). While montane willows occur throughout the reserve, most are so sparsely distributed as to have no reproductive capability and thus no long-term future. Although difficult to measure, the extent of surviving scrub is estimated as c0.65 ha, and none qualifies as Downy Willow-Great Wood-rush NVC community type W20. The key species are; Downy Willow (*Salix lapponum*), Woolly Willow (*S. lanata*), Mountain Willow (*S. arbuscula*), Whortle-leaved Willow (*S. myrsinites*), Net-leaved Willow (*S. reticulata*), Dark-leaved Willow (*S. myrsinifolia*) and Eared Willow (*S. aurita*). The last two are not classified as montane species but occur at high altitude within the montane zone. Juniper is also a component of the scrub.

Issues
- Montane scrub, like sub-montane woodland and tall herbs, has declined due to man's activities, intensive grazing of livestock, especially sheep, high deer populations and burning. The habitat now survives only on inaccessible ledges on cliffs and gorges. With such vestigial populations, made up of small and often single sex plants, reproduction is no longer possible.

- Ledge sites are also subject to dynamic, sometimes catastrophic, change leading to loss of plants and the progressive decline of the populations.

Ben Lawers, NNR. David Mardon/National Trust, Scotland

- The conditions required for viability, i.e. regeneration by seedling establishment, require a large seed rain and frequent creation of bare ground niches, e.g. by landslip. Due to the wind dispersal mechanism of seed, large areas are involved. Reproductive capability needs to be restored by planting to increase the size and density of populations.

- In Breadalbane the dominant land-use is sheep grazing and a large deer population is resident, sufficient to prevent regeneration of trees or shrubs. The Ben Lawers NNR is relatively small in extent (in Highland estate terms) such that managing herbivore populations only from within the estate is impossible: deer can cross the ground in a few minutes and sheep will move in to fill any vacated areas. Fencing is therefore needed to facilitate any recovery of scrub or woodland.

Objectives
- The principal nature conservation objective is to maintain the overall biodiversity, including the population size of rare species and the extent of important habitats. However, as their populations are so low, maintaining the extent of montane willows and Juniper does not provide a sustainable approach to their conservation. As a result, the objective for these communities is;

- To establish montane willow and Juniper communities on more stable and extensive sites, with annual seed production and the potential for vegetative reproduction.

- To restore a network of such sites to allow natural process of reproduction and regeneration to maintain viable populations.

The end of this management is not currently quantifiable in terms of either area or number of plants. The montane scrub is associated with and benefits from being a component of tall herb communities. Therefore, actions to benefit willow scrub will in turn benefit the associated tall herbs, which have a capacity to regenerate with protection from grazing.

Methods

The work is included in the NTS Ben Lawers Management Plan 1998–2003, (and was in the previous plan). The prescriptions are general, and do not specify timescales or area targets. These are inappropriate due to the pioneering nature of the projects and unpredictability of natural events on mountains.

The duration of ongoing projects, established during the period 1987–2001, is well beyond the life of the current or any future plan, and is estimated at over 50 years. This is due to slow growth rates at high altitude and to the sporadic, unpredictable nature of regeneration of shrubs in the montane environment.

Expansion of stands will therefore be slow, unpredictable, and determined by ecological limits rather than management planning and action. The projects are of a trial nature, partly to test the feasibility of such a restoration process.

SNH, SEPA, Montane Scrub Action Group, community groups and neighbours were consulted prior to the establishment of the project and there is ongoing communication.

Management methods

Exclosure fences are used to exclude all large herbivores from the areas under restoration. While earlier projects were carried out within 30 ha of exclosures, the current project involves protection of willows within a 170 ha exclosure and planting of the endangered species within some 10% of this area. Within the exclosures, planting is done to increase the small, relict populations of willows and Juniper to a level that can achieve good pollination and seed production. Plants are propagated from seed, to maximise the potential for genetic diversity in the propagated material and because the small number of source plants cannot afford to yield enough twigs for vegetative propagation.

Woollywillow. David Mardon/National Trust, Scotland

Plants are grown in cells to facilitate planting in stony ground and in summer. This avoids the frost heave of winter and enables volunteers to carry out the work. Within selected areas of suitable habitat, planting is done in a generally random pattern with irregular spacing to mimic natural dispersion, but with clustering to enhance the probability of pollination.

Fencing and planting are regarded as short-term measures, relative to the envisaged time-scale of the restoration projects, but their duration will be decades rather than years. However, long-term success must depend on better overall control of grazing and browsing, in order to achieve a level that is compatible with survival and regeneration of shrub willows without the need for fencing. To this end the Trust adopted a policy of gaining control of the grazing rights, exercised when a farmer chooses to sell a farm or the rights attached to it.

Staff engaged in this work on the Reserve includes the Property Manager, one full-time Ranger and one seasonal Ranger, with occasional participation of other staff and conservation volunteers. The full-time and seasonal Rangers spend c80% of their time on the habitat projects, of which about half is on the montane areas (treeline & scrub), and half on the submontane areas, while the Property Manager spends less than 10% of his time directly on this work. Conservation volunteers are used in small groups with close supervision, but contractors have not been used due to the very special considerations

needed to select appropriate habitat for each species and the dispersion pattern of planting.

Results

Monitoring the growth and development of new plants, and thus the scrub community, has been established with a bespoke method of measuring size (and area) of plants, and their degree of branching. This was established for two dominant species, those large and upright enough to be easily measured. It will be repeated at 6-year intervals initially, to be reviewed as the commitment grows. As the method was designed to measure success in establishment of new plants, those that had not increased in size yet, ie were too small to be easily found, were not measured. It is anticipated that these will feature in subsequent monitoring.

Data were recorded in 1998 in two exclosures with a combined area of 30 ha where planting had been carried out in increments over the period 1991–1998. Prior to work the areas had 265 surviving plants of five species, but only 25 of the two species monitored after planting. The numbers planted of *Salix myrsinifolia* and *Salix lapponum* were 2,545 and 3,290 respectively. The sites planted with these species have a total area of 0.9 ha, while the area actually covered by the plants in 1998 was 0.007 ha, or 0.8% of the suitable habitat. Due to the slow rate of growth and development of these plants at high altitude (440–810 m asl), little or no growth of many individual plants had taken place by 1998. Assuming that this process continues, the likely result will eventually be about 1 ha of scrub within these exclosures. For the two species measured, this would be an increase in area of scrub of at least 400 times.

General observation of the plants shows that virtually no measurable growth occurs for at least 3 years after planting, and no significant flowering for about 6 years. Predation of shoot tips (with the growing points) by Mountain Hares is an important factor influencing plant development, inhibiting upward growth and resulting in bushiness. It remains to be seen how much time is required for fully mature plants to develop. We have concluded that such projects require a long-term commitment to have any real chance of success.

There has been success in establishing seed-producing populations in two widely separated locations, although the amount of seed must increase greatly with further growth of the plants. Ultimately, success will depend on demonstrating that sufficient new plants to maintain the population are produced by reproduction.

Assessment/lessons learned

- The two exclosures monitored are both on the Ben Lawers range, where grazing rights effectively constrain the scale of projects that can be considered. Scale may be an issue in conserving willows, as the fluffy seeds are dispersed by wind, potentially over great distances. Thus plants in small exclosures may send their seeds to remote sites unprotected from herbivores. It seems likely that larger projects may have a better chance of seedling establishment than small ones, other factors being equal.

- Fencing on steep ground at high altitude is predictably subject to damage by snow, rock fall or landslip, and possibly wires snapping in low temperatures. Lessons from early projects have led to use of an unconventional fence design in the Tarmachan project, with several advantages, including less threat to birds such as grouse species. Routing and design of fencing can relieve maintenance problems to some extent, but any project on mountains must allow for a considerable, long-term maintenance commitment. Management of herbivores without fencing would, if possible, be the first choice of method. For more details of practical considerations, see Mardon, 2002.

- Many observations at relict willow scrub sites and of close observation of plants in the nursery and on the Reserve, has led to a working hypothesis explaining the dynamics of montane willow populations (see Mardon, in press). These trial projects are in part designed to test some aspects of this hypothesis. Much has been learned about propagation of willows, but nursery pests remain a serious problem. An early attempt at measuring success rates with planting indicated a first year survival rate of at least 93%, the remaining 7% being partly due to the loss of tags and not necessarily the loss of the plants themselves. Progressive loss of tags reduced the sample size drastically after the first year.

- Some planting has been less successful, possibly due to vole predation when their population was at its peak. Hare predation, from relatively small populations, does not appear to affect survival of willows, but this may not apply to areas with much larger populations.

Modifications to future proposals/plans

- The Trust's acquisition of hill ground on the neighbouring Meall nan Tarmachan range (within the same SSSI, NNR & cSAC) in 1996, with no externally owned grazing rights attached, enabled a larger habitat restoration project to be planned. The Tarmachan Habitat Restoration & Improvement Project (THRIP) covers some 300 ha in three separate areas. One of these, an exclosure of c170 ha over an altitude range of 520–840 m, is aimed at restoring tree-line woodland (herb-rich birchwood), willow scrub and tall herbs. This site includes the best surviving population

of the nationally scarce Mountain Willow, *Salix arbuscula*, which has probably tolerated the browsing due to its predominantly procumbent habit. However, the taller species *Salix myrsinifolia* and *Salix lapponum* are present but reduced to a small number of scattered individuals. Planting of these has begun, and should continue for some years. The site is subject to dynamic change such as landslip, which should favour the creation of bare ground niches for seedling establishment. The planting, maintenance, and monitoring of this area, together with the older projects, will keep our staff fully occupied for many years. It is anticipated that no further fencing projects will be carried out.

- As stated above, the projects already established will be sufficient to occupy existing staff for many years. The immediate challenge is to ensure that we can maintain continuity of staff time available to meet this ongoing management commitment. The biggest challenges for any body planning to conserve montane scrub are both effective control of browsers and making an effective commitment for the long term.

- Ultimately, we seek to achieve favourable conservation status for montane scrub on Ben Lawers NNR. The established projects will not be sufficient to achieve that, but we hope they will provide a stock of plants with reproductive capability as base for further expansion if and when control of herbivores is achieved. It will be premature to consider additional projects on Ben Lawers NNR for many years, but, as the habitats develop, so will their exploitation for demonstration, education, research and advocacy. This work is pioneering the restoration of montane willow scrub from an endangered, vestigial condition to viability. We hope that many more useful lessons will be learned for application elsewhere.

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Further reading/websites

Gilbert, D., (Ed.) (2002). *Guidance for the restoration of montane scrub in Scotland*. 1, **MacKenzie, N.A.**, *Montane scrub in Scotland*; 2, **McBride, A.D.**, *Montane scrub restoration action planning*; 3, **Wood-Gee, V.**, *Integration with other land uses*; 4, **Wood-Gee, V.**, *Protection of sites*; 5, **Sullivan, G.**, *Propagation of species*. Scrubbers' Bulletin: 4. **www.highlandbirchwoods.co.uk**

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7.8 Hambledon Hill

Location: Blandford Forum, Dorset.
ST 848122

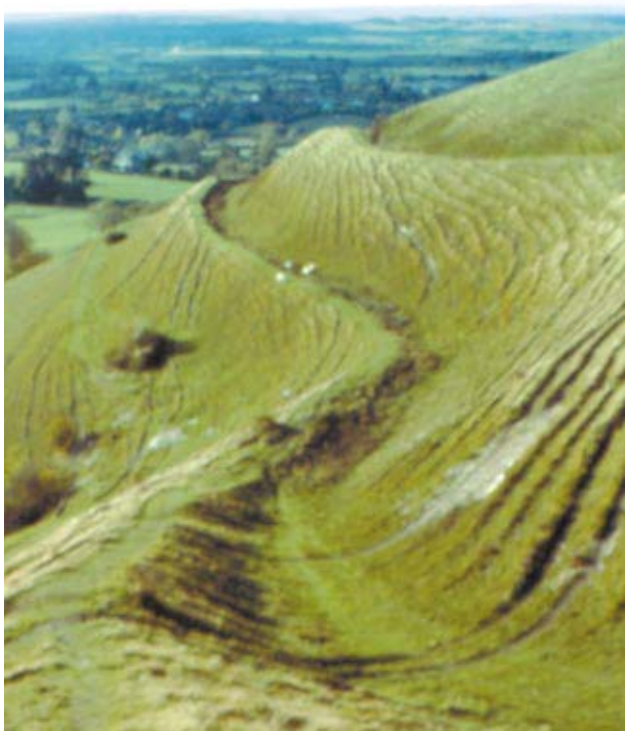
Status: NNR, Scheduled Ancient Monument

Site owner/manager: Hawthorn Trust (northern section), English Nature (via Management Agreement with landowners) and English Heritage

Site description
Hambledon Hill is located between the Stour and Iwerne valleys and rises steeply to a height of over 190 m. Some 10,000 people visit the site each year, many coming to admire the superb views from the hilltop.

The site covers 74 ha, comprising 44 ha of unimproved chalk grassland, 18 ha of chalk scrubland and 5 ha of Yew woodland. It contains important archaeological features: earthworks forming the ramparts of an Iron Age hill fort and older remnant Neolithic features including two long-barrows.

The main ecological feature of Hambledon Hill is the chalk grassland, which supports a variety of plants including Early Gentian, Horseshoe Vetch and at least 18 butterfly species including Dingy Skipper and Adonis Blue.



Hambledon Hill NNR, Ramparts. Ian Nicol/English Nature

Issues

- The main issue at Hambledon Hill is the maintenance of the ecological and archaeological interest of the site; this requires the maintenance of a dynamic balance between grassland and scrub, whilst preventing scrub encroachment on key archaeological features, principally the earthworks.

- The site has organic status and management techniques need to be sought that do not rely on the use of chemicals in order to achieve the objectives.

Objectives

- To maintain ecological and archaeological interest features in good condition.

- To prevent scrub encroachment from damaging the archaeological interest of the site.

- To control or eradicate scrub where damage is likely to be incurred.

- To prevent significant scrub encroachment onto chalk grassland.

- To maintain a dynamic balance between scrub and grassland in less archaeologically sensitive areas.

- To use organic methods and techniques to achieve the management objectives.

- To provide public access (open access for people on foot, with riders and cyclists restricted to bridleways).

Methods
The principles of site management required to meet the objectives given above are set out in a Site Management Plan, which is revised every five years. This plan does not lay down precise management details (eg size and location of scrub areas to be cut in each year); it is felt that variable factors such as the length of the growing season, and hence vigour of scrub growth, require that staff on the ground have the ability to be reactive, and that an overly prescriptive management plan would be too inflexible. Local staff therefore use their own judgement to make management decisions in keeping with the principles of the management plan.

As a statutory body, English Heritage is consulted on any operations, which may affect the archaeological heritage. Close liaison was maintained with the previous site grazier, although a recent change of land ownership has affected this. Other stakeholders and interested parties consulted on management issues are the landowners, the National Trust (who own some of the adjacent land) and the local DEFRA ESA officer (some of the adjacent land is currently entered into an ESA downland reversion scheme, although this is likely to cease following the recent change of land ownership). Specialists within English Nature are also consulted if necessary. Local stakeholders are kept informed and have the opportunity to comment on site management via occasional meetings, talks and articles in the Parish magazine.

Maintenance of scrub communities
The intention is to maintain roughly the same area of scrub on the site, but to prevent succession to woodland and encroachment onto south-facing slopes and onto the earthworks. The development of large, solid scrub blocks is prevented, which maximises the area of scrub/grassland interface. Where possible, grassland corridors are created running east to west through the scrub, which provide sheltered 'glades' with a south-facing edge for invertebrates.

The rotation cycle for scrub cutting and re-growth varies but is around 25 years. The coup size varies, but is rarely greater than 20 m x 20 m. Around 0.2–0.5 ha is coppiced per year, usually in 2–4 blocks.

Prevention of encroachment and eradication
Grazing and mechanical cutting are used to prevent scrub encroachment. Herbicides cannot be used, as the site has organic status, therefore, repeat cutting with aftermath grazing are used in areas where scrub is to be eradicated. Around 0.05–0.5 ha of scrub is cut for eradication each year, and repeat cutting occurs across 1–2 ha.

General methodology
A variety of different scrub cutting methods are employed. A tractor-mounted hedge flail is used where access is possible (ie flatter areas where the grassland sward is less diverse). An Aebi (a small low ground pressure tractor designed for use in alpine meadows) with a front-mounted drum flail can cope with steeper slopes than a normal tractor (up to 1:4). The steepest slopes are cut by hand using brushcutters, chainsaws and handtools. Root-cutting chainsaws have potential benefits through their ability to reduce the amount of re-growth, although they are yet to be tested at Hambledon where flint may prove to be a problem.

AEBI tractor flailing scrub regeneration near earth works.
Ian Nicol/English Nature

Arisings are usually burnt on recently cut areas where the ground is bare, but small amounts of arisings from repeat cutting may be placed in adjacent scrub blocks.

Regeneration is prevented with repeat cutting by hand or with machine-mounted cutters where possible. Repeat cutting is usually carried out every year; July/August is preferable in terms of the damage inflicted on re-growth, but care is taken to ensure that breeding birds are not present. Regeneration and encroachment are also controlled with grazing. Cattle graze the site from late April to late September, although they are taken off earlier when sward growth is less vigorous. Approximately 35 cattle graze 40 ha of grassland. The breed of cattle used was originally Beef Shorthorn, although this will probably change due to recent changes in site ownership. Sheep (Portlands, Hebrideans and hybrids) are grazed on the site from October to late February; around 200–300 animals are normally used. The aim of the winter sheep grazing is to tighten up the sward across the site, particularly on steeper east-facing slopes, which the cattle make little impact on.

New Forest ponies are occasionally used for grazing. They are particularly good at removing dead litter from areas of rank grass, including tor grass *Brachypodium pinnatum*, where they will have a marked impact even in the winter months. Pony grazing has been used largely in the winter. Last year, a 10 ha south and west facing enclosure was grazed with 9 ponies through the high summer months, and with 4 or 5 ponies during the winter until the area was judged to be sufficiently grazed.

Much of the scrub clearance is carried out under contract. Volunteer groups are also used, but the amount of work they can undertake is restricted by the steepness of some of the slopes. Volunteer groups use hand tools for scrub clearance. Around three two-day volunteer tasks with 10–12 people are held at Hambledon each year, giving a total of 60–72 man days per year. The amount of work carried out by contractors is increasing as more of the scrub on the earthworks is cleared; approximately 20 man days per year are currently spent maintaining previously cleared areas. Grazing may eventually suppress scrub re-growth to the extent where repeat cutting is substantially reduced, but it is likely that 3–5 years of mechanical control will be required before this occurs.

Financial costs of management vary depending on whether management is carried out by EN staff, contractors or volunteers, and the steepness of the slopes being managed. Volunteer groups cost around £500/year. Machine-mounted cutting equipment costs between £200–£450/day. Clearing saw contractors cost around £80/day.

No management of public access is required with regard to scrub management, as the scale of works is generally small and the access across the site is unrestricted for walkers.

Results

In general, the scrub management at Hambledon Hill has been successful and the ecological and archaeological features of interest are being maintained. The presence of significant archaeological interest dictates that less scrub can be tolerated than perhaps would be the case on a site without significant archaeological interest.

Site management has achieved the desired results in that the features for which the SSSI is designated are all in favourable condition, scrub removal on the earthworks has been successful and the dynamic balance between scrub and grassland communities is being maintained. The only qualification is the increasing amount of mechanical control required to prevent scrub re-growth; management inputs increase as more and more scrub is cleared from the earthworks, and until re-growth is reduced to the point where it is suppressed by grazing alone, this cost will continue to increase.

Assessment/Lessons learned

- The use of a variety of control techniques has ensured that scrub encroachment does not take place.

- The long-term control of cut areas may be slightly more problematic given the increasing costs of re-growth cutting. This problem has arisen mainly because the organic status of the site prevents the use of herbicides.

- However, it can also be argued that restrictions on herbicide use have prompted the development of innovative combinations of control measures, which are demonstrably successful.

- No problems have been encountered with the public's perception of scrub removal. The site has always been predominantly grassland, and so the amount of scrub cleared at any one time is generally small. Scrub clearance on the earthworks also enhances the appearance of the hill fort and ramparts, and the erection of signs during the main visiting season explaining the reasons for clearance work has ensured that no complaints have been received.

Modifications to future proposals/plans

- No changes to current site management practices are therefore anticipated in the foreseeable future.

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Further reading/websites

Anon, (2002), *Soil Association technical guides – Organic weed and scrub control on nature conservation sites*. Soil Association
Tolhurst, S., Oates, M., (2001), *The Breed Profiles Handbook*, GAP, FACT, English Nature
http://www.english-nature.org.uk (follow the map links to Special Sites/National Nature reserves and look for site under Dorset)

8. Appendices

The Appendices are:

Appendix 8.1. Sites in Nature Conservation Review with scrub of conservation value.

Appendix 8.2. Examples of Special Areas of Conservation (SACs) with important scrub communities.

Appendix 8.3. Conservation value of scrub within BAP Priority Habitats.

Appendix 8.4. Description and distribution of major NVC scrub communities.

Appendix 8.5. Species lists for Britain and Ireland.
8.5.1. Native British and Irish species.
8.5.2. Introduced British and Irish species.

Appendix 8.6. Initial qualitative assessment of various management techniques for each species of shrub.
8.6.1 Qualitative assessment of shrub removal techniques.
8.6.2 Qualitative assessment of shrub maintenance and reduction techniques.
8.6.3 The grazing and browsing ability and likely impact of livestock breeds.

Appendix 8.7. Herbicide information.

Appendix 8.8. Scrub management calendar.

Appendix 8.9. Management costs.

Appendix 8.10. Grant opportunities.

Appendix 8.11. Useful postal and website addresses.

Appendix 8.12. Health and safety.

Appendix 8.13. Scientific names of species in text.

Appendix 8.1 Sites in Nature Conservation Review with scrub of conservation value

(adapted from Mortimer *et al*, JNCC report 308, 2000. pp 112-113)
Key to scrub types: Coast = Coastal, Acid = Acidic, Calc = Calcareous, Mixed = Mixed.
1 = scrub a minor component of the site, 2 = scrub a major component of the site.

Table 8.1: Sites in Nature Conservation Review with scrub of conservation value.

Site, County	Area (ha)	Scrub type			
		Coast	Acid	Calc	Mixed
Folkestone Warren, Kent	480	1			
Needles – St Catherine's Point, Isle of Wight	480	2			
North Solent Marshes, Hampshire	2250	1			
Saltfleetby/Theadlethorpe Dunes, Lincolnshire	900	2			
Durlston Head – Ringstead Bay, Dorset	600	2			
Boscastle – Widemouth, Cornwall	345	2			
Steeple Point – Blackchurch Rock, Cornwall	800	2			
South Gower Coast: Glannau de Gwyr, Glamorgan	830	2			
Bury Inlet, Glamorgan	5000	1			
Morecambe Bay (inc. Wyre-Lune), Lancashire		1			
Beast Cliff/Robin Hood's Bay, Yorkshire	350	2			
Hart Warren – Hawthorn Dene Coast, Durham	270	2			
Mull of Galloway – Crammag Head, Wigtownshire	265	1			
St Abb's Head, Berwickshire	285	1			
Borgue Coast, Kirkcudbrightshire	1200	2			
Ross of Mull, Argyll	160	2			
Loch Fleet, Sutherland	1400	2			
Ardmeanach, Mull, Argyll	400	2			
Wye & Crundale Downs, Kent	415		1		
Castle Hill, Sussex	190		1		
Dunwich Heaths & Marshes, Suffolk	1900		1		
Stanford Practical Training Area, Norfolk	4740		1		
East Wretham Heath, Norfolk	150		1		
Cavenham – Tuddenham Heaths, Suffolk	175		1		
Wangford Warren – Airfield Lights	60		2		
Maidcross Hill, Suffolk	26		1		
Holt Lowes, Norfolk	50		2		
Barnham Heath, Suffolk	80		1		
Thetford Warren, Norfolk	130		1		
Harting Down, Sussex	200			2	
Kingley Vale, Sussex	160			2	
Wouldham – Detling Escarpment, Kent	440			2	
Halling – Trottiscliffe, Kent	650			2	
White Downs, Surrey	225			2	
Folkestone – Etchinghill Escarpment, Kent	205			1	
Heysholt Down, Sussex	40			1	
Aston Rowant, Oxfordshire	130			2	

Site, County	Area (ha)	Scrub type			
		Coast	Acid	Calc	Mixed
Aston Upthorne Downs, Berkshire	40			2	
Martin Down, Hampshire	115			1	
Old Winchester Hill, Hampshire	80			1	
Porton Down, Wiltshire/Hampshire	1700			2	
Ellesborough Warren, Buckinghamshire	60			2	
Burghclere Beacon, Hampshire	125			2	
Rushmore Down, Hampshire	105			2	
Bulford Downs, Wiltshire	560			2	
Ivinghoe Hills, Steps Hill & Pitstone Hill, Bucks/Herts	230			2	
Coombe Hill, Wendover, Bucks	55			2	
Barton Hill, Bedfordshire	60			1	
Castor Hanglands, Cambridgeshire	45			2	
Boxwell, Gloucestershire	5			2	
Avon Gorge, Gloucestershire/Somerset	105			1	
Cheddar Gorge	225			1	
Brean Down & Uphill Cliff, Somerset	145			1	
Crook Peak, Somerset	90			1	
Dolebury Warren, Somerset	115			1	
Great Ormes Head: Pen y Gogarth, Caernarvon	345			1	
Dove Valley & Biggin Dale, Derbyshire	540			2	
Lathkill Dale, Derbyshire	142			2	
Cressbrook Dale, Derbyshire	132			2	
Monk's Dale, Derbyshire	66			2	
Long Dale & Gratton Dale, Derbyshire	80			1	
Coombs Dale, Derbyshire	65			2	
Miller's Dale, Derbyshire	120			2	
Topley Pike & Deepdale, Derbyshire	50			2	
Humphrey Head, Lancashire	30			2	
Gait Barrow, Lancashire	70			2	
Hutton Roof Crags & Farleton Knott, Cumbria	630			2	
Whitbarrow Scar, Cumbria	1000			2	
Scout & Cunswick Scars, Cumbria	215			2	
Crosby Gill, Cumbria	150			1	
Arnside Knott & Warton Crag, Cumbria/ Lancashire	180			2	
Lullington Heath, Sussex	63			1	2
Box Hill – Headley, Surrey	570			1	2
Fulking Escarpment/Newtimber Hill, Sussex	370			1	2
Tennyson Down, Isle of Wight	80			1	2
Weeting Heath, Norfolk	140				1
Sketchvar Heath, Suffolk-Norfolk	20				1

Appendix 8.2 Examples of Special Areas of Conservation (SACs) with important scrub communities

(adapted from Mortimer *et al*, JNCC report 308, 2000 pp114-117)

Table 8.2: Examples of Special Areas of Conservation (SACs) with important scrub communities.

Site, County	Area (ha)	Habitats Directive Annex 1 description
Avon Gorge Woodlands, Avon	152	Lime-Maple ravine forests.
Barnack Hill and Holes, Cambridgeshire	23	Semi-natural dry grassland and scrub on calcareous soils; important orchid site.
Barry Links, Angus	1027	Humid dune slacks.
Ben Alder & Aonach Beag, Highland	182	Sub-arctic willow scrub.
Ben Heasgarnich, Argyll & Bute, Stirling	2780	Sub-arctic willow scrub.
Ben Lawers, Perth & Kinross, Stirling	5027	Sub-arctic willow scrub.
Ben Lui, Argyll & Bute, Stirling	2060	Sub-arctic willow scrub.
Braunton Burrows, Devon	1347	Dunes with Creeping Willow.
Breckland, Norfolk/Suffolk	7600	Semi-natural dry grassland and scrub on calcareous soils.
Burry Inlet: Dunes Cilfach Burry:Twyni, Carmarthenshire, Swansea	1208	Dunes with Creeping Willow.
Caenlochan, Aberdeenshire, Angus, Perth & Kinross	5204	Sub-arctic willow scrub.
Cairngorms, Aberdeenshire, Highland, Moray	57474	Caledonian forest, bog woodland, Juniper on acid and calcareous grasslands.
Castle Hill, East Sussex	115	Semi-natural dry grassland and scrub on calcareous soils; important orchid site.
Chesil & the Fleet, Dorset	1632	Mediterranean and thermo-Atlantic halophilous scrub (Arthrocnemetalia), perennial vegetation of stony banks.
Chiltern Beechwoods, Buckinghamshire,Oxfordshire	523	Juniper on acid and calcareous grasslands.
Coed y Cerrig, Monmouthshire	9	Residual alluvial forest (Alder).
Conon Islands, Highlands	120	Residual alluvial forest (Alder).
Corsydd Mon Anglesey Fens, Anglesey	416	Alkaline fens.
Cothill Fen, Oxfordshire	44	Alkaline fens.
Craven Limestone, N Yorks	5328	Semi-natural dry grassland and scrub on calcareous soils. Limestone pavements.
Craeg Meagaidh, Highland	6144	Sub-arctic willow scrub.
Culbin Bar, Highland, Moray	613	Perennial vegetation on stony banks.
Dungeness, East Sussex, Kent	3224	Perennial vegetation on stony banks.
Culm Grasslands, Devon	769	Purple moor-grass meadows on chalk and clay.
Dornoch Firth & Morrich More, Highland	6249	Dune Juniper thickets.
Drigg Coast, Cumbria	1391	Dunes with Creeping Willow.
Drumochter Hills, Highland, Perth & Kinross	9446	Sub-arctic willow scrub.
Folkestone to Etchinghill Escarpment	182	Semi-natural dry grassland and scrub on calcareous soils; important orchid site.
Glannau Mon: Twyni Anglesey Coast: Dunes, Anglesey	908	Dunes with Creeping Willow.
Glen Coe, Highland	2978	Eutrophic tall herbs.

Site, County	Area (ha)	Habitats Directive Annex 1 description
Gower Commons Tiroedd Comin Gwyr, Swansea	1750	North Atlantic wet heath with Cross-leaved heath.
Great Orme's Head Pen y Gogarth, Conwy	305	Semi-natural dry grassland and scrub on calcareous soils.
Inchnadamph, Highland	1283	Sub-arctic willow scrub, Limestone pavements.
Ingleborough, N Yorkshire	5769	Limestone pavement. Juniper on acid and calcareous grasslands.
Invernaver, Highland	295	Dune Juniper thickets, dunes with Creeping willow.
Isle of Portland to Studland Cliffs, Dorset	1432	Vegetated sea cliff of the Atlantic & Baltic coasts.
Kenfig Cynfigg, Bridgend	1029	Dunes with Creeping Willow
Kinveachy Forest, Highland		Caledonian forest.
Lewes Downs, East Sussex	147	Semi-natural dry grassland and scrub on calcareous soils; important orchid site.
Loch Etive Woods, Argyll & Bute, Highland	2238	Old oak woods with Holly & Hard Fern.
Loch Sunart Woodlands, Highlands	3161	Old oak woods with Holly & Hard Fern.
Meall na Samhna, Highland		Sub-arctic willow scrub.
Mole Gap to Reigate Escarpment, Surrey	640	Stable Box formation on calcareous slopes.
Loch Lomond Woods, Argyll & Bute, West Stirling	1458	Old oak woods with Holly & Hard Fern.
Lower River Spey/Spey Bay, Moray	640	Perennial vegetation on stony banks, residual alluvial forest (Alder).
Lydden and Temple Ewell Downs, Kent	62	Semi-natural dry grassland and scrub on calcareous soils; important orchid site.
Moor House to Upper Teesdale, Cumbria, Durham	38796	Semi-natural dry grassland and scrub on calcareous soils. Juniper on acid and calcareous grasslands.
Mound Alderwoods, Highlands	298	Perennial vegetation on stony banks, residual alluvial forest (Alder).
Morecambe Bay Pavements, Cumbria	2230	Semi-natural dry grassland and scrub on calcareous soils. Juniper on acid and calcareous grasslands.
Morfa Harlech a Morfa Dyffryn, Gwynedd	1061	Dunes with Creeping Willow.
Morrone Birkwood, Aberdeenshire	315	Juniper on acid and calcareous grasslands.
Morven and Mullachdubh, Aberdeenshire	917	Juniper on acid and calcareous grasslands.
Newham Fen, Northumberland	13	Alkaline fens.
North Norfolk Coast & Gibraltar Point Dunes	3454	Perennial vegetation of stony banks, Mediterranean and thermo-Atlantic halophilous scrub (Arthrocnemetalia).
North Northumberland Dunes, Northumberland	1148	Dunes with Creeping Willow.
Peak District Dales, Derbyshire, Staffordshire	1344	Semi-natural dry grassland and scrub on calcareous soils.
Peak District Dales Woodlands, Derbyshire, Staffordshire	804	Lime-Maple ravine forests.
Penhale Dunes, Cornwall	626	Dunes with Creeping Willow.
Queendown Warren, Kent	14	Semi-natural dry grassland and scrub on calcareous soils; important orchid site.
Reiside Moss, Aberdeenshire	87	Active raised bog.
Rodborough Common, Gloucestershire	104	Semi-natural dry grassland and scrub on calcareous soils.
Salisbury Plain, Hampshire, Wiltshire	21114	Semi-natural dry grassland and scrub on calcareous soils. Juniper on acid and calcareous grasslands.
Sandwich Bay, Kent	1190	Dunes with Creeping Willow.
Sefton Coast, Merseyside	4102	Dunes with Creeping Willow.
Sidmouth to West Bay, Devon, Dorset	897	Vegetated sea cliff of the Atlantic & Baltic coasts.

Site, County	Area (ha)	Habitats Directive Annex 1 description
South Wight Maritime, Isle of Wight	19863	Vegetated sea cliff of the Atlantic & Baltic coasts.
St Albans Head to Durlston Head, Dorset	278	Vegetated sea cliff of the Atlantic & Baltic coasts. Semi-natural dry grassland and scrub on calcareous soils; important orchid site.
St David's Ty Ddewi, Pembrokeshire	954	Vegetated sea cliff of the Atlantic & Baltic coasts.
Strath, Highland	1377	Limestone pavements.
Strathglass Complex, Highland	23582	Caledonian forest, sub arctic willow scrub.
The Broads, Norfolk, Suffolk	5282	Residual alluvial forest (Alder).
The New Forest, Hampshire	29262	Residual alluvial forest (Alder), Bog woodland, North Atlantic wet heaths with Cross-leaved heath, Dry heaths (all types).
The Wash & North Norfolk Coast, Lincolnshire, N Norfolk	107802	Perennial vegetation of stony banks, Mediterranean and thermo-Atlantic halophilous scrub (Arthrocnemetalia).
Thrislington, South Yorkshire	23	Semi-natural dry grassland and scrub on calcareous soils.
Thursley, Ash, Pirbright & Chobham, Surrey	5101	Dry heaths (all types).
Tintagel – Marsland – Clovelly, Devon, Cornwall	2435	Vegetated sea cliff of the Atlantic & Baltic coasts.
Tyne & Allen River Gravels, Northumberland	37	Calaminarian grasslands.
Wye & Crundle Downs, Kent	112	Semi-natural dry grassland and scrub on cal careous soils important orchid site.
Wye Valley Woodlands Coetiroedd Dyffryn, Gloucestershire, Hereford & Worcestershire	876	Lime-Maple ravine forests.

Appendix 8.3 Conservation value of scrub within BAP Priority Habitats

(adapted from Mortimer *et al*, JNCC report 308, 2000. pp 25-34)

Table 8.3a: Coastal scrub communities.

Habitat	Conservation value
Coastal shingle	Significant proportion of European shingle resource in UK. Scrub forms an important component on large sites. Several designated SACs with extensive shingle areas with scrub.
Maritime cliffs	Part of a mosaic of grassland, heathland and open pioneer vegetation on cliff tops and slumping cliffs, particularly valuable where undercliffs occur. Scrub on western sea cliffs important for bryophytes and lichens. Also important food resource for migrant and breeding birds.
Salt marshes	Only at sites with extensive salt marsh, dune and shingle mainly on south and east coasts. Three SACs contain significantly important stands of Shrubby Sea-blight and Sea-purslane.
Coastal dunes	Juniper thicket of N E Scotland is a Priority Habitat. Sea-buckthorn dune is listed under the Habitats Directive, but not yet classified a UK priority for SAC designation, primarily because of its invasive nature outside of its natural east coast range.

Table 8.3b: Lowland wet scrub.

Habitat	Conservation value
Wet mineral soil	Low botanical diversity but important landscape component of the open water, swamp and fen and UK BAP Priority habitat.
Wet organic soils	Important component of open water, swamp, fen and wet woodland mosaics and a UK BAP Priority habitat.
Bog myrtle	Component of wet heath, mire, blanket bog and moorland. Alongside scrubby birch and willow, is important for several rare invertebrate species.

Table 8.3c: Lowland dry scrub.

Habitat	Conservation value
Dry calcareous	High structural diversity supports rich communities of mammal, bird and insect. Species composition and stand structure influence the conservation value. Box and Juniper are important because of rarity, as are Whitebeams on limestone outcrops in western Britain. Important component of semi natural grassland, especially notable for orchids. Important calcareous grassland and scrub communities in Derbyshire Dales.
Dry neutral	Common on fertile, disturbed and abandoned areas. Structural grass/scrub mosaics important for birds and insects. Patches in intensive agricultural areas a potential refuge. Blackthorn-Bramble contains fewer woody species than Hawthorn-Ivy communities, but similar field layer communities.
Dry acidic	Widespread, especially in S England. Not botanically diverse, but important to a number of species and as a component of the heathland habitat mosaic.

Table 8.3d: Upland scrub.

Habitat	Conservation value
Wet forest zone	Willow carr forms an important landscape component of open water, swamp, fen and wet woodland mosaics and a UK BAP Priority habitat. Tea-leaved Willow forms an important habitat for several rare insect species.
Dry forest zone	Important landscape component and habitat for birds. Rare in Europe.
Treeline woodland	Component of native pine Priority Habitat, rare at high altitude, representing only place in UK where trees occur at natural altitudinal limit. Occurs in association with open Juniper scrub.
Upland Juniper	High importance has Species Action Plan. Component of Juniper formation listed in Habitats Directive. Juniper-Wood-sorrel communities occur in Scottish Highlands and Southern Uplands, possible affinity to Scandinavian sub-alpine scrub. Sub-alpine stands are rare, c +/- 100 ha, restricted to East Highlands. Dwarf Juniper restricted to N W Highlands and Islands, covering c610 ha. Sub-species nana also found in Cumbria and Snowdownia.
Dwarf birch	Nationally scarce, restricted localities in North & Central Highlands. Close affinity to Scandinavian dwarf birch scrub. Component of blanket bog in Annex I of Habitats Directive.
Sub-arctic willow	High importance, nationally rare, confined to Highlands in small (< 0.5 ha) stands. Many dominants are either Nationally Scarce or Red Data Book species. Species Action Plan for Woolly Willow, a Priority UK BAP Species. Similar habitat found only in Sweden and Finland. SAC selection taken account of habitat, others listed under Annex I.

Appendix 8.4 Description and distribution of major NVC scrub communities

Table 8.4: Description and distribution of major NVC scrub communities.

Broad habitat type Mixed scrub:	Scrub NVC Community	Description	Location
Ash *Beech* *Birch spp* *Blackthorn* *Bramble spp* *Buckthorn* *Crab Apple* *Dogwood* *Elder* *Elm spp* *Field Maple* *Gorse spp* *Grey Willow* *Hawthorn spp* *Hazel* *Holly* *Honeysuckle* *Ivy* *Juniper* *Pedunculate Oak* *Privet* *Rose spp* *Spindle* *Sycamore* *Traveller's Joy* *Wayfaring Tree* *Whitebeam* *Yew*	W21 Hawthorn-Ivy	Found on neutral to base rich soils; encompasses most of Britain's thorn scrub and hedges. A mosaic of trees, shrubs and woody climbers.	Widespread and occurring on a wide range of habitat types.
	W21a Nettle sub-community and W21b Dog's Mercury sub-community	Usually species poor; mostly Hawthorn, Blackthorn, Elder some Bramble and Roses. Varies regionally, eg in the west and north Sycamore occurs, whereas in the Midlands and East Anglia, Elm suckers are frequent. The W21b sub-community is more diverse, with Ash, Field Maple and Dog's Mercury.	Widely distributed throughout much of lowland England, especially on disturbed or made up ground, landslips, abandoned arable or grazing land, and on mineral workings.
	W21c False Brome sub-community and W21d Wayfaring tree sub-community	Occur on calcareous soils; it is high in species richness; the Wayfaring Tree community is particularly so.	Restricted to free draining soils over limestone in the Derbyshire Dales and Lake District, and chalk downs in SE England, where the Wayfaring Tree sub-community occurs.
	W22 Blackthorn – Bramble scrub	Forms a closed canopy that excludes most other species; mainly on deep, moist, neutral soils. On poorer soils gorse often occurs, while Hazel and Privet occur on more base rich soils.	Widespread throughout lowland Britain. Develops on abandoned grassland on woodland edge. Also on exposed places, such as cliffs and landslips where it may form a stunted almost climax community.
	W24 Bramble-Yorkshire Fog underscrub	Early successional scrub; the Brambles usually occur as dense clumps with the coarse grasses growing between.	Occurs widely on abandoned and waste ground throughout much of Britain. Also at the edge of woodlands, as well as along hedges and transport corridors.
	W25 Bracken-Bramble underscrub	Deep free-draining, neutral to slightly acid soils. Bramble dominates with scattered Hawthorn, Blackthorn and Elder, as well as more rarely sapling Ash, Oak, Beech and Sycamore.	Widespread underscrub community, mostly typical of woodlands. In appropriate soil conditions, it can appear throughout lowland Britain.

Broad habitat type Wetland scrub:	Scrub NVC Community	Description	Location
Alder *Alder Buckthorn* *Ash* *Birch spp* *Blackthorn* *Bramble* *Buckthorn* *Elder* *Guelder Rose* *Hawthorn* *Hazel* *Holly* *Honeysuckle* *Ivy* *Oak spp* *Osier* *Rowan* *Scots Pine* *Sycamore* *Willow spp*	W1 Grey Willow-Common Marsh-bedstraw	Wet scrub occurring at the margins of standing or slow moving open water.	Widely scattered mainly throughout lowland regions.
	W2 Grey Willow-Downy Birch-Common Reed	Wet carr scrub of mires. Mainly secondary succession onto abandoned marshes. Also develops by direct invasion onto herbaceous fen.	Confined mainly to the Breckland and Broads of East Anglia, and the Cheshire Mere's.
	W3 Bay Willow-Bottle Sedge	Wet scrub of base-rich and calcareous basin mires in uplands. Grazing can restrict its development in drier conditions.	Localised, mainly North Yorkshire to southern and northeast Scotland and possibly Wales.
	W4 Downy Birch-Purple Moor-grass	Wet scrub on acidic peaty soils at the margins of blanket and valley mires. Drainage, fire, peat cutting and grazing encourage the spread of the community.	Widespread but localised, mainly NW England and the Scottish borders. Also, the Brecks and coastal East Anglia, Dorset, Sussex and Cornwall.
	W5 Alder-Greater Tussock Sedge	Wet alder carr of swamp, fen and flood plain mires on organic base-rich soils.	Local but widespread in lowland Britain, mostly in northwest, the Weald and parts of East Anglia.
	W6 Alder-Common Nettle	Wet alder carr scrub on alluvial river terraces or flood plain mires. Under suitable conditions occurs on enriched soils over acid mires.	Widespread but local throughout the lowlands, mostly the northwest and East Anglia.
	W7 Alder-Ash- Yellow Pimpernel	Wet woodland and scrub of moist to wet, neutral mineral soils.	Upland fringes in wetter regions of north and west England, parts of Wales and Scotland; outliers in southern England.
	M19 Heather-Hare's-tail Cotton Sedge Blanket mire	High altitude blanket bog; M19b Dwarf Birch sub-community contains Dwarf Birch and Cloudberry.	Occurs mostly in Pennines, the Borders and Central Highlands of Scotland. Also parts of West Wales.

Broad habitat type	Scrub NVC Community	Description	Location
Scrub in neutral grassland	W21a & W21b, W22, W24.	Widespread scrub communities, colonise where grazing or other restraints are low.	Widespread in suitable soil conditions.
Scrub in calcareous grassland: *Ash* *Beech* *Box* *Bramble* *Elder* *Gorse spp* *Hawthorn* *Holly* *Ivy* *Pedunculate Oak* *Privet* *Spindle* *Sycamore* *Whitebeam* *Willow* *Yew*	W13 Yew woodland	Occurs on chalk escarpments; Yew is the dominant here. Occasionally, Box, Juniper and Whitebeam are found growing in association.	Restricted range confined to the chalk of the North and South Downs with an outlying area on limestone in Durham.
	W21c & W21d	Occurs where grazing and other restraints are low enough to allow succession	Limestone and chalks soils (see above).
	CG5 Upright Brome-False Brome grassland	Rank, tussocky grassland occurring over limestone soils, especially on abandoned quarries. Here scrub establish in the more open areas of the sward.	On the Cotswold, Lincs and Northants limestone scarp and along the southern edge of the Derbyshire - West Yorkshire limestone region.
Scrub in acidic grassland: *Gorse spp* *Bramble* *Broom* *Heather*	W23 Common Gorse-Bramble scrub	Typical community of acidic, free-draining soils on lowland and upland fringes. In the absence of burning or grazing, the stands can grow very tall and leggy.	Widely distributed on suitable soils on marginal land, along boundaries of enclosures, along tracks and hedge banks.

Broad habitat type	Scrub NVC Community	Description	Location
Scrub in Lowland heathland: *Birch spp* *Bramble* *Gorse spp* *Juniper* *Oak spp* *Rowan* *Scots Pine* *Willow spp*	W23 Common Gorse-Bramble scrub	Dense stands of Gorse within open lowland heathland communities.	Widely distributed on lowland heathland.
	H1,H2, H3, H4, H6, H8, H9, M16 heaths	Occur on poor, generally free draining acid soils; dominated by Heather and Dwarf Gorse. Scrub invades in response to lack of management.	On suitable soils across lowland Britain, especially Brecks, Suffolk Coast, Thames Basin, Weald, New Forest, Dorset, East Devon & Cornwall.
	H7 Heather-Spring Squill heath	Maritime heaths with a range of dwarf scrub species. Juniper sub-species hemisphaerica occurs in the Thrift sub-community. Creeping Willow can be locally prominent on damp ground.	Occurs mainly on western seaboard and coasts of northeast Scotland. The Thrift sub-community is better developed in the southwest particularly around the Lizard and Pembrokeshire.
Upland heathland: *Juniper*	H15 Heather-Juniper ssp *nana* heath	Occasional but sometimes abundant stands of the rare Juniper nana occur; usually forms a low compact wind pruned matt. Juniper nana also occurs rarely in other upland heaths; H17, H20 & H21.	Restricted to the Northwest Highlands of Scotland.

Broad habitat type	Scrub NVC Community	Description	Location
Upland and Montane scrub: *Birch* *Honeysuckle* *Juniper* *Larch* *Rowan* *Scots Pine* *Spruce spp* *Willow spp*	W18 Scots Pine-Hylocomium splendens (moss spp)	Upland pine occurs on leached soils in cooler climates. Variation in stand structure influences species composition: The Juniper (W19) community can occur within open structured stands.	Restricted to central and northwestern Highlands; some geographic variation in the sub-communities caused by localised climate and soil conditions.
	W19 Juniper-Wood-sorrel	Upland scrub community associated with drier, cooler climate. It occurs in a range of soil types and conditions, and is often found within other upland communities.	The W19 community is restricted mostly to the east-central Highlands of Scotland. Other isolated stands occur in south Scotland, Northumberland, the Pennines and Lake District.
	W20 Downy Willow-Great Wood-rush	Very rare and restricted high montane scrub community. Occurs on rocky ledges, free from grazing, altitudes above 630 m in moist, neutral and base-rich soils.	It occurs in southern and central Highlands of Scotland, with other isolated stands in the northwest Highlands and southwest Scotland, and the Lake District.
	CG14 Mountain Avens-Moss Campion ledge community	A rare dwarf shrub community usually confined to calcareous rocky ledges and outcrops free of grazing pressures.	Mostly central and southern Scottish Highlands. Also northwest Highlands, North Wales, Cumbria and the Western Isles.

Upland and Montane scrub Cont...

	U12 Dwarf Willow-Racomitrium heterostichum grassland	Restricted to late spring snow beds in a few high mountaintops between 900 m and 1,250 m, characterised by cool summers and harsh winters.	Occurs widely throughout the Scottish Highlands, with other areas on Mull and the Southern Uplands.
	U7 to U11, U13, U14, U16, U17 grasslands.	A range of upland communities occurring on mountain ledges, slopes and snow beds on acid soils where various dwarf willow species occur.	Mainly the central and western Highlands of Scotland, northern England and Wales.

Broad habitat type	Scrub NVC Community	Description	Location
Saltmarsh scrub: *Shrubby Sea-blite*	SM21 Shrubby Sea-blite-Rock Sea-lavender	Occurs at the interface between salt marsh and dune systems. Heavy grazing including by Rabbits, maintains open structure, reduced grazing encourages taller, enclosed canopy.	Restricted to the North Norfolk coast.
	SM25 Shrubby sea-blite drift line community	Occurs at the shingle interface with the salt marsh.	Restricted to the Norfolk and Essex coasts.
Coastal shingle.	W22, W23, W24	General scrub communities form on stabilised shingle.	
Coastal dunes: *Birch spp* *Bramble* *Sea-buckthorn* *Dewberry* *Elder* *Hawthorn* *Oak spp* *Willow spp*	SD16 Creeping Willow-Yorkshire Fog dune slack community	On older, drier dunes maintained by livestock or Rabbit grazing. Reduced grazing causes canopy closure and invasion of other scrub species; Birch, Willow, or Buckthorn colonise to begin succession.	Found on the coasts of Wales and Northwest England and Southeast Scotland.
	SD18 Sea-buckthorn dune scrub	Occurs on stabilised dune systems at various coastal localities. Where introduced, invades other dune communities, causing problems.	Occurs naturally on the east and southeast coasts, from Kent to Scotland. Introduced on northwestern coasts of England and scattered west coast sites.
Coastal cliffs and slopes.	W21, W22, W23, W24	Develops where local enrichment and relaxation of grazing occur.	Less exposed coastlines around Britain.
Inland rock (limestone pavement).	W21c&d	Develops in cracks and fissures, where soil accumulates.	Limestone areas in Pennines.
Boundary and linear habitats.	W21, W22, W23, W24	Scrub community type depends on soil and climatic characteristics.	Widespread.

Appendix 8.5 Species lists for Britain and Ireland

The following lists have been derived from the *New Atlas of the British and Irish Flora*. They cover all woody species recorded in the wild in Britain and Ireland. From an overall total of 344 species, there are 339 species recorded in Britain, of which 167 are considered native and 172 introduced. In Ireland, the total species recorded is 250, of which 104 are considered native and 146 introduced.

The lists include the heaths, such as Bell Heather and Cornish Heath, as well as some of the woody perennial climbers and sub-shrubs such as Traveller's Joy, Honeysuckle and Rock Rose. Some species marked† are most familiar as trees and their autecology, as described in the Atlas, suggests that they have poor abilities for natural regeneration through seeding or suckering and are unlikely to pose a threat as an invasive shrub. Some species have been listed as introduced, although some parts of the population are known to be native. This was based on the percentage difference of Atlas tetrads between native and introduced records. For example: Large-leaved Lime, Box and Shrubby Cinquefoil have been listed as introduced. The only exception made has been for Scot's Pine and Sea-buckthorn, which have been listed as native and introduced. Some species are native in Britain and introduced to Ireland or vice-versa.

There is a large number of introduced species in both countries, although many of the Irish species concern few tetrad records. Most of these plants can be found as escapes around urban areas either because of birds and mammals distributing seeds, or because of dumping garden waste. Some have been introduced along transport corridors as part of landscape schemes. While the list of major problem species is well known, for example: Rhododendron and Sycamore, there are many others that could become the problem of tomorrow. This is well highlighted within the text of the New Atlas for each of these species and indicates the need for greater care, especially where amenity landscape planting is likely to occur near sites of nature conservation value.

The species highlighted below in **bold** are reviewed in Section 4.4.

8.5.1: Native British and Irish species. *(Species marked† are trees unlikely to invade as scrub).*

Common name	Scientific name	Britain	Ireland
Alder	***Alnus glutinosa***	*	*
Alder Buckthorn	***Frangula alnus***	*	*
Arctic Bearberry	*Arctostaphylos alpinus*	*	
Arran Service-tree	***Sorbus pseudofennica***	*	
Ash	***Fraxinus excelsior***	*	*
Aspen	***Populus tremula***	*	*
Atlantic Ivy	*Hedera helix subsp. Hibernica*		*
Barberry	*Berberis vulgaris*	*	
Bay Willow	***Salix pentandra***	*	*
Bearberry	*Arctostaphylos uva-ursi*	*	*
Beech	***Fagus sylvatica***	*	*
Bell Heather	*Erica cinerea*	*	*
Bilberry	*Vaccinium myrtillus*	*	*
Bird Cherry	***Prunus padus***	*	*
Black Poplar†	*Populus nigra subsp. Betulifolia*	*	*
Blackthorn	***Prunus spinosa***	*	*
Blue Heath	*Phyllodoce caerulea*	*	
Bog Bilberry	*Vaccinium uliginosum*	*	
Bog Myrtle	*Myrica gale*	*	*
Bog Rosemary	*Andromeda polifolia*	*	*

(Species marked† are trees unlikely to invade as scrub).

Common name	Scientific name	Britain	Ireland
Bramble	***Rubus fruticosus agg***	*	*
Broad-leaved Osier	*Salix caprea x S. viminalis*	*	*
Broom	***Cytisus scoparius***	*	*
Buckthorn	***Rhamnus cathartica***	*	*
Burnet Rose	***Rosa pimpinellifolia***	*	*
Burnet Rose x Sherard's Downy-rose hybrid	*Rosa pimpinellifolia x R. sherardii*	*	*
Common Ivy	*Hedera helix subsp. Helix*	*	*
Common Juniper	***Juniperus communis subsp communis***	*	*
Common Rock-rose	*Heliamthemum nummularium*	*	*
Common Whitebeam	***Sorbus aria***	*	
Common Whitebeam x Rowan hybrid	*Sorbus aria x S.aucuparia*	*	
Cornish Heath	*Erica vagans*	*	*
Cowberry	*Vaccinium vitis-idaea*	*	*
Crab Apple	*Malus sylvestris*	*	*
Cranberry	*Vaccinium oxycoccos*	*	*
Creeping Willow	***salix repens***	*	*
Cross-leaved Heath	*Erica tetralix*	*	*
Crowberry	*Empetrum nigrum*	*	*
Crowberry subspecies	*Empetrum nigrum subsp. Hermaphroditum*	*	
Dark-leaved Willow	***Salix myrsinifolia***	*	*
Dark-leaved x Tea-leaved Willow hybrid	*Salix myrsinifolia x S. phylicifolia*	*	
Dewberry	***Rubus caesius***	*	*
Diapensia	*Diapensia lapponica*	*	
Dog Rose	***Rosa canina***	*	*
Dog Rose x Harsh Downy-rose hybrid	*Rosa canina x R. tomentosa*	*	*
Dog Rose x Sherard's Downy-rose hybrid	*Rosa canina x R. sherardii*	*	*
Dog Rose x Short-styled Field-rose hybrid	*Rosa canina x R. stylosa*	*	*
Dog Rose x Sweet Briar hybrid	*Rosa canina x R. rubiginosa*	*	
Dog x Round-leaved Dog-rose hybrid	*Rosa canina x R. obtusifolia*	*	*
Dogwood	***Cornus sanguinea***	*	*
Dorset Heath	*Erica ciliaris*	*	
Downy Birch	***Betula pubescens***	*	*
Downy Currant	***Ribes spicatum***	*	
Downy Willow	***Salix lapponum***	*	
Dutch Elm	*Ulmus x hollandica*	*	*
Dwarf Birch	***Betula nana***	*	*
Dwarf Gorse	*Ulex minor*	*	
Dwarf Juniper	***Juniperus communis subsp nana***	*	*
Dwarf Willow	***Salix herbacea***	*	*
Dyers Greenweed	*Genista tinctoria*	*	
Dyer's Greenwood subspecies	*Genista tinctoria subsp. Littoralis*	*	
Eared Birch	*Betula pendula x B. pubescens*	*	*
Eared Osier	*Salix aurita x S. caprea x S. viminalis*	*	*
Eared Willow	***Salix aurita***	*	*
Eared x Creeping Willow hybrid	*Salix aurita x S. repens*	*	*
Eared x Goat Willow hybrid	*Salix aurita x S. caprea*	*	*
Eared x Grey Willow hybrid	*Salix aurita x S. cinerea*	*	*
Elder	***Sambucus nigra***	*	*
English Elm	***Ulmus procera***	*	
Field Maple	***Acer campestre***	*	
Field Rose	***Rosa arvensis***	*	*

(Species marked† are trees unlikely to invade as scrub).

Common name	Scientific name	Britain	Ireland
Field x Dog Rose hybrid	*Rosa arvensis x R. canina*	*	*
Fine Osier	*Salix cinerea x S. purpurea x S. viminalis*	*	
Glaucous Dog-rose	*Rosa caesia subsp. Glauca*	*	*
Goat Willow	***Salix caprea***	*	*
Goat Willow subspecies	*Salix caprea subsp. Sphacelata*	*	
Goat x Grey Willow hybrid	*Salix caprea x S. cinerea*	*	*
Gorse	***Ulex europaeus***	*	*
Gorse x Western Gorse hybrid	*Ulex europaeus x U. gallii*	*	*
Green-leaved Willow	*Salix purpurea x S. viminalis*	*	*
Grey Willow	***Salix cinerea***	*	*
Grey Willow subspecies	*Salix cinerea subsp. Cinerea*	*	*
Grey Willow subspecies	*Salix cinerea subsp. Oleifolia*	*	*
Guelder Rose	***Viburnum opulus***	*	*
Hairy Dog-rose	*Rosa caesia subsp. Caesia*	*	*
Hairy Dog-rose x Dog Rose hybrid	*Rosa caesia x R. canina*	*	*
Hairy Greenwood	*Genista pilos*	*	
Harsh Downy-rose	*Rosa tomentosa*	*	*
Hawthorn	***Crataegus monogyna***	*	*
Hazel	***Corylus avellana***	*	*
Heather	*Calluna vulgaris*	*	*
Hoary Rock-rose	*Helianthemum oelandicum*	*	*
Holly	***Ilex aquifolium***	*	*
Honeysuckle	***Lonicera periclymenum***	*	*
Hop	*Humulus lupulus*	*	
Hornbeam	*Carpinus betulus*	*	*
Huntingdon Elm	*Ulmus glabra x U. minor*	*	
Irish Heath	*Erica erigena*		*
Ivy	***Hedera helix***	*	*
Laurel-leaved Willow	*Salix cinerea x S. phylicifolia*	*	
Mackay's Heath	*Erica mackaiana*		*
Maritime Juniper	***Juniperus communis subsp hemisphaerica***	*	*
Mezereon	*Daphne mezereum*	*	
Midland Hawthorn	*Crataegus laevigata*	*	
Midland Hawthorn x Hawthorn hybrid	*Crataegus laevigata x C. monogyna*	*	
Mountain Willow	***Salix arbuscula***	*	
Needle Whin	*Genista anglica*	*	
Net-leaved Willow	***Salix reticulata***	*	
Pedunculate Oak	***Quercus robur***	*	*
Petty Whin	*Genisat anglica*	*	
Plot's Elm	*Ulmus plotii*	*	
Plymouth Pear	*Pyrus cordata*	*	
Prostrate Broom	*Cytisus scoparius subsp. Maritimus*	*	*
Purple Willow	***Salix purpurea***	*	*
Raspberry	***Rubus idaeus***	*	*
Red Currant	***Ribes rubrum***	*	
Round-leaved Dog-rose	*Rosa obtusifolia*	*	*
Rowan	***Sorbus aucuparia***	*	*
Scot's Pine	***Pinus sylvestris***	*	
Sea-buckthorn	***Hippophae rhamnoides***	*	
Sea Purslane	*Halimione portulacoides*	*	
Sessile Oak	***Quercus petraea***	*	*

(Species marked† are trees unlikely to invade as scrub).

Common name	Scientific name	Britain	Ireland
Sessile x Pedunculate Oak hybrid	*Quercus petraea x Q. robur*	*	*
Sherard's Downy-rose	*Rosa sherardii*	*	*
Short-styled Field-rose	*Rosa stylosa*	*	*
Shrubby Osier	*Salix aurita x S. viminalis*	*	
Shrubby Sea-blite	*Sueda vera*	*	
Silky-leaved Osier	*Salix cinerea x S. viminalis*	*	*
Silver Birch	*Betula pendula*	*	
Small Cranberry	*Vaccinium microcarpum*	*	
Small-flowered Sweet-briar	*Rosa micrantha*	*	*
Small-leaved Lime	*Tillia cordata*	*	*
Small-leaved Sweet-briar	*Rosa agrestis*	*	*
Smooth-leaved Elm	***Ulmus minor***	*	
Soft Downy-rose	*Rosa mollis*	*	*
Soft Downy-rose x Burnet Rose hybrid	*Rosa mollis x R. pimpinellifolia*	*	
Spindle	***Euonymus europaeus***	*	*
Spiny Restharrow	*Ononis spinosa*	*	
Spurge-laurel	*Daphne laureola*	*	
St Daebeoc's Heath	*Daboecia cantabrica*		*
Strawberry Tree	*Arbutus unedo*		*
Sweet-briar	*Rosa rubiginosa*	*	*
Tea-leaved Willow	***Salix phylicifolia***	*	*
Trailing Azalea	*Loiseleuria procumbens*	*	
Traveller's Joy	***Clematis vitalba***	*	
Tutsan	*Hypericum androsaemum*	*	*
Wayfaring Tree	***Viburnum lantana***	*	
Western Gorse	*Ulex gallii*	*	*
White Rock-rose	*Heliamthemum apenninum*	*	
Whortle-leaved Willow	***Salix myrsinites***	*	
Wild Cherry	***Prunus avium***	*	*
Wild Cotoneaster	***Cotoneaster cambricus***	*	
Wild Plum x Blackthorn hybrid	*Prunus domestica x P. spinosa*	*	*
Wild Privet	***Ligustrum vulgare***	*	
Wild Service-tree	*Sorbus torminalis*	*	
Woolly Willow	***Salix lanata***	*	
Wych Elm	***Ulmus glabra***	*	*
Wych x Plot's Elm hybrid	*Ulmus glabra x U. Plotii*	*	
Yew	***Taxus baccata***	*	*
Whitebeams	***Sorbus angelica***	*	
	Sorbus arranensis	*	
	Sorbus bristoliensis	*	
	Sorbus devoniensis	*	
	Sorbus eminens	*	
	Sorbus hibernica		*
	Sorbus lancastriensis	*	
	Sorbus leptophylla	*	
	Sorbus leyana	*	
	Sorbus minima	*	
	Sorbus porrigentiformis	*	
	Sorbus rupicola	*	
	Sorbus subcuneata	*	
	Sorbus vexans	*	
	Sorbus wilmottiana	*	

8.5.2 Introduced British and Irish species. *(Species marked† are trees unlikely to invade as scrub).*

Common name	Scientific name	Britain	Ireland
Almond Willow	***Salix triandra***	*	*
Ash-leaf Maple	*Acer negundo*	*	
Atlantic Ivy	*Hedera helix subsp. Hibernica*	*	
Atlas Cedar†	*Cedrus atlantica*	*	
Austrian Pine/Corsican Pine	***Pinus nigra***	*	*
Balm-of-Gilead	***Populus balsamifera x P. deltoides***	*	*
Barberry	*Berberis vulgaris*		*
Bay	*Laurus nobilis*	*	*
Billiards Bridewort	*Spirea alba x S. douglasii*	*	*
Black Currant	***Ribes nigrum***	*	*
Black Poplar hybrid†	***Populus deltoides x P. nigra***	*	*
Box	***Buxus sempervirens***	*	*
Box-leaved Honeysuckle	*Lonicera pileata*	*	*
Bridewort	*Spirea salicifolia*	*	*
Broad-leaved Cockspurthorn	*Crataegus persimilis*	*	
Bullate Cotoneaster	*Cotoneaster rehderi*	*	*
Butterfly-bush	***Buddleja davidii***	*	*
Cappadocian Maple	*Acer cappadocicum*	*	
Cedar-of-Lebanon†	*Cedrus libani*	*	
Cherry Laurel	***Prunus laurocerasus***	*	*
Cherry Plum	***Prunus cerasifera***	*	*
Chinese Bramble	*Rubus tricolor*	*	*
Chinese Quince	*Chaenomeles speciosa*	*	
Coastal Redwood	*Sequoia sempivirens*	*	*
Common Whitebeam	***Sorbus aria***		*
Confused Bridewort	*Spirea douglasii x S. salicifolia*	*	*
Cornelian Cherry	***Cornus mas***	*	*
Crack Willow†	*Salix fragilis*	*	*
Crack Willow hybrid†	*Salix alba x S. fragilis*	*	*
Darwin's Barberry	*Berberis Darwinii*	*	*
Deodar†	*Cedrus deodara*	*	
Diel's Cotoneaster	***Cotoneaster dielsianus***	*	
Dorset Heath	*Erica ciliaris*		*
Douglas Fir	*Pseudotsuga menziesii*	*	*
Dutch Rose	*Rosa 'Hollandica'*	*	
Dwarf Cherry	***Prunus cerasus***	*	*
English Elm	***Ulmus procera***		*
Escallonia	*Escallonia macrantha*	*	*
European Larch	***Larix deciduosa***	*	*
European Silver-fir	*Abies alba*	*	*
European Violet-willow	*Salix daphnoides*	*	*
Evergreen Oak	***Quercus ilex***	*	*
Evergreen Spindle	*Euonymus japonicus*	*	*
False-acacia	*Robinia pseudoacacia*	*	*
False Virginia-creeper	*Parthenocissus inserta*	*	
Field Maple	***Acer campestre***		*
Fig	*Ficus carica*	*	
Firethorn	*Pyracantha coccinea*	*	*
Flowering Currant	*Ribes sanguinium*	*	*
Fly Honeysuckle	*Lonicera xylosteum*	*	*
Forsythia	*Forsythia suspensa x F. viridissima*	*	*

(Species marked† are trees unlikely to invade as scrub).

Common name	Scientific name	Britain	Ireland
Franchet's Cotoneaster	***Cotoneaster franchetii***	*	*
Garden Lavender	*Lavendula angustifolia x L. latifolia*	*	
Garden Privet	*Ligustrum ovalifolium*	*	*
Giant Fir†	*Abies grandis*	*	*
Gooseberry	***Ribes uva-crispa***	*	*
Grape-vine	*Vitis vinifera*	*	
Grey Alder	*Alnus incana*	*	*
Grey Poplar	***Populus alba x P. tremula***	*	*
Hairy-fruited Broom	*Cytisus striatus*	*	
Hairy Mock-orange†	*Philadelphus x virginalis*	*	*
Hedge Barberry	*Berberis Darwinii x B. empetrifolia*	*	*
Hedge Veronica	*Hebe elliptica x H. speciosa*	*	*
Highclere Holly	*Ilex aquifolium x I. Perado*	*	*
Himalayan Cotoneaster	***Cotoneaster simonsii***	*	*
Himalayan Honeysuckle	*Leycesteria formosa*	*	*
Hollyberry Cotoneaster	*Cotoneaster bullatus*	*	*
Holme Willow	*Salix caprea x S. cinerea x S. viminalis*	*	*
Hop	*Humulus lupulus*		*
Horse-chestnut	*Aesculus hippocastenum*	*	*
Hybrid Coralberry	*Symphoricarpus microphyllus x S. orbiculatus*	*	
Hybrid Larch	*Larix deciduosa x L. kaempferi*	*	*
Intermediate Bridewort	*Spirea alba x S. salicifolia*	*	*
Italian Alder	*Alnus cordata*	*	*
Japanese Honeysuckle	*Lonicera japonica*	*	
Japanese Larch	***Larix kaempferi***	*	*
Japanese Red-cedar†	*Cryptomeria japonica*	*	*
Japanese Rose	*Rosa rugosa*	*	*
Juneberry	*Amelanchier lamarckii*	*	*
Koromiko	*Hebe salicifolia*	*	*
Laburnum	*Laburnum anagyroides*	*	*
Large-leaved Lime	*Tilia platyphyllos*	*	*
Late Cotoneaster	***Cotoneaster lacteus***	*	*
Laurustinus	*Viburnum tinus*	*	*
Lawson's Cypress	*Chamaecyparis lawsoniana*	*	*
Leyland Cypress†	*Chamaecyparis nootkatensis x Cupressus*	*	*
Lilac	*Syringa vulgaris*	*	*
Lime	*Tilia cordata x T. platyphyllos*	*	*
Lodgepole Pine	*Pinus contorta*	*	*
Lombardy Poplars†	*Populus nigra (fastigiate cultivars)*	*	*
London Plane	*Platinus x hispanica*	*	*
Many-flowered Rose	*Rosa multiflora*	*	*
Maritime Pine	***Pinus pinasta***	*	
Medlar	*Mespilus germanica*	*	
Midland Hawthorn	*Crataegus laevigata*		*
Midland Hawthorn x Hawthorn hybrid	*Crataegus laevigata x C. monogyna*		*
Mock-orange†	*Philadelphus coronarius*	*	*
Monkey Puzzle	*Araucaria araucana*	*	*
Monterey Cypress†	*Cypressus macrocarpa*	*	*
Monterey Pine†	*Pinus radiata*	*	*

(Species marked are trees unlikely to invade as scrub).*

Common name	Scientific name	Britain	Ireland
Mountain Currant	***Ribes alpinum***	*	
New Zealand Broadleaf†	*Griselinia littoralis*	*	*
New Zealand Holly	*Oleria macrodonta*	*	*
Noble Fir†	*Abies procera*	*	*
Norway Maple	*Acer platanoides*	*	*
Norway Spruce	***Picea abies***	*	*
Olive Willow	*Salix eleagnos*	*	*
Orange-ball-tree	*Buddleja globosa*	*	
Oregon-grape	*Mahonia aquifolium*	*	*
Osier	***Salix viminalis***	*	*
Pears	*Pyrus communis sens. Lat*	*	*
Perfoliate Honeysuckle	*Lonicera caprifolium*	*	
Persian Ivy	*Hedera colchica*	*	
Portugal Laurel	*Prunus lusitanica*	*	*
Prickly Heath	*Gaultheria mucronata*	*	*
Rauli	*Nothofagus nervosa*	*	
Red-berried Elder	*Sambucus racemosa*	*	*
Red Horse-chestnut	*Aesculus carnea*	*	
Red Currant	***Ribes rubrum***		*
Red Oak	*Quercus rubra*	*	*
Red-osier Dogwood	*Cornus sericea*	*	*
Red-leaved Rose	*Rosa ferruginea*	*	*
Rhododendron	***Rhododendron ponticum***	*	*
Roble	*Nothofagus obliqua*	*	
Rose-of-Sharon	*Hypericum calycinum*	*	*
Rosemary	*Rosmarinus officinalis*	*	
Rum Cherry	*Prunus serotina*	*	
Salmonberry	*Rubus spectibilis*	*	*
Sawara Cypress	*Chamaecyparis pisifera*	*	
Scot's Pine	***Pinus sylvestris***	*	*
Sea-buckthorn	***Hippophae rhamnoides***	*	*
Service-tree	*Sorbus domestica*	*	
Shallon	*Gaultheria shallon*	*	*
Sharp-stipuled Willow	*Salix triandra x S. viminalis*	*	*
Shiny-leaved Willow	*Salix fragilis x S. pentandra*	*	*
Shrubby Cinquefoil	*Potentilla fruticosa*	*	*
Shrubby Osier	*Salix aurita x S. viminalis*		*
Shrub Ragwort	*Brachyglottis 'Sunshine' (Senecio greyii)*	*	*
Silver Maple	*Acer saccharinum*	*	*
Sitka Spruce	*Picea sitchensis*	*	*
Small-leaved Cotoneaster	***Cotoneaster microphyllus agg.***	*	*
Smooth-leaved Elm	***Ulmus minor***		*
Snowberry	***Symphoricarpus alba***	*	*
Spanish Broom	*Spartium junceum*	*	
Spanish Gorse	*Genista hispanica*	*	
Spotted-laurel	*Aucuba japonica*	*	*
Spreading Cotoneaster	***Cotoneaster divaricatus***	*	
Spurge-laurel	*Daphne laureola*		*
St Daebeoc's Heath	*Daboecia cantabrica*	*	
Stag's-horn Sumach	*Rhus typhina*	*	
Steeple Bush	*Spirea douglasii*	*	*
Stern's Cotoneaster	***Cotoneaster sternianus***	*	

(Species marked are trees unlikely to invade as scrub).*

Common name	Scientific name	Britain	Ireland
Stinking Tutsan	*Hypericum hircinum*	*	*
Strawberry Tree	*Arbutus unedo*	*	
Swedish Whitebeam	*Sorbus intermedia*	*	*
Sweet Chestnut	*Castanea sativa*	*	*
Sycamore	***Acer pseudoplatanus***	*	*
Tall Tutsan	*Hypericum androsaemum x H. hircinum*	*	*
Tamarisk	*Tamarix gallica*	*	*
Teaplants	*Lycium agg.*	*	*
Thumberg's Barberry	*Berberis thunbergii*	*	*
Traveller's Joy	***Clematis vitalba***		*
Tree Cotoneaster	***Cotoneaster frigidus***	*	*
Tree-of-heaven	*Ailanthus altissima*	*	
Tree Lupin	*Lupinus arboreus*	*	*
Turkey Oak	***Quercus cerris***	*	*
Virginia-creeper	*Parthenocissus quinquefolia*	*	*
Wall Cotoneaster	*Cotoneaster horizontalis*	*	*
Walnut	*Juglans regia*	*	
Waterer's Cotoneaster	***Cotoneaster frigidus x C. salicifolius***	*	*
Wayfaring Tree	***Viburnum lantana***		*
Weeping Willow†	*Salix alba x S. babylonica*	*	*
Wellingtonia†	*Sequoiadendron giganteum*	*	*
Western Balsam-poplar	***Populus trichocarpa***	*	*
Western Hemlock-spruce	*Tsuga heterophylla*	*	*
Western Red-cedar	*Thuja plicata*	*	*
Weymouth Pine	***Pinus strobus***	*	
White Dogwood	*Cornus alba*	*	*
White Poplar	***Populus alba***	*	
White Willow†	*Salix alba*	*	*
Wild Plum	*Prunus domestica*	*	*
Wild Privet	***Ligustrum vulgare***		*
Willow-leaved Cotoneaster	***Cotoneaster salicifolius***	*	
Wilson's Honeysuckle	*Lonicera nitida*	*	*
Yellow Azalea	*Rhododendron luteum*	*	*
Whitebeams	*Sorbus croceocarpa*	*	
	Sorbus latifolia	*	*

Appendix 8.6 Initial qualitative assessments of various management techniques for each species of shrub

Much of the following information is based on anecdotal observation and should therefore only be treated as general guidance. **We welcome any feedback on the qualitative scorings as a way of developing our knowledge base and so that future updates can be refined.** See feedback form.

The information is presented in three sections:

- Appendix 8.6.1 Qualitative assessments of shrub **removal** techniques.
- Appendix 8.6.2 Qualitative assessments of shrub **maintenance** and **reduction** techniques.
- Appendix 8.6.3 The **grazing and browsing ability** and likely **impact** of livestock breeds.

8.6.1 Qualitative assessments of shrub *removal* techniques.

Assessments in this table are provisional as of July 2003 and are subject to review (courtesy of GAP). The effectiveness of many of the techniques in this Table will depend on the physical properties of the soil type and how wet or sun-baked it is. The current scorings relate to ideal conditions and represent the best result that can be expected. **We welcome any additional information to help add to and refine the information in this table.** See feedback form.

Note: inappropriate or untimely use of these techniques can result in harm to conservation and wildlife interests.

The provisional qualitative assessments are:

Key: A = Very effective impact; B = Effective impact; C = Partial impact; D = Minor impact; - = Not applicable; * = Not known;

Species	Growth from roots or root fragments	Pulling of saplings	Mattock type tool	Root cutting chainsaw	Stump grinding	Stump lifting	Comments
Alder	None; but grows from surface running roots.	A	A	A	A	A	
Ash	Can grow from surface running roots.	C	C	B/C	B/C	B/C	Seeds on bare ground. Tap roots go deep. Shoots tend to break off when pulling.
Aspen	Grows vigorously from surface running roots.	C	C	C	C	C	Forms dense suckering stands.
Beech	None; occasional weak growth from surface running roots.	A	A	A	A	A	Beech masts germinate prolifically on bare ground.
Birch - Dwarf		-	-	-	-	-	Rare species. Prolific seeding; slow growing.
Birch – Silver, Downy	None; may grow from surface roots on thin soils.	B	B	A	B	B	Seed prolifically on bare ground.
Blackthorn and prunus spp	Numerous shoots from shallow roots.	D	C	B	D	B	Stumps small and roots difficult to secure for grinding.
Box	Numerous shoots from shallow fibrous roots.	C	C	C	-	B	Shade tolerant.
Bramble and rubus spp	Shoots strongly even from deep tap-root remnants.	C	B	B	-	-	Multiple rooted. Fewer deep tap roots. Arching layering growths.
Broom	None; very little growth from shallow roots.	A	A	A	-	A	Prolific seeding on bare ground. Does not regrow once it losses juvenile vigour.
Buckthorn and Alder Buckthorn	Shoots from shallow roots.	C	B	B	-	B	Stumps small and difficult to secure for grinding.
Buddlia	Shoots from shallow surface roots.	A	A	A	B	A	Prolific seeding and germination on bare soil.

Appendix 8.6.1 Removal techniques. Cont...

Key: A = Very effective impact; B = Effective impact; C = Partial impact; D = Minor impact; - = Not applicable; * = Not known;

Species	Growth from roots or root fragments	Pulling of saplings	Mattock type tool	Root cutting chainsaw	Stump grinding	Stump lifting	Comments
Cherry Laurel	Shoots from surface running roots.	*	*	*	*	*	
Cherry (Wild / Gean)	Numerous shoots from shallow roots.	D	C	C	C	C	
Cotoneaster (ornamentals)	Shoots from surface roots.	*	*	*	*	*	Do not control wild cotoneaster.
Currant	Numerous shoots from shallow fibrous roots.	C	B	B	-	B	
Conifers	Do not shoot from roots.	A	A	A	A	A	Conifers do not re-grow. Only remove stumps for access.
Dogwood	Numerous shoots from shallow fibrous roots.	D	C	C	-	-	
Elder	Shoots from surface running roots.	C	B	A	C	A	Shoots full of sap and bark slides – difficult to pull. Seeds on bare ground.
Elm	None; but shoots from surface running roots.	*	B	B	B	B	
Field Maple	Virtually no shoots from roots.	A	A	A	A	A	
Gorse	Roots can produce shoots; also shoots from surface running roots.	C(but small and prickly!)	B	B	-	B	Seeds in bare ground. Stumps small and difficult to secure for grinding.
Guelder Rose	Shoots from surface roots.	*	B	B	C	B	Generally regarded to have high conservation value.
Hawthorn	Little growth from surface roots.	C	A	A	B	B	Berries germinate well on bare soil.
Hazel	None; some shoots from surface running roots.	A	A	A	A	A	Nuts germinate well.
Holly	Shoots strongly from surface running roots.	C	B	B	A	A	Shoots can break off when pulling.
Honeysuckle	Shoots from any surface roots.	C	B	B	-	-	Long winding roots.
Hornbeam	Not known.	C	B	B	B	A	
Horse chestnut	None, but may grow from surface running roots.	B	A	A	A	A	
Ivy spp	Depends on species.	B	C	C	-	B	Surface/ shallow rooted.
Juniper	None	-	-	-	-	-	High conservation value.

Appendix 8.6.1 Removal techniques. Cont...

Key: A = Very effective impact; B = Effective impact; C = Partial impact; D = Minor impact; - = Not applicable; * = Not known;

Species	Growth from roots or root fragments	Pulling of saplings	Mattock type tool	Root cutting chainsaw	Stump grinding	Stump lifting	Comments
Lime	None, but can grow from surface running roots.	*	B	B	B	C	
Oak (Pedunculate & Sessile).	None.	B	B	A	A	A	Acorns germinate readily. Tap roots of seedlings can go deep.
Oak (Turkey & Holme).	Do not readily shoot from surface running roots.	B	B	B	A	B	Tap roots of seedlings can go deep.
Pine	Does not shoot from roots.	A	A	A	A	A	
Poplar	Grows from all root fragments.	D	B	B	D	B	
Privet	Numerous shoots from shallow fibrous roots.	C	C	C	-	-	Hand pulling can give good control for small areas.
Rhododendron	Grows from all root fragments.	A	C	C	C	C	
Rose spp	A few shoots from deep root remnants.	D	C	C	-	-	Very deep tap roots.
Rowan	Shoots from surface running roots.	A	B	B	B	B	
Sea buckthorn	Some growth – and grows prolifically from surface running roots.	C	C	B	-	B	Stumps small and difficult to secure for grinding.
Snowberry	Numerous shoots from shallow fibrous roots.	D	D	C	-	-	Numerous shooting roots.
Spindle	Shoots from surface running roots.	B	B	B	-	B	High conservation value.
Sycamore	Can grow from stumps and from surface running roots.	A	A	A	A	A	Seeds & germinates prolifically most years, even in grassland.
Sweet chestnut	None from roots.	A	A	A	A	A	
Traveller's Joy (Old man's beard)	Can grow from stumps and from surface running roots.	C	B	B	-	-	Straggly, twisted roots. Seeds on bare ground.
Wayfaring tree	None, but can grow from surface running roots.	B	B	B	B	A	
Whitebeam	None, but can grow from surface running roots.	B	A	A	A	A	
Willow/sallows	Grows from all root fragments & surface running roots.	D	C	C	D	C	
Yew	Grows from surface running roots.	A	A	A	B	A	Berries germinate in bare soil.

Source: Originally sourced from documents being developed by the Grazing Animals Project (GAP) and supplied by GAP to the Soil Association for use as Table 3 in their Technical Guide: *Organic Weed and scrub control on nature conservation sites (2002)*. They were then updated from information/feedback received by GAP / Scrub Handbook Working Group to July 03.

8.6.2 Qualitative assessments of shrub *maintenance* and *reduction* techniques

Assessments in this table are provisional as of July 2003 and are subject to review. **We welcome any additional information to help add to and refine the information in this table.** See feedback form.

Note: inappropriate or untimely use of these techniques can result in harm to conservation and wildlife interests.

See Appendix 8.6.3 for livestock breeds summary assessment of impact on individual shrub species.

The provisional qualitative assessments are:

Key: A = Very effective impact; B = Effective impact; C = Partial impact; D = Minor impact; - = Not applicable; * = Not known;

Species	Growth habit from remaining cut stump	Grazing/browsing impact (see also Appendix 8.6.3)				Burning	Repeated cutting to ground level by small hand tools	Repeated cutting to ground level by mechanical tools	Flailing/ mulching	Comments
		Goats	Ponies	Cattle	Sheep					
Alder	Vigorous coppice growth	C	D	C	C	-	C	C	C	
Ash	Vigorous coppice growth	B	B	B	B	-	C	C	C	Ponies, goats & sheep can de-bark stems in winter.
Aspen	Coppice growth	*	*	B	B	-	C	C	C	Palatable to rabbits.
Beech	Normally only weak growth	B	D	B	B	-	B	B	B	Palatable to rabbits.
Birch - Dwarf	Coppice shoots	*	*	*	*	-	-	-	-	Rare species. Palatable to deer.
Birch – Silver, Downy.	Coppice growth	C	D	B	B	-	C	C	C	Not so palatable early season.
Blackthorn and prunus spp	Vigorous growth	C	D	D	D	-	D	C	C	Browsing reduces when thorns harden. Rabbit and deer tip young shoots.
Box	Coppice growth	*	D	-	-	-	D	D	D	Foliage protected by toxins.
Bramble and rubus spp	Vigorous coppice growth	B	C	C	B	-	D	C	C	Browsing depends on thorniness.
Broom	None	B	D	C	B	-	B	B	B	Only young Broom is vigorous.
Buckthorn and Alder Buckthorn	Vigorous coppice growth	C	-	C	C	-	C	C	C	Toxic to ponies.
Buddlia	Vigorous coppice growth	*	*	D	*	-	C	C	C	Not palatable to deer.
Cherry Laurel	Vigorous coppice growth	-	-	-	-	-	C	C	C	Poisonous to livestock.
Cherry (Wild/Gean)	Vigorous coppice growth	B	B	B	B	-	D	D	D	

Appendix 8.6.2 Shrub *maintenance* & *reduction* techniques. Cont...

Key: A = Very effective impact; B = Effective impact; C = Partial impact; D = Minor impact; - = Not applicable; * = Not known;

Species	Growth habit from remaining cut stump	Grazing/browsing impact (see also Appendix 8.6.3)				Burning	Repeated cutting to ground level by small hand tools	Repeated cutting to ground level by mechanical tools	Flailing/ mulching	Comments
		Goats	Ponies	Cattle	Sheep					
Cotoneaster	Coppice growth	*	D	D	D	-	C	C	C	
Currant	Coppice growth	B	*	B	B	-	C	C	C	
Conifers	None	A	A	C	C	-	A	A	A	
Dogwood	Vigorous coppice growth from young stumps – dies if older stems	B	C	C	C	-	D	C	C	
Elder	Vigorous coppice growth from young stumps	A	C	B	B	-	D	C	C	Bark palatable to goats & ponies in winter.
Elm	Vigorous coppice growth	B	B	B	B	-	D	C	C	Ponies will de-bark in winter.
Field maple	Coppice growth	B	B	B	B	-	C	C	C	
Gorse	Coppice growth	C	C	C	C	B	C	C	B	Ponies especially browse in winter.
Guelder Rose	Coppice growth only from young stumps	*	*	*	*	*	*	*	*	High conservation value.
Hawthorn	Coppice growth	C	D	D	C	-	C	C	C	Toxins reduce browse.
Hazel	Coppice growth	B	D	C	C	-	C	C	C	Often de-barked and browsed by deer in winter.
Holly	A few strong coppice shoots	C	C	C	D	-	D	C	C	Important winter browse for ponies.
Honeysuckle	Some coppice growth	B	D	D	C	-	C	C	C	Climber. Browsed by Fallow Deer.
Hornbeam	Coppice growth	C	*	C	C	-	C	C	C	
Horse chestnut	Vigorous growth	D	*	C	C	-	C	B	B	
Ivy spp	Shoots from surface roots.	B	D	B	B	-	-	-	D	Low growing/climber. Browsed by Roe & Fallow Deer.
Juniper	None	*	*	*	*	-	-	-	-	High conservation value.
Lime	Coppice growth	*	*	B	B	-	C	C	C	
Oak – Pedunculate, Sessile & Turkey	Coppice growth	B	D	B	B	-	C	C	C	
Oak – Holme	Some coppice growth from young trees	B	D	B	C	-	C	C	C	

Appendix 8.6.2 Shrub *maintenance* & *reduction* techniques. Cont...

Key: A = Very effective impact; B = Effective impact; C = Partial impact; D = Minor impact; - = Not applicable; * = Not known;

Species	Growth habit from remaining cut stump	Grazing/browsing impact (see also Appendix 8.6.3)				Burning	Repeated cutting to ground level by small hand tools	Repeated cutting to ground level by mechanical tools	Flailing/ mulching	Comments
		Goats	Ponies	Cattle	Sheep					
Pine	None	C	D	C	*	-	A	A	A	
Poplar	Vigorous coppice growth	C	*	C	C	-	D	D	D	
Privet	Multiple coppice growths	C	C	C	B	-	D	C	C	
Rhododendron	Vigorous coppice growth	-	-	-	-	-	B	C	B	Poisonous.
Rose spp	Vigorous growth	C	*	*	C	-	D	C	C	
Rowan	Coppice growth	B	B	B	B	-	C	C	C	Browsed & de-barked by deer. Mountain Hare browse seedlings.
Sea buckthorn	Vigorous coppice growth	C	D	C	C	-	D	C	C	
Snowberry	Not applicable	C	*	*	*	-	D	D	D	
Spindle	Coppice growth	*	*	C	C	-	C	C	C	High conservation value.
Sweet chestnut	Vigorous coppice growth	*	*	D	D	-	C	C	C	
Sycamore	Vigorous growth	B	D	B	B	-	C	C	C	
Traveller's Joy (Old man's beard)	Coppice growth	C	-	C	B	-	D	C	C	Climber
Wayfaring tree	Coppice growth only from young stumps	C	*	C	C	-	D	C	C	
White beam	Coppice growth from young stumps.	*	*	C	C	-	C	C	C	Ignored by rabbits.
Willow/sallows	Vigorous coppice growth.	B	B	B	B	-	D	D	D	Livestock also de-bark in winter.
Yew	Coppice growth from young trees.	-	-	-	-	-	C	C	C	Potentially poisonous to livestock.

Source: Originally sourced from documents being developed by the Grazing Animals Project (GAP) and supplied by GAP to the Soil Association for use as Table 2 in their Technical Guide: *Organic Weed and scrub control on nature conservation sites (2002).* They were then updated from information/feedback received by GAP / Scrub Handbook Working Group to July 03.

8.6.3 The grazing and browsing ability and likely impact of livestock breeds

Assessments in this table are provisional as of July 2003 and are subject to review. **We welcome any additional information to help add to and refine the information in this table.** See feedback form.

Observations may be based on a few herds or individuals with particular traits and may not be a true representation of the breed. The differences between individuals may be greater than between breeds, for example stock of different provenance and upbringing, even known hardy breeds, may have been kept under 'improved' or 'unimproved' conditions.

The issues relating to age, sex, physiological status, experience and learning may all be important, possibly over-riding that of the breed. These are all discussed in section 5.8.8.

Past management of the site will also have an influence, as will the availability and palatability of other plants species in the herbage which itself will vary as the seasons change. Livestock may take plants they would not normally eat, simply because little else is available. Similarly, if plenty of grass is available, then grazing animals will take little interest in scrub.

Note: inappropriate or untimely use of grazing and browsing can result in harm to conservation and wildlife interests. See Appendix 8.6.2 for **livestock species** summary assessment of impact on individual shrub species.

Key to Table:

Rating: '4' = Breed always impacts scrub by browsing;
'3' = Breed regularly impacts scrub by grazing/browsing;
'2' = Breed sometimes impacts scrub by grazing/browsing;
'1' = Breed rarely impacts scrub by grazing/browsing.

Cattle:

Breed	Rating	Comment
Aberdeen Angus	2	Will browse new scrub and trample to prevent encroachment. Browses thorn, hedging shrubs, gorse and Beech.
Beef Shorthorn	2/3	Browses readily although extent of scrub control not known. Favour willows and ivy, will browse Ash, Hawthorn, Blackthorn and Bramble. Non hardy or 'improved' varieties (2).
Belted Galloway	3/4	Will take a wide range of scrub species, including, Cotoneaster, Scots Pine, Holm Oak, Silver Birch, Blackthorn, Hawthorn, Ash, Whitebeam, Cherry, Beech and Spindle. Will trample bramble.
British White	2	
Charolais	1	
Dexter	3	Limited role as browser depending upon food availability. Will take young Birch, gorse and Brambles.
Friesian x Holstein	1	Not suitable for scrub management.
Galloway	3/4	Varies from site to site. Will take Whortleberry, Blackthorn, Hawthorn, gorse and Holly, especially during the winter. Some privet taken with Ivy a favourite on some sites.
Gloucester	1	
Guernsey	2	
Hereford	3	Significant browser of a range of species, including, birch.
Mixed Hereford x	2/3	Observed to eat Calluna, Dwarf Gorse, Scots Pine, young European Gorse, Rowan, Silver Birch, Ivy. Also the seeds of Chestnut and oak.
Highland	3	Able to control scrub encroachment as part of an extensive grazing system. Willingly browse Willow up to 18mm thick and pull down branches up to 75mm. Do not select ericaceous plants unless very short of other forage. Horns also cause significant damage to scrub. Lot of winter bark stripping.
Irish Moiled	2	
Jersey	1	Not suitable.
Kerry	3	Limited role as browser depending upon food availability – browse more in winter.
Lincoln Red	3	Limited information available. Maintain stable gorse population on one site. Observed to be hardy, and good in lowland Britain.
Limousin	1	Can be 'excitable' Its ability depends on its knowledge. Most likely to have been reared on rye grass leys, so not suitable on scrub.

Breed	Rating	Comment
Longhorn	3	Good browsing year round. Will take Alder, birch, Buckthorn, Creeping Willow and Hawthorn. Significant control of scrub and brambles through trampling.
Murray Grey	2	Will browse Hawthorn, Blackthorn and Elder; also tramples through scrub.
North Devon	2/3	Where paths have been cut into scrub, this breed has been found to keep them open, but mainly due to trampling. Will browse Heather in Autumn. Observed browsing Bramble.
Red Poll	2/3	Readily browses any accessible woody vegetation, including Elder and Hawthorn. Ignores Bramble.
Shetland	2	Wide variety of shrubs taken year round including Birch, Scots Pine and young Heather.
South Devon	2/3	Minimal browsing but readily push through gorse, Broom, birch and other scrub in search of tasty morsels under the canopy. Will rub and scratch on scrub also – mechanical damage. Browse some Hawthorn.
Sussex	2/3	Will lightly browse a range of trees and shrubs but not sufficiently to knock the plants back. Hazel and birch (in spring) and Bramble are taken and Alder has been recorded. Favour young low bushes and re-growth from Hawthorn and oak.
Water Buffalo	2/3	Favours willow, Bramble, Ivy, Blackthorn and Barks Alder. No gorse or Heather taken during summer.
Welsh Black	3	Will effectively browse a great diversity of trees and shrubs including Silver Birch, Rowan, oak (seedlings and re-growth), young gorse, Bramble and willow. In winter will browse Bilberry and Ling. Moves through and browses dense scrub if pathways are cut first. Will trample Bracken.
White Park	2	Determined by grazing regime. Increases with reduced availability of grazing.

Sheep:

Breed	Rating	Comment
Balwen		
Beulah Speckled Face	2	Primarily a grazer but has been known to take bark in the winter, and new growth on thorn bushes and other scrub.
Black Welsh Mountain	2	Reasonable ability to suppress saplings and scrub re–growth, particularly, willow – dislikes Bog Myrtle.
Bluefaced Leicester	1	
Border Leicester	1	
Boreray	2	Will browse, but extent of ability unknown.
British Milksheep	1	
Castlemilk Moorit	1	Will browse shrubbery and strip bark.
Clun Forest	2	
Cotswold	2	Minimal impact but will nibble leaves of new seedlings and re–growth.
Dalesbred	2	
Derbyshire Gritstone	2	
Devon Closewool		
Dorset Down	1	
Dorset Horn/Poll	1	
'Easycare'	1	Minimal but will take new re–growth.
Eppynt		
Exmoor Horn	1	
Galway		
Greyface Dartmoor		
Hampshire Down	1	
Hebridean	3	Effectively controls scrub and coppice re–growth, including Hawthorn, Creeping Willow, Sea-buckthorn and Birch. Browses Bramble leaves and tips. Will bark strip trees (especially willow) and scrub particularly during winter and when short of fodder.

Sheep cont...

Breed	Rating	Comment
Herdwick	3	Controls scrub re–growth and suppresses tree/scrub encroachment if grazed more intensively. Controls Creeping Willow on dunes. Takes birch, Hawthorn, Blackthorn, Wayfaring Tree, Sycamore, Pine, Bramble, Honeysuckle, Dogwood and Sea-buckthorn, but little gorse. Readily eats Heather.
Hill Radnor	2	
Icelandic	2/3	Keen browsers, preferring hedge to pasture. Strips Bramble, Hawthorn and Blackthorn of leaves. Bark strips range of species but avoids Heather.
Kerry Hill	2	
Lincoln Longwool	1	
Jacob	3	Rears up on hind legs to eat, often favouring browse material to grasses. Takes a wide range of species including Bramble, Ivy, Hawthorn, Hazel, Cherry, oak, Ash Whitebeam, Dogwood, Beech and Rowan. Bark strips smooth trees in winter and devastates newly laid hedges. Wethers will browse harder than ewes.
Lleyn	2	
Lonk		
Llanwenog		
Manx Loghtan	2	Bark strips trees/scrub including willow, esp. in winter and when short of fodder. Browses Bramble leaves and tips. Moderate impact on Dogwood scrub.
Masham	2	
Mules	2	Minimal although some Bramble and seedlings taken.
Norfolk Horn	1	Promising, but limited information available.
North County Cheviot	2	
North Ronaldsay	1	Will browse new Bramble growth, Hawthorn, Elder and most other trees if given access. Will bark strip.
Oxford Down	1	
Portland	3	Will suppress seedlings and re–growth although tends not to bark strip. Fond of Privet and fresh Bramble growth.
Romney Marsh	2	Observed to control willows, especially in areas where saplings are invading margins, eating the leaves and nipping buds and young shoots. Have also been observed browsing established bushes.
Rough Fell	2	Minimal impact although can have good effect on Bramble scrub and Honeysuckle if stocked heavily. Will take seedlings, Bilberry, some re–growth and young gorse tips.
Ryeland		
Scottish Blackface	3	Readily eats and suppresses Bramble, some impact on willow and birch seedling growth, otherwise, minimal impact.
Shetland	2	Readily browses dwarf shrubs, saplings and re–growth of most willow species, oak, Hawthorn and Alder. Strips bark and browses Bramble.
Shropshire		
Soay	3	Has a requirement for wood in its diet – useful for control of invasive scrub.
South County Cheviot	2	
Southdown	2	Minimal impact, although will take Bramble leaves and the more palatable shrubs such as Hazel.
South Wales Mountain	2	
Suffolk	1	Minimal although will take re–growth of softer species.
Sussex Down		
Swaledale	2	A hard-mouthed breed which can be effective on tree seedlings, Bramble and Honeysuckle, may also take live Yew. Otherwise minimal browsing impact.
Teeswater		
Welsh half bred	2	

Sheep:

Breed	Rating	Comment
Welsh Mountain	2	Moderate – browses most woody plants including Holly and Ash. Good at breaking large areas of Bramble and other low growing scrub into smaller blocks. Readily eats Heather.
Wensleydale		
Whiteface Dartmoor		
Whitefaced Woodland	2	Happily browses Bramble and thorn bushes.
Wiltshire Horn	2	Eats young scrub and hedges including Sycamore, Ash, Blackthorn, oak, willow, Pine, Spruce, birch, Cherry, Hazel, Hawthorn and Brambles.

Ponies:

Breed	Rating	Comment
Connemara	2	
Dales	2	
Dartmoor	2	Limited browsing ability depending upon general food availability. Readily eats Brambles, Honeysuckle and if short of grass may switch to feeding almost entirely on gorse. Some suppression of willow, birch and Blackthorn re–growth.
Eriskay	2	
Donkeys	2	Readily browses year round, will strip growth and can decimate newly laid hedges. 20% of diet may be browse. Species taken are gorse, Holly and Bramble.
Eriskay	2	
Exmoor	2	Limited role depending upon general food availability. Will browse Beech, gorse and Blackthorn and strip bark of broad-leaved trees and shrubs (including gorse) in winter when short of forage. May take some birch re–growth. Observed eating heath spp, Common and Dwarf Gorse, Bog Myrtle, Alder.
Fell	2	
Highland	2	Limited role. May browse gorse, Hawthorn in winter and sometimes Holly. Will browse most broadleaves.
Konik polski	3	Readily browses range of species including, Elm, willow, oak, Hawthorn, Brambles and Wild Privet on coastal dunes. Alder and birch generally ignored. Browse important part of diet in year-round grazing systems.
New Forest	2	Take growing and cut gorse and Holly, Blackthorn shoots, willow re–growth, Broom and a small amount of bracken. Sometimes bramble scrub. Little bark stripping except Dogwood in winter and occasionally Elder and oak. Observed eating Common & Dwarf Gorse, some browsing of oak (acorns a potential problem) Grey Willow, Alder, Holly, Bramble, Ivy, Bracken & Honeysuckle.
Przewalskis	2	
Rum & Skye	2	
Shetland	2	Enthusiastic browsers especially in winter. Bark strips and eats re–growth of many deciduous species: Hazel, Blackthorn, willow, Alder, elm and new gorse growth. Less interested in birch. Ignore heather.
Welsh Mountain	2	Minimal impact. Some willow, Hawthorn and Hazel re–growth and winter gorse taken.

Goats:

Breed	Rating	Comment
African Pigmy	3	
Anglo-Nubian	3	
Angorra	3	
Bagot	4	Very effective browser of Bramble, also fond of Blackthorn, Hawthorn and any other green leaf. Eats gorse. Strips bark ferociously during winter months. Browses so effectively that stump re–growth is virtually unknown in its presence.
British Alpine	3	
Feral Goat	4	Similar to Bagot, has been observed to favour Bramble, Holly, Hawthorn, gorse and Broom, also natural regeneration. Good at winter bark stripping, especially in order of preference has been observed to strip: Ash, Rowan, Holly, Hawthorn, willow.
Golden Guernsey	3	
Kashmir	3	
Saanan	3	
Toggenburg	3	

Source acknowledgement: Table has been provided by the Grazing Animals Project in conjunction with the FACT 3 Scrub Project. Information has been incorporated from the Breed Profiles Handbook, Grazing Animals Project, 2001. Table compiled by Sue McQueen and John Bacon (GAP). Comments received from RSPB site managers and incorporated as revisions by John Day, Jan 2003. Information is provisional and subject to review, July 2003.

Appendix 8.7 Herbicide information

When the 'contents' of this Handbook was being determined by the Project Working Group in 2001 it was agreed that it would be necessary to have an Appendix setting out background information relevant to the use of herbicides for the management of scrub. As readers will by now have realised the volume of material that would have been required to meet legal and operational guidance would have been enormous – far more than would have been suitable for an Appendix. So it was decided to assist English Nature in the production of: *The Herbicide Handbook – guidance on the use of herbicides on nature conservation sites.(2003).*

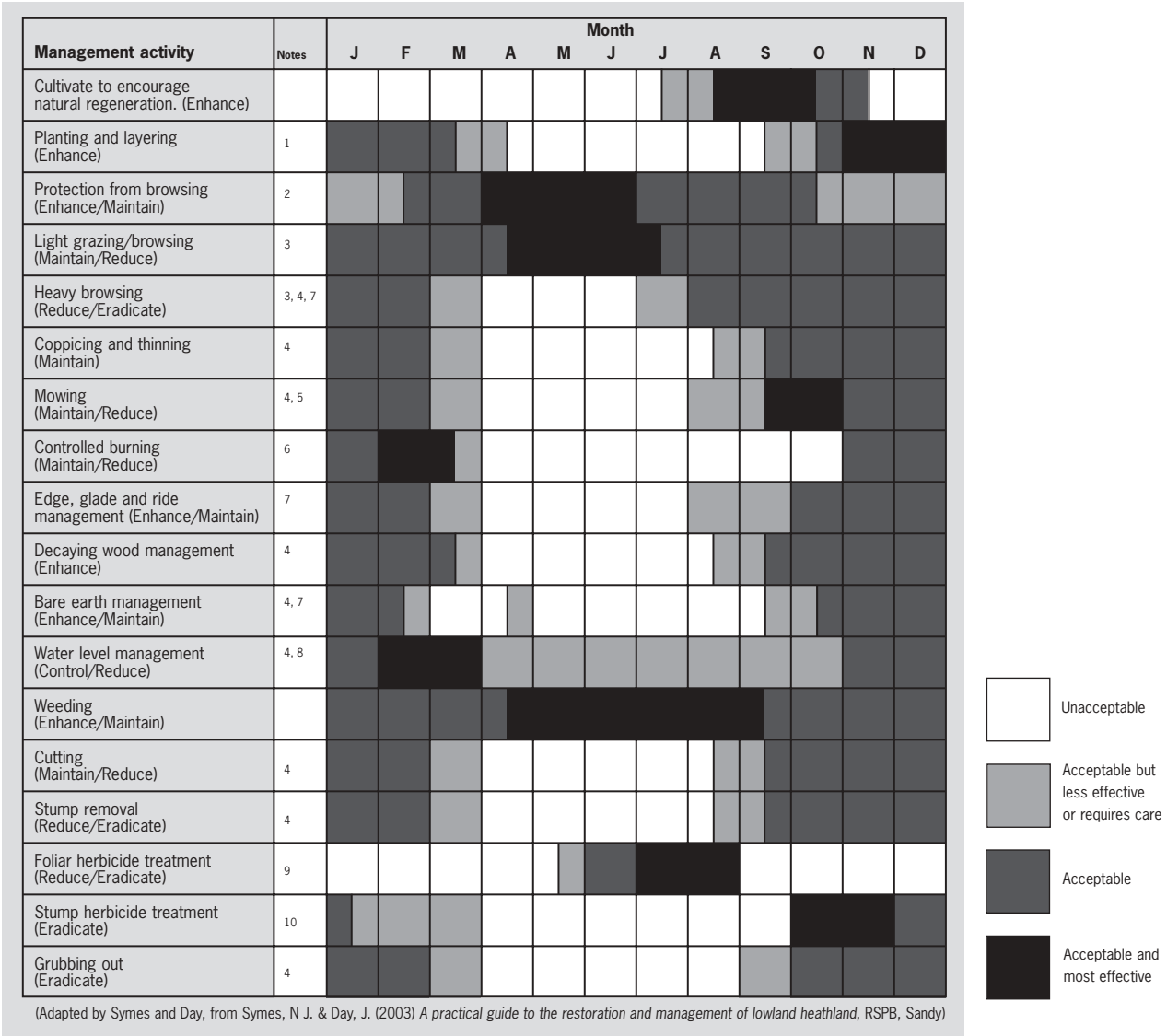
The Herbicide Handbook now accompanies this Scrub Handbook so there is no longer any need for this Appendix. It has been left in to ensure that anyone reading just the 'Contents' and wanting to go straight to the herbicide information gets referred directly to the Herbicide Handbook that follows in this folder.

Anyone managing scrub is likely to consider herbicides as a technique with the exception of those sites that are going to be, or already have been, registered as organic. We hope that the supply of both Handbooks along aside each other will assist a proper review of all techniques, followed by choice of the technique that best suites the site conditions and requirements.

Note: Readers may like to know that the Herbicide Handbook is also available on its own from English Nature without the Scrub Handbook for applications that do not involve scrub.

Appendix 8.8 Scrub management calendar

The following calendar is for guidance only. It is based on approximate timings for managing lowland scrub in southern Britain. Timings may need to be adjusted for other parts of the country. The calendar should be used in association with the sections on management planning, the species and techniques profiles and monitoring.



(Adapted by Symes and Day, from Symes, N J. & Day, J. (2003) *A practical guide to the restoration and management of lowland heathland*, RSPB, Sandy)

Notes

1. Planting container grown plants can be extended from early autumn into early spring. Early or late planting of bare rooted plants increases risk of plant mortality, especially when planted late, due to insufficient development of roots to withstand summer drought.
2. Most shrubs are vulnerable to spring and early summer browse. NB: Some species vulnerable to winter browse (see species profiles for detail).
3. Timing dependant on objectives, scrub being managed, breeds used and local conditions (see profile in section 5 for detail).
4. Avoid bird-nesting season (April to August) some birds may nest from early March, through into September.
5. Best in late summer for seed gathering. Remove cuttings.
6. Do not burn in areas with reptiles. Only burn in ideal conditions with appropriate fire control. Comply with burning regulations.

7. Caution required on Sand Lizard sites, where management needs to be carried out between end of hibernation and egg laying. Consult beforehand.
8. Where acceptable without compromise to flora or invertebrate interest, best to raise levels slowly to allow small mammals to escape and before ground nesting birds begin to breed.
9. Best soon after full leaf development, before hardening-off and the onset of senescence.
10. Less effective in late winter due to sap rise. Autumn usually best.

Appendix 8.9 Management costs

Summary
Scrub habitat can be expensive to manage or restore and budgeting for management and restoration is an essential element of any work plan. Therefore, it is useful to know the costs of management operations and how they are determined. Grants are available to help fund management; some pay fixed rates (eg £/ha), others pay a proportion of the actual costs, or a combination of the two (see Appendix 8.10).

The following information provides guidance on key points to consider when estimating costs of scrub management. For each operation, the costs of labour and machinery, together with the costs of the consumables need to be incorporated. These are used to calculate the cost per hectare of management operations, using real examples to provide a balanced interpretation of work rates and machinery use. However, the examples are for guidance only, as actual costs for work and materials will vary between regions and over time.

Work rates
Differences in costs for carrying out operations are usually related to the amount of time the task takes to complete. It is therefore important to understand the local variations that might occur and adjust the time budget accordingly.

Work rates can be influenced by:

- The density of the management issue; for example the area and quantity of scrub.
- Working conditions; steep, boggy, or stony ground, ditches, slit trenches and other obstacles, and debris will all slow work rates.
- The ease of access to the management area; across steep, boggy, or stony ground.
- The sensitivity of the habitat which influences the care that needs to be taken, eg to preserve fen structure.

Ideal working conditions on flat and dry ground, free of obstacles and with no current sensitivity can be worked with less constraint, but these conditions rarely occur.

Labour costs
These will vary across the country and it is important to get local quotes when calculating grants and costing management plans.

Labour costs usually include a combination of employed staff and contractors. The total cost for employed staff must include annual salary, National Insurance, pensions and additional administrative cost. Direct labour costs can be calculated thus:

- The total team annual salary bill, including National Insurance and pensions (A), and the team's on-costs including travel and subsistence, training, rent of work space, heat and power, telephone, print and post (B). These are summed and then divided by the total number of the work force involved including dedicated administration and management staff and including proportions of time from staff who are not full time with the team (C). Giving the simple equation:

  Direct Labour Cost (DLC) = (A + B) / C
  (/ = divide)

- Daily or hourly DLC rates can be calculated by dividing the total DLC by the number of days or hours worked: eg Daily DLC might be the total DLC / 220 days, and the Hourly DLC might be DLC / 220 days / 7.5 hours. See Table 1 for an example.

Table 1: Unit Labour Cost calculation for a hypothetical team of 5 full-time field workers, with 50% secretarial support, and 25% of input from a manager.

Cost	£
Total annual salaries (plus NI)	80,500.00
On-costs (depends on organisation)	
Travel and subsistence	5,000.00
Annual training cost	2,000.00
Rent	2,500.00
Heat and power	600.00
Telephone and post	200.00
Total	24,300.00
15% support for on-costs	3,645.00
Total on-costs	27,945.00
Grossed staffing cost	108,245.00
Total full time staff equivalent = 5.75 persons; total work days per annum = 201; hours worked per day = 7.5	
Total unit labour cost	18,825.00
Daily unit labour cost	93.66
Hourly rate per person	12.50

Contractors are responsible for their own National Insurance and other material and machinery costs, which will be accounted for in their charge. Factors affecting work rates, as listed above, will influence contractor rates, as well:

- Current workload; a contractor may have too little or too much work. Therefore may be inclined to accordingly submit a higher or lower tender.
- Local competition; an abundance of local contractors, may increase competitiveness in tendering and an element of undercutting prices.
- Complexity of the job; a contractor may balance the financial benefit of a job against the degree of difficulty of completing the job and, all other things being equal, choose the simpler job.
- There are many contractors with the capability of carrying out the specialist work required. However, choosing a contractor can be difficult and is often influenced by cost. 'Training' a local operator to carryout the work can save the additional charge incurred through the distance travelled by a known specialist. A local contractor will soon get the 'feel' for the work and level of finish expected, reducing the amount of site supervision needed. Providing regular work, especially coinciding with known slack periods, can reflect in the quote.

Equipment costs
A direct labour team will incur costs for running and maintaining their own equipment. These can be calculated as hourly or daily rates for each item of equipment. They include annual straight-line depreciation (the current cost of replacement divided by its life expectancy in years) and annual maintenance costs (parts and labour), which are divided by the number of days (or hours) the equipment is used each year (see Tables 2 & 3).

Table 2: An example calculation of tractor running costs.

Tractor cost new	£30,000.00
Life expectancy	12 years
Annual depreciation cost	£2,500.00
Annual maintenance	£1,700.00
Hours use per year	500 hours
Hourly rate	£8.40
Day rate (hourly rate x 7.5)	£63.00

NB: because sales discounts are variable – and might not always be available they should not be included in depreciation cost.

Costs of consumables
These include cost of fuel (including duty), chain oil, any herbicides and wetting agents used.

Operational costs
The cost for each operation is calculated by combining the labour cost, the cost of equipment and the cost of consumables. The cost per hectare is calculated by dividing total cost by the area managed. An example for clearing pine scrub is outlined in Table 4.

Note the time taken for an operation should include preparation work and access to the site (more remote sites and those with access problems will therefore be more expensive to manage).

Table 3: Examples of machinery costs. Note these costs are intended as a guide only.

Machinery	Current list price (excl VAT)	Expected life in years	Annual depreciation	Annual maintenance	Annual total	Usage (days/ year)	Cost per day
Chainsaw	£400.00	5	£80.00	£385.00	£465.00	55	£8.45
Clearing saw	£500.00	7	£71.00	£30.00	£101.00	8	£12.68
Tractor	£30,000.00	12	£2,500.00	£1,700.00	£4,200.00	67	£62.69
Trailer	£3,250.00	10	£325.00	£40.00	£365.00	55	£6.64
Flail	£2,000.00	10	£200.00	£75.00	£275.00	10	£27.50
Wood chipper	£11,000.00	8	£1,375.00	£225.00	£1,600.00	60	£26.67
Knapsack sprayer	£50.00	5	£10.00	£10.00	£20.00	5	£4.00
Boom sprayer	£1,900.00	10	£190.00	£150.00	£340.00	20	£17.00

Table 4: Hypothetical example of cost calculation for clearing 12 hectares of dense pine scrub.

	Amount	Unit cost (£)	Total cost (£)
Man days used	178.5	93.66	16,717.00
Equipment used (days)			
Tractor	24.0	63.00	1,512.00
Wood chipper	12.0	27.00	324.00
Trailer	12.0	6.00	72.00
Chainsaws	135.0	8.50	135.00
Total cost (equipment)			2,043.00
Consumables used			
Diesel	200.0	0.75	150.00
Petrol	200.0	0.70	140.00
Chain oil	50.0	3.00	150.00
Total cost (consumables)			**440.00**
Total cost			**19,200.00**
Cost per hectare			**1,600.00**

The following table gives operational costs of managing gorse, pine, birch and Rhododendron, based on real examples undertaken on ground with some limitations. The figures should only be used as a broad guide, as local circumstances (eg working conditions and labour costs) can cause considerable variation.

Table 5: Costs per hectare of selected heathland management operations.
Based on RSPB experience in Dorset, where a directly employed labour force is used, which is trained and certified for the equipment used. The labour and equipment costs are calculated as described above.

Operation	Team size	Equipment used	Team time	Cost
Gorse management Tree scrub management	4	3 x chainsaws, 500 l water bowser, PPE, Rabbit protection fencing	64	£4,700.00
Pine – dense cover, 20 years old	5	5 x chainsaws, 2 x tractor, wood-chipper, a 10 m3 trailer, PPE	26	£1,600.00
Pine – average about 20% cover, 15 years old	5	5 x chainsaws, 2 x tractor, wood-chipper, 10 m3 trailer, PPE	16	£995.00
Birch – average 10 years old, 80% cover	5	5 x chainsaws, 2 x tractor, wood-chipper, 10 m3 trailer, knapsack sprayer and PPE	28	£2,050.00
Humic litter removal	2	2 x tractors, 2 x 10 m3 trailers, brush and vacuum machine	15	£645.00
Rhododendron – dense, 20 years old, cut by hand	5	5 x chainsaws, 500 l water bowser, fire beaters, PPE	80	£4,700.00
Rhododendron – dense, 20 years old, by excavator	2	A 360° excavator with root rake. Arisings burnt on site	5	£1,100.00

The following tables provide further examples for a selection of costs incurred to manage scrub. These are intended for guidance only and it should be emphasised there may be considerable regional variation and change in prices due to inflation.

Table 6: Example unit and operational costs for gorse and mixed scrub clearance.

Years	Operation	Unit costs	Totals
1 - 3	Manual clearance (gorse) 0.5ha	0.2ha/day = 3 days x £300.00	£900.00
	Manual clearance (scrub) 0.6ha	0.2ha/day = 3 days x £300.00	£900.00
	Stump treatment 1ha	1ha/day = 1day x £250.00	£250.00
		Sub total:	£2,050.00
		Year 1 – 3 total = 3 x £2,050.00	£6,150.00
4 - 5	Manual clearance (scrub) 0.6ha	0.2ha/day = 3 days x £300.00	£900.00
	Stump treatment 1ha	1ha/day = 1day x £250.00	£250.00
		Sub total:	£1,150.00
		Year 4 – 5 total = 2 x £1,150.00	£2,300.00
	Additional cost		
2	Install bowser-fed trough	1 x £70.00	£70.00
1 - 5	**Total:**		**£8,520.00**
	Optional costs		
1 - 4	**Hand strim 5ha grassland**	0.2ha/day = 25 days x £300.00	£7,500.00
		Year 1 – 4 total = 4 x £7,500.00	£30,000.00

Table 7: Example work rates for pine, birch and Rhododendron clearance.

Scrub type days/ha	Habitat	Man days/ha
20 year old pine and birch (50% cover)	Heath	12
10 year old pine and birch (20% cover)	Mire	2
Up to 30 year old Rhododendron (50% cover)		30

Table 8: Example unit cost for Rhododendron clearance

Operation	Cost/ha
Manual clearance using chainsaws	Over £1,000.00
Follow-up chemical treatment to stumps and re–growth	£60.00–£65.00
Mechanical clearance including burning	Up to £1,000.00
Alternative chipping with tub-grinder	£80.00/hr hire
Mechanical clearance with forest flail mulcher	£550.00–£750.00

Table 9: Example fencing costs.

Livestock type	Area	Fencing	Costs
Ponies	11 ha	3 strand barb, field gates, stiles and fittings	£736.00 + VAT £600.00 labour
Goats		6 x 25m rolls	£40.00 ea
		Energiser and battery	£90.00
		1200m Rylock with 2 top strands	
		Shelter	£250.00
		Miscellaneous: Feed, Veterinary bills and animal dip	£125.00
		Husbandry	20 man days/year
Rabbit		Fencing	£2.50 - £5.00/m
Deer		Fencing (lowland)	£5.00/m
		Gengard portable 4 panels, each @ 2.4m x 1.2m	£55.00

Appendix 8.10 Grant opportunities

A number of grant sources are available for the conservation management of scrub. The main national grants are described here, but it should be remembered that specific grants are liable to review, change or replacement. However, it is likely that the same bodies will be offering these or replacement grants in the future, so should be contacted for the latest situation. In addition, there are a number of locally available grants provided by local authorities, national parks and statutory conservation agencies. Contact local authorities for information on what is available locally.

Environmentally Sensitive Area (ESA) scheme
The ESA scheme currently includes 22 areas in Britain. The scheme offers grants for 10-year agreements on land within the designated areas, to encourage management that maintains or enhances wildlife and landscape and the scheme is open to all farmers and landowners within the designated areas. Prescriptions are specific to each ESA, and payments rates vary depending on the tier of management that is adopted and range from £8 to £500 per hectare per annum.

Defra's Regional Rural Development Service Offices or the Defra website have full details of the schemes (see Appendix 8.11).

Countryside Stewardship Scheme (CSS) (operated in England only)
Countryside Stewardship funds work to protect, enhance, restore and recreate targeted landscapes, their wildlife habitats and historical features, and improve public access. It covers land in the wider countryside, out-with the ESAs. Ten-year agreements are offered for priority habitats, which are set at a county level. Fixed rate capital payments are made for restoration work (eg scrub clearance) and fencing. Tiered annual payments cover maintenance management including grazing. Special project payments (50% funded) are available where the standard payment options do not cover necessary works. Payments are also made for enhancing public access. Countryside Stewardship is operated by the RDS on behalf of Defra, and is open to those with long term (over ten years) tenure of the land.

Full details of the scheme are available from regional Defra Rural Development Service Offices or the Defra website (Appendix 8.11).

Countryside Premium Scheme (Scotland)
These are five-year agreements that combine farm and conservation grants along with the Habitats and Moorland Schemes. Applications are assessed after undertaking a croft/farm audit. This is a discretionary award that applies to all Scottish crofters outside ESAs, and is overseen by SOAEFD.

Tir Gofal (Wales)
This scheme aims to encourage agricultural practices that enhance and protect the landscape, culture and wildlife of Wales. It is managed by CCW. Prescriptions are similar to those in the CSS operating in England.

Organic Farming Scheme (OFS)
This is a five-year scheme providing financial support to farmers and landowners while they are converting their land over to organic management. They are paid £50 per hectare over the five years, plus lump sums that are paid annually. The Organic Conversion Information Service (OCIS) (telephone: 0117 922 7707) provides free help with options for profitable organic farming. Application packs and details are available from the Defra RDS office at Crewe (see Appendix 8.11)

Forestry Commission Grants
Outside of woodland, grants for scrub management are unlikely to be awarded unless involving the issue of felling licenses and would be reviewed on a case-by-case basis.

Wildspace!
English Nature distributes funds from the National Lottery New Opportunities Fund for work by local communities on Local Nature Reserves (LNRs). Up to £5 million is available until September 2006 for:

1. Capital projects.
2. Employing community liaison officers.
3. The purchase of new LNRs.

Reserves Enhancement Scheme (RES)
These are five-year schemes administered by English Nature. They are available to voluntary conservation organisations for the day-to-day management of their SSSI nature reserves in England.

Wildlife Enhancement Scheme
Management agreements are offered by English Nature for funding of capital works to enhance priority habitats on SSSIs.

Section 35 NNR Capital Grant Schemes
Administered by English Nature, this scheme applies to approved bodies involved in NNR management, but that are not eligible for the RES.

Volunteer Action Grant
English Nature runs the scheme, which helps fund NGOs to put volunteers in the field. The maximum payment is £1,000 per year.

Heritage Lottery Fund (HLF)
National Lottery funds targeting projects involving heritage are distributed via the HLF. The Fund's Strategic Plan for 1999-2002 has four main priorities: Heritage Conservation, National Heritage, Local Heritage, and Heritage Education and Access. Any organisation or individual may apply for an award for a project that meets the Fund's criteria, eg the project's importance to heritage, conservation benefits of the project, access benefits of the project, additional public benefits etc. The Fund considers both capital and revenue projects with a total cost of £5,000 and more.

Landfill Tax
The Landfill Tax Credit Scheme allows waste companies to withhold a proportion (20%) of their Landfill Tax liability to donate to worthy causes, such as community projects and projects that seek to minimise waste. Approximately 65% of these funds are available for waste- and recycling-related projects and 35% for community focused activities generally within 10 miles of licensed landfill site. Over £300 million has been made available to date. ENTRUST, a not-for-profit regulating company, oversees the scheme and can be contacted via www.entrust.org.uk

Management agreements
These can be agreed with the statutory conservation agencies for positive management of SSSIs, under CRoW. In Scotland similar agreements can be arranged with SNH.

EU LIFE funds
Funding from the EU for conservation is provided through the LIFE Nature fund. This is available for the conservation of natural habitats, and of wild fauna and flora within the Natura 2000 network. It is possible that LIFE Nature will cease to operate in the future as member states are required to cost the delivery of favourable condition of their Natura 2000 sites under Article 8 of the Habitats Directive. LIFE Environment currently provides funding for innovative and demonstration projects.

Appendix 8.11 Useful postal and website addresses

Government organisations

Countryside Agency
John Dower House
Crescent Place
Cheltenham
Gloucestershire
GL50 3RA
Tel: 01242 521381
Web: www.countryside.gov.uk

The Countryside Agency works to conserve and enhance the countryside by promoting social equity and economic opportunity for its inhabitants and providing everyone the opportunity to enjoy as a natural asset

Department for Environment, Food & Rural Affairs (Defra)
Nobel House
17 Smith Square
London
SW1P 3JR
Tel: 020 7238 6000
Web: www.defra.gov.uk

Defra aims to achieve sustainable development and use of natural resources, and a better quality of life for everyone, through economic prosperity, thriving rural communities and a countryside to be enjoyed by all.

Grants and schemes are administered by Defra's regional offices (RDS). The regional offices provide information on policy services, legislation and schemes which are the responsibility of the Department. Contact details for the various regional offices are listed below.

Defra Rural Development Service Offices (RDS)
Southwest
Block 3, Government Buildings
Burghill Road
Westbury-on-Trym
Bristol
BS10 6NJ
Tel: 0117 959 1000

Southeast
Government Buildings
Coley Park
Reading
RG1 6DT
Tel: 0118 958 1222

Eastern
Block B, Government Buildings
Brooklands Avenue
Cambridge
CB2 2DR
Tel: 01223 462762

East Midlands
Block 7, Government Buildings
Chalfont Drive
Nottingham
NG8 3SN
Tel: 0115 929 1191

Northwest
Electra Way
Crewe Business Park
Crewe
Cheshire
CW1 6GJ
Tel: 01270 754000

Agricola House, Unit 5
Cowper Road
Gilwilly Trading Estate
Penrith
Cumbria
CA11 9BN
Tel: 01768 865900

Yorkshire and Humber
Government Buildings
Otley Road
Lawnswood
Leeds
LS16 5QT
Tel: 0113 230 3750

Northeast
Government Buildings
Kenton Bar
Newcastle upon Tyne
NE5 3EW
Tel: 0191 214 1800

Environment Agency
Rio House
Waterside Drive
Aztec West
Almondsbury
Bristol
BS2 4UD
Tel: 01454 624400
Web: www.environment-agency.gov.uk

The Environment Agency is the leading public organisation for protecting and improving the environment in England and Wales, including all water bodies and inshore coastal waters.

Forestry Commission
231 Corstorphine Road
Edinburgh
EH12 7AT
Tel: 0131 334 0303
Web: www.forestry.gov.uk

The Forestry Commission is the government's department for the protection and expansion of Britain's woodlands and forests. It manages many sites on existing or former heathland, with opportunity for largescale heathland re-creation.

Joint Nature Conservation Committee (JNCC)
Monkstone House
City Road
Peterborough
PE1 1JY
Tel: 01733 562626
Web: www.jncc.gov.uk

JNCC is the wildlife adviser to the government, undertaking national and international conservation work on behalf of the three country agencies.

Statutory Organisations

Cadw: Welsh Historic Monuments
National Assembly for Wales
Cathays Park
Cardiff,
CF10 3NQ
Tel: 029 2050 0200
Web: www.cadw.wales.gov.uk

The statutory agency in Wales for the care and maintenance of the historic environment.

Countryside Council for Wales CCW)
Plas Penrhos
Flordd Penrhos
Bangor
Gwynedd
LL57 2LQ
Tel: 01248 385500
Web: www.ccw.org.uk

Along with other responsibilities CCW is the Welsh Office's adviser on nature conservation and the agency that manages the majority of National Nature Reserves in Wales.

English Heritage
Swindon
SN2 2YP
England
Tel: 01793 414600
Web: www.english-heritage.org.uk

The statutory agency in England for the care and maintenance of the historic environment.

English Nature (EN)
Northminster House
Peterborough
PE1 1UA
Tel: 01733 455100
Web: www.english-nature.org.uk

The Government's adviser on nature conservation and the agency that manages the majority of National Nature Reserves in England.

Environment and Heritage Service of Northern Ireland (EHSNI)
Calvert House
High Street
Belfast
Tel: 028 9025 1477
Web: www.ehsni.gov.uk

Amongst other responsibilities EHS is the agency that manages the majority of National Nature Reserves and historic heritage in Northern Ireland.

Environment and Heritage Service of Northern Ireland
See above

Historic Scotland
Longmore House
Salisbury Place
Edinburgh
EH9 1SH
Tel: 0131 668 8600
Web: www.historic-scotland.gov.uk

The statutory agency in Scotland for the care and maintenance of the historic environment.

Scottish Natural Heritage (SNH)
17 Hope Terrace
Edinburgh
EH9 2AS
Scotland
Tel: 0131 447 4784
Web: www.snh.org.uk

Along with other responsibilities SNH is the Scottish Office's adviser on nature conservation in Scotland and the agency that manages the majority of National Nature Reserves in Scotland.

Local Authorities
Details can be found in local telephone directories or the Internet.

Non-statutory voluntary organisations

British Dragonfly Society
Dr W H Wain (Secretary)
The Haywain
Hollywater Road
Bordon
Hampshire
GU35 0AD
e-mail: thewains@ukonline.co.uk
Web: www.dragonflysoc.org.uk

The BDS promotes the study and conservation of dragonflies in their natural habitat.

British Entomological and Natural History Society
c/o The Pelham-Clinton Building,
Dinton Pastures Country Park,
Davis Street,
Hurst,
Reading,
Berkshire
RG10 0TH
Web: www.benhs.org.uk

The society for amateur and professional entomologists, which promotes advancement in entomological research.

British Trust for Conservation Volunteers
36 St. Mary's Street
Wallingford
Oxfordshire
0X10 0EU
Tel: 01491 839766
Web: www.btcv.org

Is the UK's largest practical conservation charity, helping over 130,000 volunteers to undertake practical conservation tasks in a range of habitats.

Buglife (The Invertebrate Conservation Trust)
PECT
High Street,
Fletton
Peterborough
PE2 8DT
Tel: 01733 760881
Web: www.buglife.org.uk

The first organisation in Europe devoted to conserving all invertebrates and their habitats.

Butterfly Conservation
Manor Yard
East Lulworth
nr Wareham
Dorset
BH20 5QP
Tel: 01929 400209
Web: www.butterfly-conservation.org

Butterfly Conservation protects habitats for butterflies carries out practical conservation, research monitoring.

Floralocale
The Nature Conservation Bureau Ltd
36 Kingfisher Court
Hambridge Road
Newbury
RG14 5SJ
Tel: 01635 550380
Web: www.naturebureau.co.uk/pages/floraloc/homepage.html

Flora locale promotes and advances the conservation of native wild flora and associated biodiversity. See also Natural History Museum Post Codes Plant Data Base below.

Forum for the Application of Conservation Techniques (FACT)
English Nature
PO Box 25
Church Stretton
SY6 7WL
Tel: 01694 723101
John Bacon (co-ordinator)
Email: jbacon7586@aol.com
http://www.fact-group.org

English Nature,
Roughmoor,
Bishops Hull,
Taunton.
TA1 5AA.
Tel: 01823 283211
Tony Robinson (Information provider)
Email: tony.robinson@english-nature.org.uk

FACT is made up from 30 conservation organisations with the objective of working together to identify and encourage the uptake of best practice land management techniques in relation to the practical, economic and sustainable management of land for wildlife and nature conservation.

Grazing Animals Project (GAP)
The GAP Office
The Kiln, Waterside
Mather Road
Newark
Notts.
NG24 1WT
Tel: 01636 670095 (Answer machine if Co-ordinators not available)
Fax: 01636 670001
e-mail: gap@cix.co.uk
http://www.grazinganimalsproject.org

Established in 1997 in partnership with the FACT programme (see above). Over twenty organisations from the nature conservation, agriculture and livestock industries work together to co-ordinate and integrate efforts to remove practical constraints and deliver economically and environmentally sustainable grazing for biodiversity and the countryside.

GAP runs 'Nibblers' a discussion group for land managers using livestock for conservation grazing. For details and to sign-up contact the GAP office - see above.

Herpetological Conservation Trust
655a Christchurch Road
Boscombe
Bournemouth
Dorset
BH1 4AP
Tel: 01202 391319
Web: www.hcontrst.f9.co.uk

The HCT is a non-membership voluntary conservation organisation that manages sites for and promotes awareness of herpetofauna.

Plantlife
21 Elizabeth Street
London
SW1W 9RP
Tel: 020 7808 0100
Web: www.plantlife.org.uk

A national charity dedicated to conserving all plants in their natural habitats, with 22 reserves throughout the country.

Soil Association
Bristol House
40-56 Victoria St
Bristol
BS1 8BY
0117 929 0661
http://www.soilassociation.org.uk/

The Soil Association is an organic organisation that aims to research develop and promote sustainable relationships between the soil, plants, animals and the biosphere, in order to produce healthy food and other products while protecting and enhancing the environment.

The National Trust
36 Queen Anne's Gate
London
SW1H 9AS
Tel: 020 7222 9251
Web: www.nationaltrust.org.uk

The Trust owns nearly 250,000 ha of land throughout England, Wales and Northern Ireland.

The RSPB
The Lodge
Sandy
Bedfordshire
SG19 2DL
Tel: 01767 680551
Web: www.rspb.org.uk

The RSPB manages over 150 nature reserves throughout England, Wales, Scotland and Northern Ireland.

The Wildlife Trusts
The Kiln
Waterside
Mather Road
Newark
Nottinghamshire
NG24 1WT
Tel: 01636 677711
Web: www.wildlifetrust.org.uk

A countrywide partnership with a network of 47 local Wildlife Trusts, which combined, manage over 2,500 nature reserves.

Other useful Web addresses

British Mountaineering Council
http://www.thebmc.co.uk/

British Trust for Ornithology
www.bto.org

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

Conservation Management System (CMS) database:
www.CMSP.co.uk

Ecolots (free advertising service related to the sustainable management of land, trees and wildlife). A 'FACT' service.
www.ecolots.co.uk

Health and Safety Executive
www.hse.gov.uk

Her Majesty's Stationary Office (HMSO)
www.hmso.gov.uk/legis.htm
Website has useful down-loadable information for the latest acts of parliament and statutory legislations.

Lantra Trust (skills training)
www.lantra.co.uk

National Biodiversity Network
www.nbn.org.uk

Natural History Museum (Post Codes Plant Database)
http://www.nhm.ac.uk/science/projects/fff

Practical Solutions Handbook
Equipment, techniques and ideas for wildlife management (2nd edition)
www.practicalsolutionshandbook.info

Appendix 8.12 Health and safety

Scrub management work can carry significant risks and attendence to health and safety issues is of paramount importance. All scrub management and survey activity should be reviewed with regard to the health and safety of personnel and the public. It is essential to carryout a complete and thorough assessment of all likely risks to personnel and members of the public and to ensure this is reviewed at regular intervals in complience with all current legislation. Health and safety is covered by an array of legislation and regulation. The entries, references and publications listed below are a sample to raise awareness. Where there is any doubt contact the local Health and Safety Executive office.

Legislation and regulations
Health and Safety at Work Act 1974.
Food and Environmental Protection Act 1985.
Control of Pesticides Regulations (COPR) 1986.
Management of Health, Safety and Welfare at Work Regulations 1999.
Personal Protective Equipment at Work Regulations 1992.
Provision and Use of Work Equipment Regulations 1998.
Control of Substances Hazardous to Health Regulations (COSHH) 1999.

Safety information on pesticides and equipment.
(For fuller information on pesticides please refer to the *"Herbicide Handbook – Guidance on the use of herbicides on nature conservation sites" that accompanies this Handbook.* (English Nature 2003).

Working with Pesticides
Code of Practice for the Safe Use of Pesticides on Farms and Smallholdings Guidelines for the use of Herbicides on Weeds in or near Watercourses.

The above are available through Defra, Land Use Division, Nobel House,
17 Smith Square, London SW1P 3JR
Website: www.defra.gov.uk

UK Pesticide Guide 2003 (and annually) is available from BCPC Publications Sales, Bear Farm, Binfield, Bracknell, Berkshire RG42 5QE. Tel: 0118 934 2727.

Every drop counts: Think Water – Keep it clean is available from the Crop Protection Association.
Website: www.cropprotection.org.uk

Pesticides 2003 (and annually) is available from HMSO, The Stationary Office, 51 Nine Elms Lane, London SW8 5DR.
Website: www.thestationeryoffice.com

HSE Guidelines on chainsaws: INDG317 *Chainsaws at Work.*

Tractor Action: and other publications on the safe use of tractors and tractor-mounted machinery are available from the HSE and can be downloaded from the Internet. See below for contact details.

Information and training
Training is an essential part of overcoming risk. Training is a legal requirement for the use of some machinery and is strongly advisable for most scrub management operations.

Training in pesticides use, tractor and implement use, chainsaw and clearing saw use are required and may be obtained through:
Lantra Training, National Agricultural Centre, Stoneleigh, Kenilworth, Warwickshire CV8 2LG.
Tel: 01203 696996 for information on local ATB training centres.

National Proficiency Test Council, Stoneleigh, Kenilworth, Warwickshire CV8 2LG.
Tel: 01203 696553 or write for information about the requirements for national testing and other organisations which may offer training courses.

Information on the regulations governing pesticide use and other safety matters may be obtained from:
Health and Safety Executive (HSE), Information Services, Caerphilly Business Park, Caerphilly, Mid Glamorgan S3 7HQ. Telephone the HSE Infoline on 0541 545500 or visit www.hse.gov.uk

The BTCV runs training courses throughout the UK on a range of conservation techniques and equipment use, which cover health and safety issues. The British Trust for Conservation Volunteers (BTCV), 36 St Mary's Street, Wallingford OX10 0EU Tel: 01491 839766.

Agricultural colleges and other institutions also run courses.

Use of hazardous substances
The use of hazardous substances at work is mainly governed by COSHH and COPR (see above). There are four stages in preventing occupational health hazards and protecting workers, these are:

- The provision of instruction and information on occupational health hazards.
- Precautions and personal hygiene.
- Removal or substitution of an 'unhealthy' process, eg where a potentially toxic chemical is being used, it may be possible to substitute a less toxic material that will do the same job, segregation of processes so that only those immediately involved are in contact.
- Personal protection – being the last resort in employee protection.

Planning to minimise risks
Nature conservation sites can be potentially dangerous places in which to work, with areas of uneven ground, soft and boggy mires, deep pools and sharp vegetation. There are also risks from accidental fire, extremes of temperature, insect bites and diseases. The key to safe working on activities such as scrub management is careful planning and assessment. Some general rules can be outlined to assist this:

- A responsible and competent person should carry out a full risk assessment for each task. All staff and volunteers should be familiar with the assessment. This is a requirement under the Management of Health, Safety and Welfare at Work Regulations (1999).
- Under the same regulations, all staff and volunteers should be familiar with the hazards and risks and how to prevent or at least reduce them.
- Contractors should also be aware of the risk assessment for the activity and in some circumstances, it may be necessary to supervise them to ensure that the work is carried out safely.
- All persons intending to operate equipment must be trained to the appropriate level.
- Where there is public access, advance notice of the work should be given including an explanation of why it is being carried out. The work area and its surrounds should be temporarily closed to the public during operations.
- All staff and volunteers should be provided with the required personal protective equipment including protection from foul weather.
- An agreed procedure for emergency action should be established before entering the work area.
- An appropriate first aid kit should be available on-site containing the minimum required items for the number of staff/volunteers present.
- In addition to this general guidance, the following sections give specific guidance on common work situations. Any risks specific to a particular scrub management technique are described in Section 5.

Working alone
Working alone in hazardous or potentially hazardous situations should be avoided. The following precautions should be considered:

- Inform someone of your plans: where you are going and how long you expect to be. Give an indication of the time you expect to return and ensure that you inform them of your safe return.
- A mobile phone or CB radio should be carried and regular contact maintained with the work base or home.
- Hazardous tasks such as operating machinery should not be undertaken.
- Do not take any risks.

HSE have an information leaflet on the subject that can be viewed and/or downloaded from the www.hse.gov.uk/pubns/hazards.htm.

Working on or near water
Special considerations are needed when working near deep water:

- Avoid working near deep water if you cannot swim.
- Life jackets should be available for those required to work in deep water.
- Persons operating boats should be trained.
- Be aware of the likelihood of flooding, eg after periods of prolonged rainfall. Avoid working in areas at risk.
- Avoid steep or unstable ground adjacent to deep water.
- Do not enter the water if the bottom is not visible.

Risk from fire
Fires can be a particular risk, especially in the summer. Precautions should be taken to avoid starting a fire. Persons should not put themselves at risk by attempting to tackle a fire. All reasonable safety precautions should be considered when using a fire to burn brash or for other forms of management described in this Handbook:

- Always liaise with the local fire authority.
- Liaise with, and inform, neighbours.
- Ensure adequate emergency fire access to the site is provided and a fire plan is produced.
- Do not light a fire in very dry conditions or in unfavourable wind conditions.
- Do not light fires near vehicles or sources of flammable material.
- Ensure adequate fire protection is provided around the fire site, including bowsered water, fire beaters, and if deemed necessary create firebreaks.
- Never take risks by tackling a fire should it get out of control.

Infectious diseases
There is some risk from a number of infectious diseases that could be encountered when managing scrub.

Lyme disease.
This disease is transmitted to humans by a bite from an adult female of the hard-backed sheep tick. Not all ticks carry the bacteria and most tick bites do not therefore lead to infection. Risk of being bitten can be reduced by wearing close weave clothes that fully cover limbs, sturdy footwear and insect repellent, and by tucking trousers into boots etc, and by regular self-inspection.

Although the incidence of Lyme disease is still low in the UK, it is increasing. Most cases have been from the south west of England, but pockets of incidence also occur in the Pennines, the Lake District, Wales and the Welsh Marches, southwest England, the New Forest, Thetford Chase and the North and South Downs. It is possible that it could occur in every British county where the appropriate conditions exist. These conditions include rough grassland and mature heathland vegetation in warm moist climates.

There are several websites about Lyme disease, which can be found using a suitable search engine.

Leptospirosis (Weil's disease)

Weil's disease is the most serious form of an illness called leptospirosis. In the UK it is most commonly associated with rats, and is caused by bacteria found in some rats' urine. The bacteria can survive in freshwater for about four weeks. Infection occurs through contact with muddy water contaminated with infected rat urine. The bacteria enter the human body through cuts, grazes and sores, and the mucous membranes of the eyes, nose and mouth.

Rats are not commonly associated with water bodies; workers on urban sites may be at some risk, particularly in areas close to settlements, industrial areas or landfills. Rural areas, close to farmland where livestock are fed might also harbour rats.

For more information contact the Health and Safety Executive for a leaflet *Leptospirosis – are you at risk?* Also available from their website: www.hse.gov.uk/pubns/indg84.htm

Blue-green algae
Blue-green algae are natural inhabitants of many aquatic systems. In freshwater, they are found in suspension, attached to rocks and other surfaces at the bottom of shallow waters or along the edges of lakes and rivers.

For reasons not yet fully understood, bloom- and scum-forming blue-green algae can produce toxins. These toxins have caused the death of wild and domesticated animals in the UK. In humans, rashes may occur following skin contact. Illnesses have occurred when the algae have been ingested.

Further information can be obtained from the Environment Agency, Rio House, Waterside Drive, Aztec West, Almondsbury, Bristol BS2 4UD Tel: 01454 624400 or contact your Environment Agency regional office.

Appendix 8.13 Scientific names of species in text

Note: See also appendices 8.5.1 and 8.5.2 where species may be additionally listed

Plants. **Common name**	**Scientific name**	**Page**
Alder	*Alnus glutinosa*	4/11
Alder Buckthorn	*Frangula alnus*	4/49 7/17
Almond Willow	*Salix triandra*	4/179
Arctic Bearberry	*Arctostaphylos alpinus*	8/17
Arran Service-tree	*Sorbus pseudofennica*	4/151
Ash	*Fraxinus excelsior*	4/15
Ash-leaf Maple	*Acer negundo*	8/21
Aspen	*Populus tremula*	4/19
Atlantic Ivy	*Hedera helix subsp. Hibernica*	8/17
Atlas Cedar	*Cedrus atlantica*	8/21
Austrian Pine/Corsican Pine	*Pinus nigra*	8/21
Balm-leaved Figwort	*Scrophularia scorodonia*	2/10
Balm-of-Gilead	*Populus balsamifera x P. deltoides*	8/21
Balsam poplar	*Populus trichocarpa*	8/24
Baneberry	*Actaea spicata*	2/9
Barberry	*Berberis vulgaris*	8/17
Bastard Balm	*Melittis melissophyllum*	2/19
Bay	*Laurus nobilis*	8/21
Bay Willow	*Salix pentandra*	4/183
Bearberry	*Arctostaphylos uva-ursi*	8/17
Beech	*Fagus sylvatica*	4/23
Bell Heather	*Erica cinerea*	8/17
Bilberry	*Vaccinium myrtillus*	8/17
Billiards Bridewort	*Spirea alba x S. douglasii*	8/21
Birch spp	*Betula*	7/11,17
Bird Cherry	*Prunus padus*	4/59
Bithynian Vetch	*Vicea bithynica*	2/10
Black Alpine-sedge	*Carex atrata*	(?)
Black Currant	*Ribes nigrum*	4/67
Black Poplar hybrid	*Populus deltoides x P. nigra*	8/21
Black Poplar	*Populus nigra subsp. Betulifolia*	8/17
Blackthorn	*Prunus spinosa*	4/33 5/33
Bladderseed	*Physospermum cornubiensis*	2/10
Bloody Crane's Bill	*Geranium sanguineum*	2/8
Blue Heath	*Phyllodoce caerulea*	8/17
Bog Bilberry	Vaccinium uliginosum	4/4
Bog Myrtle	*Myrica gale*	2/4 4/6
Bog Rosemary	*Andromeda polifolia*	8/17
Bottle Sedge	*Carex rostrata*	(?)
Box	*Buxus sempervirens*	4/37
Box-leaved Honeysuckle	*Lonicera pileata*	8/21
Bracken	*Pteridium aquilinum*	4/4
Bramble	*Rubus fruticosus agg*	4/41 5/16

Common name	Scientific name	Page
Bridewort	*Spirea salicifolia*	8/12
Broad-leaved Cockspurthorn	*Crataegus persimilis*	8/21
Broad-leaved Osier	*Salix caprea x S. viminalis*	8/18
Broom	*Cytisus scoparius*	4/45
Buckthorn	*Rhamnus cathartica*	4/49 7/17
Bullate Cotoneaster	*Cotoneaster rehderi*	8/21
Burnet Rose	*Rosa pimpinellifolia*	4/143
Burnet Rose x Sherard's Downy-rose hybrid	*Rosa pimpinellifolia x R. sherardii*	8/18
Butterfly-bush	*Buddleja davidii*	4/53
Cappadocian Maple	*Acer cappadocicum*	8/21
Cedar-of-Lebanon	*Cedrus libani*	8/21
Cherry Laurel	*Prunus laurocerasus*	4/57
Cherry Plum	*Prunus cerasifera*	4/33
Chiltern Gentian	*Gentiana germanica*	2/9
Chinese Bramble	*Rubus tricolor*	8/21
Chinese Quince	*Chaenomeles speciosa*	8/21
Cloudberry	*Rubus chamaemorus*	8/58
Coastal Redwood	*Sequoia sempivirens*	8/21
Common Cow-wheat	*Melampyrum pratense*	2/9
Common Ivy	*Hedera helix subsp. Helix*	8/18
Common Juniper	*Juniperus communis subsp communis*	4/115 7/25,29
Common Marsh-bedstraw	*Galium palustre*	(?)
Common Meadow-rue	*Thalictrum flavum*	(?)
Common Nettle	*Urtica dioica*	(?)
Common Ragwort	*Senecio jacobaea*	2/11 5/56
Common Reed	*Phragmites australis*	8/12
Common Rock-rose	*Heliamthemum nummularium*	8/18
Common Whitebeam	*Sorbus aria*	4/175
Common Whitebeam x Rowan hybrid	*Sorbus aria x S.aucuparia*	8/18
Confused Bridewort	*Spirea douglasii x S. salicifolia*	8/21
Coral Root Orchid	*Corallorhiza trifida*	8/58
Cornelian Cherry	*Cornus mas*	4/71
Cornish Elm	*Ulmus stricta*	4/79
Cornish Heath	*Erica vagans*	8/18
Corsican Pine	*Pinus nigra*	4/127
Cowberry	*Vaccinium vitis-idaea*	8/18
Crab Apple	*Malus sylvestris*	4/4
Crack Willow hybrid	*Salix alba x S. fragilis*	8/21
Crack Willow	*Salix fragilis*	8/21
Cranberry	*Vaccinium oxycoccos*	8/18
Creeping Willow	*Salix repens*	4/187
Cross-leaved Heath	*Erica tetralix*	8/18
Crowberry	*Empetrum nigrum*	2/1
Crowberry subspecies	*Empetrum nigrum subsp. Hermaphroditum*	8/18
Dark-leaved Willow	*Salix myrsinifolia*	7/33 4/183
Dark-leaved x Tea-leaved Willow hybrid	*Salix myrsinifolia x S. phylicifolia*	4/183
Dark-red Helleborine	*Epipactis atrorubens*	2/19
Darwin's Barberry	*Berberis Darwinii*	8/21
Deodar	*Cedrus deodara*	8/21
Dewberry	*Rubus caesius*	4/41
Diapensia	*Diapensia lapponica*	8/18
Diel's Cotoneaster	*Cotoneaster dielsianus*	8/21
Dog Rose	*Rosa canina*	4/143
Dog Rose x Harsh Downy-rose hybrid	*Rosa canina x R. tomentosa*	8/18

Common name	Scientific name	Page
Dog Rose x Sherard's Downy-rose hybrid	*Rosa canina x R. sherardii*	8/18
Dog Rose x Short-styled Field-rose hybrid	*Rosa canina x R. stylosa*	8/18
Dog Rose x Sweet Briar hybrid	*Rosa canina x R. rubiginosa*	8/18
Dog x Round-leaved Dog-rose hybrid	*Rosa canina x R. obtusifolia*	8/18
Dog's Mercury	*Mercurialis perennis*	(?)
Dogwood	*Cornus sanguinea*	4/71 7/7
Dorset Heath	*Erica ciliaris*	8/18
Douglas Fir	*Pseudotsuga menziesii*	8/21
Downy Birch	*Betula pubescens*	4/29
Downy Currant	*Ribes spicatum*	4/67
Downy Willow	*Salix lapponum*	4/187 7/33
Dutch Elm	*Ulmus x hollandica*	4/79
Dutch Rose	*Rosa 'Hollandica'*	4/143
Dwarf Birch	*Betula nana*	4/5 4/27
Dwarf Broom	*Cytisus S.s.maritimus*	4/45
Dwarf Cherry	*Prunus cerasus*	4/33
Dwarf Gorse	*Ulex minor*	4/87
Dwarf Juniper	*Juniperus communis subsp nana*	4/115
Dwarf Willow	*Salix herbacea*	4/5, 4/187
Dyers Greenweed	*Genista tinctoria*	8/18
Dyer's Greenwood subspecies	*Genista tinctoria subsp. Littoralis*	8/18
Eared Birch	*Betula pendula x B. pubescens*	8/18
Eared Osier	*Salix aurita x S. caprea x S. viminalis*	8/18
Eared Willow	*Salix aurita*	7/33 4/183
Eared x Creeping Willow hybrid	*Salix aurita x S. repens*	4/183
Eared x Goat Willow hybrid	*Salix aurita x S. caprea*	4/179,183
Eared x Grey Willow hybrid	*Salix aurita x S. cinerea*	4/179,183
Early Gentian	*Gentianella anglica*	7/37
Elder	*Sambucus nigra*	4/75
Elongated Sedge	*Carex elongata*	2/9
English Elm	*Ulmus procera*	4/79
Escallonia	*Escallonia macrantha*	8/21
European Larch	*Larix deciduosa*	8/21
European Silver-fir	*Abies alba*	8/21
European Violet-willow	*Salix daphnoides*	8/21
Evergreen Oak	*Quercus ilex*	4/123
Evergreen Spindle	*Euonymus japonicus*	8/21
False Brome	*Brachypodium pinnatum*	(?)
False Virginia-creeper	*Parthenocissus inserta*	8/21
False-acacia	*Robinia pseudoacacia*	8/21
Fibrous Tussock Sedge	*Carex appropinquata*	2/9
Field Maple	*Acer campestre*	4/83
Field Rose	*Rosa arvensis*	4/143
Field x Dog Rose hybrid	*Rosa arvensis x R. canina*	8/19
Fig	*Ficus carica*	8/21
Fine Osier	*Salix cinerea x S. purpurea x S. viminalis*	8/19
Fingered Sedge	*Carex digitata*	2/9
Firethorn	*Pyracantha coccinea*	8/21
Flowering Currant	*Ribes sanguinium*	8/21
Fly Honeysuckle	*Lonicera xylosteum*	8/21
Forsythia	*Forsythia suspensa x F. viridissima*	8/21
Franchet's Cotoneaster	*Cotoneaster franchetii*	8/22
Fungus spp	*Cylindrocladium*	8/59
Garden Lavender	*Lavendula angustifolia x L. latifolia*	8/22

Common name	Scientific name	Page
Garden Privet	*Ligustrum ovalifolium*	4/135
Giant Fir	*Abies grandis*	8/22
Glaucous Dog-rose	*Rosa caesia subsp. Glauca*	8/19
Goat Willow	*Salix caprea*	4/179
Goat Willow subspecies	*Salix caprea subsp. Sphacelata*	8/19
Goat x Grey Willow hybrid	*Salix caprea x S. cinerea*	8/19
Goldilocks Aster	*Aster linosyris*	2/8
Gooseberry	*Ribes uva-crispa*	4/67
Gorse	*Ulex europaeus*	4/87 5/37 7/3,7
Gorse x Western Gorse hybrid	*Ulex europaeus x U. gallii*	2/1
Grape-vine	*Vitis vinifera*	8/22
Great Wood-rush	*Lazula sylvatica*	8/60
Greater Broomrape	*Orobancha rapum-genistae*	2/10
Greater Tussock Sedge	*Carex peniculata*	8/60
Green-flowered Helleborine	*Epipactis phyllanthes*	2/9
Green-leaved Willow	*Salix purpurea x S. viminalis*	8/19
Grey Alder	*Alnus incana*	8/22
Grey Poplar	*Populus alba x P. tremula*	8/22
Grey Willow	*Salix cinerea*	4/1,3,4,179
Grey Willow subspecies	*Salix cinerea subsp. Cinerea*	4/179 8/18,19
Grey Willow subspecies	*Salix cinerea subsp. Oleifolia*	8/11 8/19
Guelder Rose	*Viburnum opulus*	4/91
Hairy Dog-rose	*Rosa caesia subsp. Caesia*	8/19
Hairy Dog-rose x Dog Rose hybrid	*Rosa caesia x R. canina*	8/19
Hairy Greenwood	*Genista pilos*	8/19
Hairy Mock-orange	*Philadelphus x virginalis*	8/22
Hairy-fruited Broom	*Cytisus striatus*	8/60
Hare's-tail Cotton Sedge	*Eriophorium vaginatum*	8/60
Harsh Downy-rose	*Rosa tomentosa*	8/19
Hawthorn	*Crataegus monogyna*	4/95 5/52
Hazel	*Corylus avellana*	4/99
Heather	*Calluna vulgaris*	4/4
Hedge Barberry	*Berberis Darwinii x B. empetrifolia*	8/22
Hedge Bindweed	*Calystegia sepium*	2/9
Hedge Veronica	*Hebe elliptica x H. speciosa*	8/22
Highclere Holly	*Ilex aquifolium x I. Perado*	8/22
Himalayan Cotoneaster	*Cotoneaster simonsii*	4/63
Himalayan Honeysuckle	*Leycesteria formosa*	8/22
Hoary Rock-rose	*Helianthemum oelandicum*	8/19
Hogweed	*Heracleum sphondylium*	2/11
Holly	*Ilex aquifolium*	4/103
Hollyberry Cotoneaster	*Cotoneaster bullatus*	4/63
Holme Willow	*Salix caprea x S. cinerea x S. viminalis*	8/22
Honeysuckle	*Lonicera periclymenum*	4/107
Hop	*Humulus lupulus*	8/19
Hornbeam	*Carpinus betulus*	8/19
Horse-Chestnut	*Aesculus hippocastanum*	8/22
Horseshoe Vetch	*Hippocrepis comosa*	7/37
Huntingdon Elm	*Ulmus glabra x U. minor*	8/19
Hybrid Coralberry	*Symphoricarpus microphyllus x S. orbiculatus*	8/22
Hybrid Larch	*Larix deciduosa x L. kaempferi*	8/22
Intermediate Bridewort	*Spirea alba x S. salicifolia*	8/22
Irish Heath	*Erica erigena*	8/19
Italian Alder	*Alnus cordata*	8/22

Common name	Scientific name	Page
Italian Lords-and-Ladies	*Arum italicum*	2/9
Ivy	*Hedera helix*	4/111
Ivy Broomrape	*Orobancha hederae*	2/9
Japanese Honeysuckle	*Lonicera japonica*	8/22
Japanese Larch	*Larix kaempferi*	8/22
Japanese Red-cedar	*Cryptomeria japonica*	8/22
Japanese Rose	*Rosa rugosa*	8/22
Jersey Elm	*Ulmus sarniensis*	4/79
Juneberry	*Amelanchier lamarckii*	8/22
Koromiko	*Hebe salicifolia*	8/22
Laburnum	*Laburnum anagyroides*	8/22
Lady Orchid	*Orchis purpurea*	2/9
Larch	*Larix spp*	4/127
Large-leaved Lime	*Tilia platyphyllos*	8/22
Late Cotoneaster	*Cotoneaster lacteus*	8/22
Laurel-leaved Willow	*Salix cinerea x S. phylicifolia*	8/19
Laurustinus	*Viburnum tinus*	8/22
Lawson's Cypress	*Chamaecyparis lawsoniana*	8/22
Lesser Hairy Brome	*Bromus benekenii*	2/9
Leyland Cypress	*Chamaecyparis nootkatensis x Cupressus*	8/22
Lilac	*Syringa vulgaris*	8/22
Lime	*Tilia cordata x T. platyphyllos*	8/22
Lodgepole Pine	*Pinus contorta*	8/22
Lombardy Poplars	*Populus nigra (fastigiate cultivars)*	8/22
London Plane	*Platinus x hispanica*	8/22
Mackay's Heath	*Erica mackaiana*	8/19
Man Orchid	*Acerus anthropophorum*	2/9
Many-flowered Rose	*Rosa multiflora*	8/22
Maple spp	*Acer*	8/61
Maritime Juniper	*Juniperus communis subsp hemisphaerica*	8/19
Maritime Pine	*Pinus pinasta*	4/127
Marsh Fern	*Thelypteris palustris*	2/10
Marsh Pea	*Lathyrus palustris*	2/9
Medlar	*Mespilus germanica*	8/22
Mezereon	*Daphne mezereum*	8/19
Midland Hawthorn	*Crataegus laevigata*	4/95
Midland Hawthorn x Hawthorn hybrid	*Crataegus laevigata x C. monogyna*	8/19
Mock-orange	*Philadelphus coronarius*	8/22
Monkey Puzzle	*Araucaria araucana*	8/22
Monterey Cypress	*Cypressus macrocarpa*	8/22
Monterey Pine	*Pinus radiata*	8/22
Moss spp	*Hylocomium splendens*	8/61
Moss spp	*Racomitrium heterostichum*	8/61
Moss spp	*Sphagnidae: Sphagnales*	8/61
Mountain Avens	*Dryas octopetala*	8/61
Mountain Currant	*Ribes alpinum*	4/67
Mountain Willow	*Salix arbuscula*	4/187 7/33
Narrow-leaved Lungwort	*Pulmonaria longifolia*	2/10
Narrow-lipped Helleborine	*Epipactis leptochila*	2/9
Needle Whin	*Genista anglica*	8/19
Net-leaved Willow	*Salix reticulata*	4/187 7/33
New Zealand Broadleaf	*Griselinia littoralis*	8/23
New Zealand Holly	*Oleria macrodonta*	8/23
Noble Fir	*Abies procera*	8/23

Common name	Scientific name	Page
Norway Maple	*Acer platanoides*	8/23
Norway Spruce	*Picea abies*	8/23
Olive Willow	*Salix eleagnos*	8/23
Orange-ball-tree	*Buddleja globosa*	8/23
Oregon-grape	*Mahonia aquifolium*	8/23
Osier	*Salix viminalis*	4/179
Pears	*Pyrus communis sens.*	8/23
Pedunculate Oak	*Quercus robur*	4/119
Perfoliate Honeysuckle	*Lonicera caprifolium*	8/23
Persian Ivy	*Hedera colchica*	8/23
Petty Whin	*Genisat anglica*	8/19
Plot's Elm	*Ulmus plotii*	4/79
Plymouth Pear	*Pyrus cordata*	8/19
Portugal Laurel	*Prunus lusitanica*	8/23
Prickly Heath	*Gaultheria mucronata*	4/3
Prostrate Broom	*Cytisus scoparius subsp. Maritimus*	8/19
Purple Gromwell	*Lithospermum purpurocoeruleum*	2/9
Purple Moor-grass	*Molinia caerulea*	4/2
Purple Willow	Salix purpurea	4/183
Raspberry	*Rubus idaeus*	4/41
Rauli	*Nothofagus nervosa*	8/23
Red Currant	*Ribes rubrum*	4/67
Red Horse-chestnut	*Aesculus carnea*	8/23
Red Oak	*Quercus rubra*	8/23
Red-berried Elder	*Sambucus racemosa*	8/23
Red-leaved Rose	*Rosa ferruginea*	8/23
Red-osier Dogwood	*Cornus sericea*	8/23
Rhododendron	*Rhododendron ponticum*	4/139 7/5
Roble	*Nothofagus obliqua*	8/23
Rock Sea Lavender	*Limonium binervosum*	8/62
Rose spp	*Rosa*	4/143
Rosemary	*Rosmarinus officinalis*	8/23
Rose-of-Sharon	*Hypericum calycinum*	8/23
Round-leaved Dog-rose	*Rosa obtusifolia*	8/19
Round-leaved Wintergreen	*Pyrola rotundifolia*	2/10
Rowan	*Sorbus aucuparia*	4/147
Rowan/Whitebeam spp	*Sorbus angelica*	4/151
Rowan/Whitebeam spp	*Sorbus arranensis*	4/151
Rowan/Whitebeam spp	*Sorbus bristoliensis*	4/151
Rowan/Whitebeam spp	*Sorbus devoniensis*	8/20
Rowan/Whitebeam spp	*Sorbus eminens*	4/151
Rowan/Whitebeam spp	*Sorbus hibernica*	4/151
Rowan/Whitebeam spp	*Sorbus lancastriensis*	4/151
Rowan/Whitebeam spp	*Sorbus leptophylla*	4/151
Rowan/Whitebeam spp	*Sorbus leyana*	4/151
Rowan/Whitebeam spp	*Sorbus minima*	4/151
Rowan/Whitebeam spp	*Sorbus porrigentiformis*	4/151
Rowan/Whitebeam spp	*Sorbus rupicola*	4/151
Rowan/Whitebeam spp	*Sorbus subcuneata*	8/20
Rowan/Whitebeam spp	*Sorbus vexans*	8/20
Rowan/Whitebeam spp	*Sorbus wilmottiana*	4/151
Rowan/Whitebeam spp	*Sorbus latifolia*	8/24
Rum Cherry	*Prunus serotina*	8/23
Salmonberry	*Rubus spectabilis*	8/23

Common name	Scientific name	Page
Sawara Cypress	*Chamaecyparis pisifera*	8/23
Scot's Pine	*Pinus sylvestris*	4/127 7/11,23
Sea Purslane	*Halimione portulacoides*	4/6
Sea-buckthorn	*Hippophae rhamnoides*	4/153 7/19,23
Service-tree	*Sorbus domestica*	8/23
Sessile Oak	*Quercus petraea*	4/119
Sessile x Pedunculate Oak hybrid	*Quercus petraea x Q. robur*	8/20
Shallon	*Gaultheria shallon*	4/3
Sharp-stipuled Willow	*Salix triandra x S. viminalis*	8/23
Sherard's Downy-rose	*Rosa sherardii*	8/20
Shiny-leaved Willow	*Salix fragilis x S. pentandra*	8/23
Short-styled Field-rose	*Rosa stylosa*	8/20
Shrub Ragwort	*Brachyglottis 'Sunshine' (Senecio greyii)*	8/23
Shrubby Cinquefoil	*Potentilla fruticosa*	8/23
Shrubby Osier	*Salix aurita x S. viminalis*	8/20
Shrubby Sea-blite	*Sueda vera*	4/5
Silky-leaved Osier	*Salix cinerea x S. viminalis*	8/20
Silver Birch	*Betula pendula*	4/29
Silver Maple	*Acer saccharinum*	8/23
Sitka Spruce	*Picea sitchensis*	8/23
Small Cranberry	*Vaccinium microcarpum*	8/20
Small-flowered Sweet-briar	*Rosa micrantha*	8/20
Small-leaved Cotoneaster	*Cotoneaster microphyllus agg.*	4/63
Small-leaved Lime	*Tillia cordata*	8/20
Small-leaved Sweet-briar	*Rosa agrestis*	2/10
Smooth-leaved Elm	*Ulmus minor*	4/79
Snowberry	*Symphoricarpus alba*	4/157
Soft Downy-rose	*Rosa mollis*	8/20
Soft Downy-rose x Burnet Rose hybrid	*Rosa mollis x R. pimpinellifolia*	8/20
Spanish Broom	*Spartium junceum*	4/45
Spanish Gorse	*Genista hispanica*	8/23
Spindle	*Euonymus europaeus*	2/21 4/159
Spiny Restharrow	*Ononis spinosa*	8/20
Spotted-laurel	*Aucuba japonica*	8/23
Spreading Bellflower	*Campanula patula*	2/9
Spreading Cotoneaster	*Cotoneaster divaricatus*	8/23
Spring Squill	*Scillia verna*	(?)
Spruce spp	*Picea abies*	4/127
Spurge-laurel	*Daphne laureola*	8/23
St Daebeoc's Heath	*Daboecia cantabrica*	8/20
Stag's-horn Sumach	*Rhus typhina*	8/23
Steeple Bush	*Spirea douglasii*	8/23
Stern's Cotoneaster	*Cotoneaster sternianus*	8/23
Stinking Hellebore	*Helleborus foetidus*	2/9
Stinking Tutsan	*Hypericum hircinum*	8/24
Strawberry Tree	*Arbutus unedo*	8/20
Suffolk Lungwort	*Pulmonaria obscura*	2/10
Swedish Whitebeam	*Sorbus intermedia*	8/24
Sweet Chestnut	*Castanea sativa*	8/24
Sweet-briar	*Rosa rubiginosa*	4/143
Sycamore	*Acer pseudoplatanus*	4/163
Tall Tutsan	*Hypericum androsaemum x H. hircinum*	8/24
Tamarisk	*Tamarix gallica*	8/24
Tea-leaved Willow	*Salix phylicifolia*	4/183

Common name	Scientific name	Page
Teaplants	*Lycium agg.*	8/23
Thistle spp	*Cirsium spp*	(?)
Thrift	*Armeria maritima*	8/14
Thumberg's Barberry	*Berberis Thunbergii*	8/24
Trailing Azalea	*Loiseleuria procumbens*	8/20
Traveller's-joy	*Clematis vitalba*	4/167
Tree Cotoneaster	*Cotoneaster frigidus*	8/24
Tree Lupin	*Lupinus arboreus*	8/24
Tree-of-heaven	*Ailanthus altissima*	8/24
Turkey Oak	*Quercus cerris*	4/123
Tutsan	*Hypericum androsaemum*	8/20
Upright Brome	*Bromus erectus*	(?)
Virginia-creeper	*Parthenocissus quinquefolia*	8/24
Wall Cotoneaster	*Cotoneaster horizontalis*	4/63
Walnut	*Juglans regia*	8/24
Waterer's Cotoneaster	*Cotoneaster frigidus x C. salicifolius*	8/24
Wavy-hair Grass	*Deschampsia flexuosa*	(?)
Wayfaring Tree	*Viburnum lantana*	4/171
Weeping Willow	*Salix alba x S. babylonica*	8/24
Wellingtonia	*Sequoiadendron giganteum*	8/24
Western Balsam-poplar	*Populus trichocarpa*	8/24
Western Gorse	*Ulex gallii*	4/87
Western Hemlock-spruce	*Tsuga heterophylla*	8/24
Western Red-cedar	*Thuja plicata*	8/24
Weymouth Pine	*Pinus strobus*	8/24
White Dogwood	*Cornus alba*	8/24
White Poplar	*Populus alba*	4/131
White Rock-rose	*Heliamthemum apenninum*	8/20
White Willow	*Salix alba*	8/24
Whitebeams	*Sorbus angelica*	4/2 8/20
Whitebeams	*Sorbus croceocarpa*	8/24
Whortle-leaved Willow	*Salix myrsinites*	4/187 7/33
Wild Angelica	*Angelica sylvestris*	(?)
Wild Cherry	*Prunus avium*	4/59
Wild Cotoneaster	*Cotoneaster cambricus*	4/5
Wild Plum	*Prunus domestica*	4/33
Wild Plum x Blackthorn hybrid	*Prunus domestica x P. spinosa*	8/20
Wild Privet	*Ligustrum vulgare*	4/135 7/7
Wild Service-tree	*Sorbus torminalis*	8/20
Willow spp	*Salix*	7/17
Willow-leaved Cotoneaster	*Cotoneaster salicifolius*	4/63
Wilson's Honeysuckle	*Lonicera nitida*	8/24
Wood-sorrel	*Oxalis acetosella*	8/10
Woolly Willow	*Salix lanata*	4/187 7/33
Wych Elm	*Ulmus glabra*	4/79
Wych x Plot's Elm hybrid	*Ulmus glabra x U. Plotii*	8/20
Yellow Azalea	*Rhododendron luteum*	8/24
Yellow Pimpernel	*Lysimachia nemorum*	(?)
Yellow Vetch	*Vicea lutea*	2/10
Yew	*Taxus baccata*	4/2,191
Yorkshire Fog	*Holcus lanata*	4/3

Insects. **Common name**	**Scientific name**	**5/8** **Page**
A hoverfly	*Doros profuges*	2/13
A jewel beetle sp.	Coleoptera: *Buprestidae*	2/13
A leaf beetle	Coleoptera: *nitidulus*	2/13
A weevil	*Melanapion minimum*	2/13
Adonis Blue	*Lysanda bellargus*	7/37
Ants	Hymenoptera: *Formicidae*	2/11
Aphids	Hemiptera: *Aphidomorpha*	2/11
Barberry Carpet moth	*Pareulype berberata*	2/13
Barred Tooth-striped Moth	*Trisateles emortualis*	2/13
Bees	Hymenoptera: *Apoidea*	6/4
Beetles	*Coleoptera*	2/12
Black Hairstreak	*Satyrium pruni*	2/13
The Brimstone	*Gonepteryx rhamni*	4/49
Brown Hairstreak	*Thecla betulae*	4/16
Butterflies	Lepidoptera: *Rhopalocera*	6/5
Chalkhill Blue	*Lysandra coridon*	7/29
Chequered Skipper	*Heteropterus morpheus*	2/13
Cousin German	*Paradiarsia sobrina*	2/13
Dark Bordered Beauty	*Epione vespertaria*	4/19
Dark bush cricket	*Pholidoptera griseoaptera*	2/14
Dingy Mocha	*Cyclophora pendularia*	2/13
Dingy Skipper	*Erynnis tages*	7/37
Duke of Burgundy Fritillary	*Hamearis lucina*	2/12,14
Dusky cockroach	*Ectobius lapponicus*	2/14
Gall midges	*Cecidomyiidae*	2/11
Great Green Bush Cricket	*Tettigonia viridissima*	2/14
Hazel Pot Beetle	*Cryptocephalus coryli*	2/13
Holly Blue	*Calastrina argiolus*	4/104
Juniper Carpet	*Thera juniperata*	2/13
Leaf miners	Various insect orders	2/12
Lesne's Earwig	*Forficula lesnei*	2/14
Micro moths	*Eriocraniid* micro moths	6/5
Mites	*Acari*	2/11
Moths	*Lepidoptera*	6/5
Narrow-headed Ant	*Formica exsecta*	2/12,14
New Forest Cicada	*Cicadetta montana*	2/13
Oak Bush Cricket	*Meconema thalassinum*	2/14
Pale shining brown moth	*Polia bombycina*	2/14
Pearl-bordered Fritillary	*Boloria euphrosyne*	2/13
Scarce Vapourer moth	*Orgyia recens*	2/14
Short-winged Earwig	*Apterygida media*	2/14
Small Eggar moth	*Eriogaster lanestris*	2/14
Small Ermine moths	*Yponomeuta padella*	2/14
Solitary wasps	Hymenoptera: *Aculeata*	2/12
Southern Wood Ant	*Formica rufibarbis*	2/13
Speckled Bush Cricket	*Leptophyes punctatissima*	2/14
Spiders	*Arachnidae spp*	2/12
Square-spotted Clay	*Xestia rhomboidea*	2/13
Ten-spotted Pot Beetle	*Cryptocephalus decemmaculatus*	2/13
True bugs	Hemiptera: *Heteroptera*	2/11
Two-winged flies	*Diptera*	2/11
Wasps	*Hymenoptera*	2/11,12
White-letter hairstreak	*Strymonidia w-album*	4/79
White-spotted Pinion	*Cosmia diffinis*	2/13

Reptiles and amphibians. **Common name**	**Scientific name**	**5/8** **Page**
Adder	*Vipera berus*	2/15 6/7
Common Lizard	*Lacerta vivipara*	2/15 6/7
Common Toad	*Bufo bufo*	2/15 6/8
Grass Snake	*Natrix natrix*	2/16 6/7
Great Crested Newt	*Triturus cristatus*	2/16 6/8
Natterjack Toad	*Bufo calamita*	2/16 5/8 6/8
Palmate Newt	*Triturus helveticus*	2/16 6/8
Sand Lizard	*Lacerta agilis*	2/16 5/8 6/7
Slow Worm	*Anguis fragilis*	2/16 6/7
Smooth Newt	*Triturus vulgaris*	2/16 6/8
Smooth Snake	*Coronella austriaca*	2/16 6/7

Birds. **Common name**	**Scientific name**	**5/8** **Page**
Black Grouse	*Tetrao tetrix*	2/18 4/128 5/8
Blackbird	*Turdus merula*	2/17
Blackcap	*Sylvia atricapilla*	2/19
Bullfinch	*Pyrhulla pyhulla*	2/18
Capercaillie	*Tetrao urogallus*	4/128 5/20
Cetti's Warbler	*Cettia cetti*	2/19
Chiffchaff	*Phylloscopus collybita*	2/19
Chough	*Pyrrhocorax pyrrhocorax*	4/7
Cirl Bunting	*Emberiza cirlus*	2/18
Corn Bunting	*Emberiza calandra*	2/18
Dartford Warbler	*Sylvia undata*	2/19 4/3
Dunnock	*Prunella modularis*	2/17
Fieldfare	*Turdus pilaris*	2/19
Firecrest	*Regulus ignicapillus*	2/19
Garden Warbler	*Sylvia borin*	2/18,19
Goldcrest	*Regulus regulus*	2/19
Goldfinch	*Carduelis carduelis*	4/11 4/30
Grasshopper Warbler	*Locustella naevia*	2/18
Great Spotted Woodpecker	*Dendrocopos major*	4/11
Greenfinch	*Carduelis chloris*	2/19
Lesser Whitethroat	*Sylvia curruca*	2/19
Linnet	*Carduelis cannabina*	2/18
Long-eared Owl	*Asio otus*	2/19
Marsh Warbler	*Acrocephalus palustris*	2/18
Merlin	*Falco columbarius*	2/19
Nightingale	*Luscinia megarhynchos*	2/2,19
Nightjar	*Caprimulgus europaeus*	2/18
Red Grouse	*Lagopus lagopus scoticus*	7/28
Redpoll	*Acanthis flammea*	4/11 4/30
Redwing	*Turdus iliacus*	2/19
Reed Bunting	*Emberiza schoeniclus*	2/18
Sedge Warbler	*Acrocephalus schoenobaenus*	2/19
Siskin	*Carduelis spinus*	4/11,30
Song Thrush	*Turdus philomelos*	2/18
Stonechat	*Saxicola torquata*	2/19 4/3,4
Stone curlew	*Burhinus oedicnemus*	5/8
Tree pipit	*Anthus trivialis*	4/4
Tree Sparrow	*Passer montanus*	2/18

Turtle Dove	*Streptopelia turtur*	2/18
Whinchat	Saxicola rubetra	4/4
Whitethroat	*Sylvia communis*	2/17
Willow Tit	*Parus montanus*	2/18 4/11,30
Willow Warbler	*Phyloscopus*	2/19
Wren	*Troglodytes troglodytes*	2/17
Yellowhammer	*Emberiza citrinella*	2/17 2/18

Mammals. **Common name**	**Scientific name**	**5/8** **Page**
Badger	*Meles meles*	2/20 4/3
Bank Vole	*Clethrionomys glareolus*	2/20 5/8
Bat spp	*Chiroptera*	2/20
Deer spp	*Cervidae*	2/20
Dormouse	*Muscardinus avellanarius*	2/20 4/42
Fallow Deer	*Dama dama*	4/107
Fox	*Vulpes vulpes*	2/20 5/8
Grey Squirrel	*Neosciurus carolinensis*	5/20
Harvest Mouse	*Micromis minutus*	5/8
Hedgehog	*Erinaceus europaeus*	2/20
Mountain Hare	*Lepus timidus*	8/31
Muntjac	*Muntiacus reevesi*	2/20
Otter	*Lutra lutra*	2/20
Pine martin	*Martes martes*	4/128
Rabbit	*Oryctolagus cuniculus*	2/20 4/3 5/5,20
Red Deer	*Cervus elaphus*	5/19
Red squirrel	*Sciurus vulgaris*	4/128
Roe Deer	*Capreolus capreolus*	5/19
Shrew	*Soricidae*	5/8
Sika Deer	*Cervus nippon*	5/19
Wild boar	*Sus scrofa*	5/5
Wood Mouse	*Apodemus sylvaticus*	2/20

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Glossary

An explanation of some words and terms used in the Handbook.

Acidic. Soils or water with a pH less than seven.
Adjuvant. *(Includes: acidifier, adjuvants, anti-transpirant, cationic surfactant, drift retardant, extender, mineral oil, non-ionic surfactants, penetrant, spreaders, sticker, vegetable oil, wetters).* A substance other than water which enhances the effectiveness of a pesticide with which it is mixed. Although not classed as pesticides themselves, only currently authorised adjuvants may be legally used. An authorised adjuvant has an 'Adjuvant number'.
Adventitious roots. Roots that develop at the base of nodes where stems contact the soil, allowing plants to spread vegetatively.
Alginate. A gelatinous substance derived from seaweed. It is mixed with water and used as a fire retardant for controlled heather burns.
Amphibian. A cold-blooded vertebrate that lays eggs in water, has aquatic larvae that breathe using gills, but develop into adults with lungs.
Arisings. By-products of management, especially from clearing and cutting work.
ATV (All Terrain Vehicle). Vehicles usually with wide tyres or tracks resulting in low ground pressure and thereby able to access wet or boggy terrain that other vehciles cannot. Vehicles often have a low centre of gravity and have all wheels driven to improve traction.
Back-burning. Burning into the wind to give a hot, controlled burn of vegetation.
Beaufort scale. A numerical scale indicating the force of the wind from 0 (calm) to 12 (hurricane).
Bill-hook. A flat metal blade, rectangular in shape, with a hook-tip, attached to a short handle.
Biodiversity. The variety of plant and animal life in a particular habitat; or in general.
Biodiversity Action Plan (BAP). A targeted plan developed to guide the enhancement of the conservation status of a particular species or habitat.
Biomass. The weight or volume of organisms in a given population or inhabiting a given area.
Bobcat. Small compact loader with a front mounted bucket/blade. They have wide low-pressure tyres or rubber tracks. Very manouverable in small areas and those with a low centre of gravity can access difficult terrain.
Boom sprayer. A wide arm with a series of nozzles, connected to a tank with diluted pesticide and mounted on the rear of a tractor or ATV.
Bowsaw. A course toothed hand saw with varying length blade mounted on a metal bow-shape frame.
Brash. The arisings from tree or scrub management other than timber, sometimes referred to as lop-and-top.
Browse. To feed on the leaves and shoots of especially woody plants. Sometimes used as a noun to describe the vegetation browsed.
Bryophyte. Moss or liverwort: any of the botanical division Bryophyta.
Calcareous grassland. A semi-arid unimproved grassland that has developed over chalk or limestone based soils.
Cambium layer. The layer of cells in woody plants that produce tissue for the vessels that carry water and foods, bringing about an increase in girth. The cambium also produces bark and callus tissue after injury.
Centre for Ecology and Hydrology (CEH). Carries out research, survey, and monitoring in terrestrial and freshwater environments.
Chainsaw. A hand-held, two-stroke petrol engine with a metal guide bar along which, at high speed, runs a toothed cutting chain.
Chainsaw root-cutter. A root cutting chainsaw has modifications to saw attachments (chain, guide bar, chain cover) to enable use in ground to cut through near-surface roots of small shrubs and stumps on appropriate soils.
Clearing saw. A toothed, circular steel blade, driven by a small two-stroke petrol engine, carried with the aid of a body harness. The blade is attached to the end of a long drive shaft.
Climax community or vegetation. Stable natural vegetation community that develops under prevailing soil and climatic conditions without human intervention.
Coppice. To cut trees or scrub to encourage regeneration from the stumps, usually of woody plants.
Countryside Agency (CA). Is the statutory agency working to improve the countryside and quality of life for the people that live in it.
Countryside Council for Wales (CCW). The statutory organisation responsible for looking after nature conservation in Wales.
Countryside Information System (CIS). Is a software package that allows the user to view and analyse spatial data relating to the countryside of Great Britain and Northern Ireland. A wide range of datasets are available, based on both census and sample surveys. A number of datasets from CS2000 and previous Countryside Surveys are available in CIS format.
Dam. Mother of young livestock.

Deposition. Laying down of material by natural processes, such as that transported by wind, water or natural decay.

Domin scale. A scale of abundance used to estimate vegetation cover. The scale is from 1 to 10, where 1 = up to 4 individuals and 10 is 91-100% (see Goldsmith (1991) for details.

Dwarf shrub. Low-growing usually woody shrubs comprising mostly ericaceous species and gorses.

Ecological unit. The wider surrounding related ecosystem(s), usually considered when evaluating a site within for nature conservation.

Edaphic. Of the soil, or influenced by the soil.

Endemic. A plant or animal species that is restricted to a particular area.

English Nature (EN). The statutory organisation responsible for looking after nature conservation in England.

Environment and Heritage Service of Northern Ireland (EHSNI). The statutory organisation responsible for looking after nature conservation in Northern Ireland.

Epiphyte. A plant growing on another plant but using it only for support and not for food.

EU Priority Habitats. A rare or threatened habitat identified for priority action and protection under the 1992 EU Habitats Directive.

Flail. A machine that mulches scrub using hinged cutters or chains acting vertically on a high speed rotating cylinder. (See also swipe).

Forest grinder/mulcher. A heavy-duty machine that uses fixed or retractable teeth, or swinging hammers, acting vertically and mounted spirally on a high-speed rotating cylinder.

Fragmentation. The breaking up of large areas of contiguous habitat into smaller units, usually by human development: roads, housing, agriculture or forestry.

Genus. A category used in the classification of organisms that consists of a number of similar or closely related species.

Livestock Unit (LSU). Method of describing different stock types and age groups based on their energy requirements. Standard ratios are used, commonly based on one livestock unit equalling one Friesan dairy cow.

Habitat. A characteristic environment in which an organism lives.

Herbaceous plant. A plant with little permanent woody tissue. The aerial parts die back after the growing season.

Herbicide. Any chemical approved specifically for the purpose of killing or controlling the growth of any 'weed' or other target plant species.

Herbivore. An animal that eats living plant tissue.

Humus layer. The partially decomposed dead plant material that forms the surface layer in the soil.

Hydrology. The dynamics of water.

Japanese Paper Pot (JPP) or Eco pot. Rigid thick paper pot used to grow seedlings in nursery conditions. They are biodegradable.

Joint Nature Conservation Committee. The JNCC is the UK Government's wildlife adviser, undertaking national and **(JNCC)** international conservation work on behalf of the three country nature conservation agencies.

Lanceolate. A leaf shaped like a lance-head, tapering at each end.

Lateral shoots. Side shoots growing from the main branches of a shrub.

Leguminous. A member of the pea family producing protein rich seeds (pod) called a legume. Some members are able to fix nitrogen in the soil and help maintain soil fertility.

Linkage. The points on the rear of a tractor used to attach machinery (i.e. three point linkage).

Litter. An accumulation of dead, organic matter, derived mainly from plants.

Long-handled lopper. Large jawed blades, attached to long handles. They cut in either a scissor or anvil action.

Long-handled slasher. A flat metal blade, rectangular in shape, with a hook-tip, attached to a long handle.

Marsh-mat. A portable base made of metal or wood interlocking sheets that distribute the weight of heavy machinery travelling across boggy terrain, minimising damage.

Mesolithic period. The middle period of the Stone Age, from about 10,000 BC to 4,000 BC, but starting rather later in Britain: about 8,000 BC.

Micro-climate. The climate of a specific place within a wider environment.

Micro-habitat. The smallest unit of habitat that has its own environmental or community characteristics.

Micron ULVA. A lightweight hand-held herbicide applicator for spraying large areas using small amounts of herbicide (ULVA = Ultra Low Volume Applicator).

Montane scrub. A climax community of woody plants that inhabit the area immediately above the tree line in mountain areas.

Mosaic. A mix or patchwork of vegetation types, ages or structures within a habitat.

Mycorrhizal. The symbiotic association between the mycelium of a fungus and the roots of certain plant species.

Myxomatosis. A highly infectious, fatal viral disease affecting Rabbits.

National Vegetation Classification (NVC). The standardised method used to describe vegetation communities in Britain, classifying vegetation communities by their species composition.

Naturalness. The extent to which a habitat is uninfluenced by human activity.

Niche. A set of ecological conditions which provides a species with what it needs.

Nutrient. Substances needed for the nourishment of organisms, including plants.

Nutrification. Enrichment of the soil by phosphates and

nitrates, especially that caused by atmospheric pollution.
Nymph. An immature form of some insects, such as dragonflies, similar to the adult but with undeveloped wings and undeveloped sex organs.
Oceanic climate. Climate affected and influenced by oceanic temperatures.
Panicle. A loose branching cluster of flowers, often seen in members of the grass family such as oats.
Pastoralism. Farming with livestock, based around extensive agricultural land use.
Pedestrian mower. Small to medium sized walk behind petrol mower, either hand pushed or self-propelled and guided by the operator. Those used for managing scrub, rides and glades will be rotary. Glades can also be cut using a mower with reciprocating blades.
pH. A scale of 14 points indicating the degree of acidity or alkalinity of water or soil, with 7 as neutral.
Photosynthesis. Generation of plant nutrients by the synthesis of organic compounds from carbon dioxide and water, using light energy absorbed by chlorophyll.
Pinnae. The series of small leaflets on the leaf of a plant or fern.
Pinnate. A leaf with leaflets on either side of the leaf-stalk.
Pioneer. The early growth stage of heather (or gorse), occurring between 1-5 years.
Poaching. The trampling usually of wet turf that exposes bare soil or substrate, usually by animals, eg livestock.
Power Take Off (PTO). The drive mechanism on tractors used to power and turn machinery.
Priority species. An organism of priority conservation concern listed in the UK Biodiversity Action Plan.
Raceme. A flower cluster with separate flowers attached by short stalks at equal distances along the stem.
Rank. Thick, coarse vegetation, usually the result of nutrification or a lack of management.
Reciprocating mower. A pair of parallel blades mounted horizontally which cut in a side to side motion.
Red Data Book. Lists endangered species under different degrees of threat.
Rehabilitation. Returning a habitat to a former state – synonymous with restoration.
Reptile. A cold-blooded, usually egg-laying, vertebrate with scaled skin that breathes using lungs.
Restoration. Returning a habitat to a previous state – synonymous with rehabilitation.
Rhizome. The underground runner (adapted root) of certain plants. It is a means of vegetative spread. In bracken, it also stores energy as starch.
Ring barking. The process of killing a tree in situ by cutting through the bark into the heartwood, thus preventing the flow of sap. Broadleaved trees often re-sprout from below the cut.
Rotoburier. see Stone burier.
Scarify. Disturb or loosen the soil surface to create a seedbed, often using hand rakes, chains or harrows.
Scottish Natural Heritage (SNH). The statutory organisation responsible for looking after nature conservation in Scotland
Scrub. Collective term for young trees and shrubs.
Seedbank. The accumulated viable seeds in the soil, which may germinate if exposed to light, warmth and moisture.
Senescence. Deterioration with age. The latter stages of life in a plant, characterised by the inability to repair or re-grow tissue. Also used to describe the end of season slowing in growth.
Seral. A complete succession of plant communities, leading to the climax community. A sere is composed of a series of different plant communities that change with time, known as seral stages or seral communities.
Sinuous. A waved or winding shape.
Site evaluation. Assessment of the interest and value of a site, including ecological, cultural, historical, recreational and health and safety aspects. An early stage in management planning.
Site of Special Scientific Interest (SSSI). A conservation designation awarded to a site for its biological or geological interest.
Special Area of Conservation (SAC). Designated as part of the EU Habitats and Birds Directive, to form a network of protected sites across the EU called "Natura 2000".
Special Protection Area (SPA). Part of the EC Directive on the Conservation of Wild Birds and "Natura 2000", to protect the habitats of migratory and threatened birds.
Species richness. The diversity of species in an area or habitat.
Stand. An area of vegetation with similar species and structural composition.
Statutory Country Conservation Agency. Encompasses English Nature (EN), Scottish Natural Heritage (SNH), Countryside Council for Wales (CCW) and the Environment and Heritage Service of Northern Ireland (EHSNI).
Stoloniferous. Producing stolons, or surface runners by which certain plants spread.
Stoneburier. A machine like a rotovator, with L shaped blades on a rotating cyclinder, but with the rotation against the direction of travel and a sifting grid used to bury stones, vegetation or litter
Stool. The stump of a tree or shrub cut back to ground level: often multi-stemmed, from which coppice re–growth takes place.
Stump grinder. A pedestrian guided petrol or diesel powered machine that uses toughed teeth on a revolving disc.
Succession. The natural replacement of one vegetation type by another.
Sward. An area of grass or other low vegetation.
Swipe/bush hog/rotary blade. A heavy-duty

horizontally acting rotary mower, using chains or blades. Large models are multi-bladed. Swipes have additional hinged knife blade attached to the end of the rigid blade. Stumps are normally left undamaged and give rise to regrowths.

Systemic. Spreading through the tissues of a plant, especially from leaf to roots.

Tilth. The condition of the soil, including its texture, structure and consistency; especially after cultivation.

Topography. The shape of the land surface.

Transpiration. The release of water through the leaves of plants.

Turf. The surface layer of soil containing the roots. Verb describes the process of lifting grass or heath turves. This reveals bare ground for re-colonisation.

Umbel. Umbrella-like flower head, with stalks of equal length springing from one point, as in carrot.

Weed wipe. Herbicide application equipment which uses a herbicide soaked wipe-head, that draws chemical from an integral reservoir. The wipe-head is drawn over or wiped against target weed plants, directly applying herbicide to stems and foliage. There are hand-held, ATV or tractor mounted versions. Requires a height difference between target plants and surrounding vegetation. There is no herbicide 'drift' with this technique.

Feedback Form

The Handbook Production Team on behalf of FACT hope that the Scrub Management Handbook will be a useful practical aid. We realise that users may wish to feed back comments to us on the material or how it is presented. Please do this below.

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John Bacon, FACT, on behalf of the SMH Production Team. July 2003.

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