

2 Definition and classification

2.1 Definition of scrub

The nature of scrub communities in the Britain has led to difficulties in defining the limits of what is meant by ‘scrub’. Many scrub communities in the Britain can be considered as seral stages in the succession from herbaceous communities to woodland. Scrub may occur as part of primary successions on screes, cliffs and quarries, but is more widely encountered as part of secondary succession after the abandonment of arable land or the relaxation or cessation of grazing on grassland or heathland. In places, succession of scrub to woodland may be arrested, for example as a result of exposure or altitude, or in places where seeds of tree species are absent or scarce.

A robust definition of scrub therefore has to include not only characteristics of the scrub vegetation itself, but also thresholds that separate it from preceding herbaceous communities and the woodland that may develop from it.

2.1.1 Scrub characteristics

Most definitions of scrub describe it as vegetation dominated by shrubs or bushes (e.g. Tansley 1939). However, the distinction between shrubs and trees is somewhat arbitrary. The height and growth form of woody species is commonly used to separate shrubs from trees. The definition of scrub given by Barkmann (1990) is therefore typical:

‘vegetation 0.5 – 5 (-10) m high,
consisting of woody plants with many stems.’

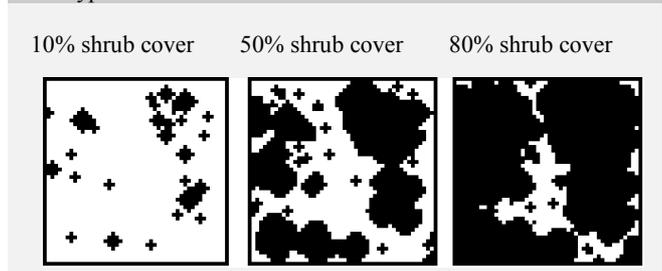
However, such a definition would include the early stages of regrowth after coppicing in established woodland, a vegetation type probably better considered with other woodland vegetation. The low, dense, stiff branching growth form of living shrubs is noted in some definitions, although height is more widely used to separate shrubs from trees. Separation of woody species (phanerophytes) using Raunkiaer’s life form classification has been suggested (Tansley 1939). Such an approach also has its limitations. Some species, best considered as small trees, are classified with many shrubs as microphanerophytes (buds held at 2-8m above the ground), whilst several species of dwarf shrub are classified as nanophanerophytes (buds at 0.25-2m), but would not be considered as scrub species (e.g. petty whin *Genista anglica*, western gorse *Ulex gallii*).

2.1.2 Distinction from herbaceous communities

Most definitions of scrub limit it to stands ‘dominated’ by shrub species. Accordingly, Ward (1974) defines scrub as ‘extending from the stage at which the area covered by woody plants exceeds that covered by grassland’. Similarly, many land cover classifications use a threshold of 50% canopy cover by shrub species (e.g. ITE Countryside Survey, National Countryside Monitoring Scheme, Northern Ireland Countryside Survey), although some schemes use lower thresholds. An example is the

monitoring scheme used for Environmentally Sensitive Areas (ESAs) which uses three categories of scrub, scattered scrub with grassland dominant (shrub cover 10-50%), scattered scrub with scrub dominant (shrub cover 50-80%) and dense scrub (shrub cover 80-100%) (Wyatt *et al.* 1994).

Figure 2.1 Illustrative 0.25 ha stands showing threshold levels of shrub cover used in the ESA Monitoring Scheme definition of scrub types.



2.1.3 Distinction from woodland

The distinction between scrub and woodland vegetation is less clear. Most schemes use the criteria of canopy height and/or the canopy cover of tree species. Thus, Ward (1974) defined the upper limit of scrub as the point ‘when woody plants exceed 7 m in height and are composed mainly of tree species’. Current land cover classifications used in the UK differ in their means of distinguishing between scrub and woodland. These differences relate to survey methods adopted.

- ITE Countryside Survey (field survey)
Stands greater than 5 m high are classified as woodland if >25% cover by tree species.
- National Countryside Monitoring Scheme (air photo)
Stands greater than 5 m tall are classified as woodland if >50% cover by tree species.
- National Parks Monitoring Scheme (air photo)
Scrub has <20% tree cover, tree species less than 3.5 m high, scrub species may be higher.

2.1.4 Definition adopted in this report

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

The definition excludes dwarf shrub heaths (dominated by ericaceous shrubs, crowberry *Empetrum nigrum*, dwarf gorse *Ulex minor*, etc.), planted stands of young trees and coppice stump regrowth less than 5m high.

2.2 Classification of scrub

2.2.1 Criteria for classifying scrub

2.2.1.1 Floristics

The most widely used schemes for the description of European vegetation use floristics as a means of classifying stands. Procedures for classifying vegetation developed by Braun-Blanquet and Tuxen, known as the Zurich-Montpellier School, have been widely used in continental Europe and Ireland since the 1920s. These methods place vegetation units in a hierarchical system of associations, alliances, orders and classes. Character species are identified for each level, based on their ecological amplitude and fidelity to particular units. The large amount of data collected from across Europe using such methods is currently being standardised into a single scheme, the European Vegetation Survey (Mucina 1997).

Such phytosociological techniques were not widely adopted in the UK, ecologists tending to focus on the mechanisms determining vegetation composition rather than extensive description and inventory. The value of setting ecological studies into their appropriate context was recognised in the surveys of Scottish mountain vegetation in the 1950s. This factor, combined with the need for a standard system of classification of the British vegetation in order to select sites for nature conservation, led to the National Vegetation Classification (NVC), commissioned by the Nature Conservancy Council in the 1970s.

2.2.1.2 Dominant canopy species

Prior to publication of the NVC, and in the absence of a systematic classification of vegetation within the UK based on floristics, scrub types were defined on the basis of the dominant canopy shrub species (e.g. Ward 1974, Ratcliffe 1977). This means of distinguishing scrub types is still widely used by site managers for management plans. The CORINE Biotopes Project Habitat Classification (Anon 1991) also describes several scrub types according to dominant shrub species.

2.2.1.3 Physiognomy

Classifications of scrub type that rely on differences in canopy structure and texture (e.g. Barkmann 1990) have several advantages over schemes using floristics. Scrub stands can be classified without the need for extensive inventory of plant species. In addition, the use of hierarchical schemes based on floristics for the classification of species-poor scrub, such as thickets dominated by one shrub species, is impossible because of the absence of potential character species. Perhaps more importantly, structural schemes may be more appropriate for describing the value of different scrub types for animals, as they better describe the micro-environmental conditions within the scrub stand for example, microclimate or the presence of particular plant structures. Such factors, rather than the presence of particular plant species, are likely to be more important determinants of the distribution of bird and invertebrate communities in scrub.

2.2.1.4 Successional status and age structure

Scrub occurs as a climax community in Britain above the altitudinal limit of woodland vegetation or in other situations where exposure or edaphic conditions limit tree growth. In the subalpine zone, shrubs and stunted trees occur together forming a scrub woodland at the tree line. At higher altitudes, in the alpine zone, low scrub vegetation composed of dwarf and prostrate shrubs occurs (MacKenzie 1997). In exposed situations, such as on cliff tops, trees may never grow beyond the scrub canopy and persist as stunted individuals because of the exposed conditions.

Similarly, scrub communities may be maintained by edaphic conditions, for example on shallow soils associated with inland rock exposures.

In spite of the occurrence of climax scrub in certain situations, most scrub in Britain is seral. Tansley (1939) used the term 'woodland scrub' to describe dynamic seral stages in the succession of herbaceous communities to woodland. Several factors may limit the development of 'seral' scrub towards woodland, for example, heavy grazing or a paucity of sources of seed of tree species in the vicinity. Such scrub stands are described as 'thicket scrub' by Tansley (1939), and are often found on abandoned arable land. In places, grazing may even reverse the course of succession and promote the development of scrub and eventually grassland communities. Moss (1913) describes such 'retrogressive scrub' stands in the Peak District.

2.2.1.5 Vertical canopy structure

Related to the age structure of scrub is its vertical canopy structure. This characteristic is of particular importance at the edge of scrub stands. For example, nightingales *Luscinia megarhynchos* benefit from the low sucker growth found at the edge of blackthorn *Prunus spinosa* scrub (Fuller *et al.* 1999). Much of the botanical value of seral scrub habitats is associated with the tall herb vegetation occurring along the edges, the so-called 'saum' vegetation (see Figure 2.2 for definition). Management regimes often result in sharp boundaries between scrub and herbaceous vegetation, either as a result of stock fencing or where stands of scrub have been cleared. The shrub-dominated 'mantel' vegetation (Figure 2.2) may be absent from woodland edges for similar reasons. Where such sharp boundaries occur, the characteristic 'saum' and 'mantel' communities, which have high conservation value, are missing.

2.2.1.6 Horizontal spatial structure

The nature conservation value of many scrub types is derived from their occurrence in a mosaic of other vegetation types. Therefore, stands may be classified according to their spatial arrangement in relation to other habitats. This may consist of two elements, quantification of scrub cover, and description of spatial arrangement. Several land cover classifications define categories of scrub cover in relation to a background mosaic of herbaceous vegetation. For example, the ESA monitoring scheme defines categories of scattered scrub according to the percentage cover of grassland (see Figure 2.1). Scrub patches may be distributed randomly within herbaceous vegetation, or exhibit clumping as a result of vegetative spread (e.g. dogwood *Cornus sanguinea*) or local deposition of seeds in bird droppings below roost trees. Linear bands of scrub occur along ecotone boundaries, for example between grassland and woodland, or along the drier margins of swamps.

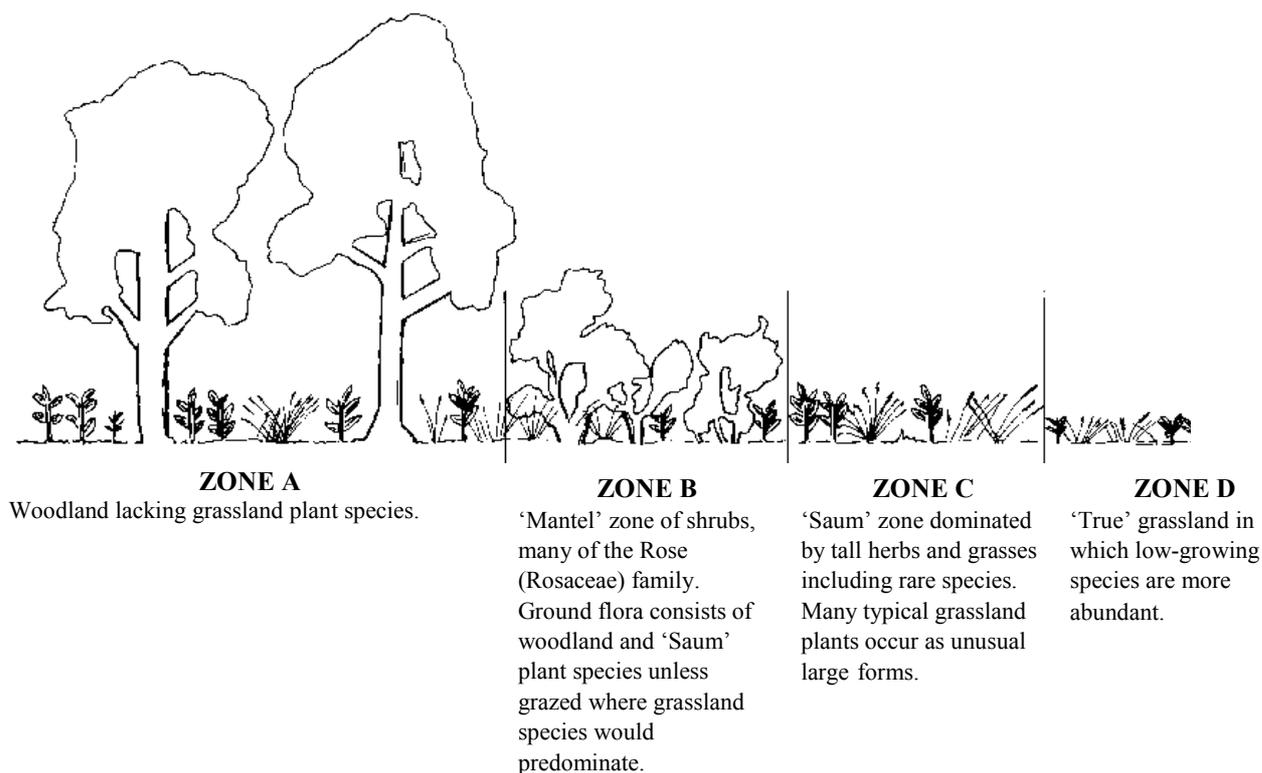


Figure 2.2 The woodland-grassland ecotone, showing characteristics of the 'saum' and 'mantel' zones (reproduced from Crofts & Jefferson 1999 with permission of English Nature & The Wildlife Trusts).

2.2.2 Current classifications and their limitations

2.2.2.1 Floristic and related classifications

Until the publication of the National Vegetation Classification, there had been no systematic description of the variation in scrub vegetation present in Britain. Classifications based on botanical composition had been developed for Scottish mountain vegetation (Poore & McVean 1957, McVean & Ratcliffe 1962). In the lowlands, scrub types had been defined according to soil type and the dominant species of tree and shrub (Ward 1974, Ratcliffe 1977). Peterken (1981), in his classification of British woodland types, described several types of seral scrub. The emphasis in Peterken's classification was on scrub as a precursor to different types of woodland. The resulting scrub types are similar to those of Ward (1974).

National Vegetation Classification

The method adopted by the NVC involved computational analysis of floristic data from around 31,000 stands of homogenous vegetation. The floristic data consisted of the abundance of species of vascular plant, bryophyte and macrolichen in samples varying in size according to vegetation type. The communities described in the NVC correspond to vegetation units of similar level to the associations defined in European phytosociology.

In the UK, statutory nature conservation agencies, conservation NGOs and local authorities have almost universally adopted the NVC as a means of describing vegetation. A review of the coverage of the NVC within the UK has recently been completed (Rodwell *et al.* 1998), and the need for description of further communities identified. Allocation of NVC communities within the hierarchical scheme of the European Vegetation Survey has been carried out (Rodwell 1997).

The NVC describes 5 scrub and two 'underscrub' communities, although no definition of scrub is given (Rodwell 1991a). Table 2.1 shows scrub and some associated vegetation types described in the NVC, and their corresponding positions in the European Vegetation Survey classification.

One of the key limitations of the NVC for nature conservation purposes, is that it is a classification of data from plots of homogenous vegetation. The value of scrub habitats is often dependent on their position in a mosaic of other vegetation types. Scrubby vegetation and scattered shrubs occur in many grassland, heath, mire and other NVC vegetation types. Similarly, several woodland NVC types have scrubby variants in situations where altitude or exposure limit tree growth. A classification of scrub types which takes account of horizontal spatial structure and canopy architecture is needed for conservation purposes.

Habitats Directive and Natura 2000

With the increase in EU legislation on nature conservation, the need for a standard scheme for describing European habitats has become clear. The Habitats Directive identified habitats of conservation importance within the European Union. Special Areas of Conservation (SACs), forming the so-called Natura 2000 network, are being designated to conserve these priority habitats. Annex I of the Habitats Directive used the hierarchical classification of European habitats developed by the CORINE Biotopes project. This has been modified and expanded in recent years to reflect conservation priorities and take account of the accession of Austria, Finland and Sweden to the EU (Anon 1996).

The relationship between NVC communities and habitats listed in the EU Habitats Directive is shown in Table 2.2.

UK Biodiversity Action Plan

The UK Biodiversity Action Plan process involves the preparation of action plans for threatened species and habitats. Twenty seven 'Broad Habitats' have been defined (17 terrestrial and freshwater, 10 coastal and marine), into which all habitats found in the UK

can be placed (Anon 1995, Anon 1998-9). The Broad Habitats form a comprehensive framework for monitoring of changes in the UK environment and, as far as possible, are compatible with other widely-used habitat and land cover classifications. Within each Broad Habitat, a number of 'Priority Habitats' have been identified, using the following criteria:

- Habitats for which the UK has international obligations
- Habitats which are threatened or at risk
- Habitats which may be functionally critical
- Habitats which are important for priority species

Priority Habitats represent distinct management units within the landscape. As such, they are defined at a larger spatial scale than NVC communities, and can consequently take account of vegetation mosaics including scrub

Scrub vegetation occurs in a number of Broad and Priority Habitats and there is not always a simple relationship between NVC communities and BAP habitats. The general relationship is illustrated in Table 2.2.

2.2.2.2 Structural classifications

A classification of European scrub and woodland communities based on vegetation structure and texture has been proposed by Barkmann (1990). This classification uses a hierarchical approach, the main criteria separating scrub types being:

- photoperiodicity of the dominant shrub species
- leaf size and leaf form of the dominant shrub species
- presence/absence of thorns or spines
- presence and nature of understorey vegetation

Such structural classifications have not been widely used, but might provide a useful ecological framework for describing the faunal interest of scrub vegetation. The classification is illustrated in Table 2.3 with reference to scrub types found in the UK. At present, there is little information on the fauna of different scrub types in the UK, so it is difficult to determine the value of such classifications. Classification involving architectural complexity of the shrub species, especially under different management regimes, may prove particularly useful for invertebrate and bird communities.

2.2.2.3 Land cover classifications

Various land cover classifications are currently in use in the UK. These include international, national and regional schemes, together with schemes covering designated areas, such as those used in National Parks and ESAs. The classifications differ in their treatment of scrub vegetation, depending on the methods and aims of the scheme in question (Wyatt *et al.* 1994). A comparison of treatment of scrub within these schemes is given in Table 2.4. The schemes also differ in their precision with regard to identifying scrub vegetation, depending on whether data are collected through satellite, aerial photo or field survey.

Table 2.1 Scrub and associated herbaceous woodland fringe vegetation, showing position of NVC vegetation types in the hierarchical European Vegetation Survey scheme (after Rodwell *et al.* 1998). Names of provisional new NVC communities given in footnotes.

Class	Order	Alliance	NVC communities	Notes
Juncetea	maritimi	Glauco-Puccinellietalia		
		Armerion maritimae	SM14, SM21, SM25	Scrubby vegetation on upper fringes of salt marshes
Galio-Urticetea		Lamio albi-Chenopodietalia boni-henrici		
		Aegopodium podagrariae	new ^{1,2}	Sunny or semi-shaded woodland margins and clearings
		Galio-Alliarion	OV24, OV25, new ³	Thermophilous communities on fertile woodland margins
Epilobietea	angustifolii	Atropetalia		
		Carici pil.-Epilobion ang.	OV27	Woodland margins and clearings on base-poor soils
		Atropion bellae-donnae	new ⁴	Woodland margins and clearings on base-rich soils
Scheuchzerio-Caricetea	fuscae	Caricetalia davallianae		
		Caricion davallianae	SD13, SD14, SD15	Dune slack scrub with <i>Salix repens</i> and/or <i>Juniperus communis</i>
Oxycocco-Sphagnetea		Sphagnetalia magellanici		
		Erico-Sphagnion papilloso	M17, M19	Bogs, including those with <i>Betula nana</i> scrub
		Erico-Sphagnetalia papilloso		
		Ericion tetralicis	M15	Wet heaths, including those with <i>Myrica gale</i> scrub
Molinio-Arrhenatheretea		Molinetalia caeruleae		
		Junco conglomerati-Molinion	M25	Mires, including those with <i>Myrica gale</i> scrub
Mulgedio-Aconitetea		Adenostyletalia alliariae		
		Salicion arbusculae	W20	Sub-alpine willow scrub
Trifolio-Geranietea	sanguinei	Origanetalia vulgaris		
		Geranion sanguinei	new ^{5,6}	Sunny scrub and woodland edges on calcareous soils ('saum')
		Melampyro-Holcetalia mollis		
		Melampyrium pratensis	new ⁷	Woodland margins and rides on dry, impoverished acid soils
		Potentilla erecta-Holcicion moll	new ⁸	Woodland margins and rides on damper acid soils
Rhamno-Prunetea		Prunetalia spinosae		
		Prunion fruticosae	W22	Scrub communities on moist, more fertile soils
		Berberidion vulgaris	W21	Scrub communities on dry, warm stony slopes
		Salicion repentis arenariae	SD16, SD18	Willow and buckthorn scrub on sand dunes
		Ulici-Sarothamnion	W23	Broom and gorse scrub
		Rubion subatlanticum	W24, W25	Bramble communities of woodland margins and hedgerows
		Sambucetalia racemosae		
		Sambuco-Salicion capreae	new ⁹	Elder and willow scrub on nutrient rich mull soils
Querco-Fagetea		Quercetalia robori-petraeae		
		Quercion robori-petraeae	U20, new ¹⁰	Includes upland thorn and <i>Rhododendron</i> scrub
		Fagetalia sylvaticae		
		Alnion incanae	W7	Includes some scrub dominated by <i>Salix aurita</i> in Scotland
Salicetea	purpureae	Salicetalia purpurea		
		Salicion albae	W6	Includes willow scrub of sub-montane and lowland areas
Alnetea	glutinosae	Alnetalia glutinosae		
		Alnion glutinosae	W1, W5	Alder woodlands of swamps, fens and wet pastures
		Salicetalia auritae		
		Salicion cinereae	W2, W3	Willow scrub and woodland of mires
Vaccinio-Piceetalia		Piceetalia excelsae		
		Dicrano-Pinion	W18, W19, new ¹¹	Upland and montane pine and juniper scrub
		Vaccinio-Piceion	W4	Includes some scrub dominated by <i>Salix aurita</i> in Scotland

Provisional new NVC communities (from Rodwell *et al.* 1998)

- 1 *Aegopodium podagraria-Urtica dioica* community
- 2 *Petasites hybridus-Aegopodium podagraria* community
- 3 *Alliaria petiolata-Chaerophyllum temulentum* community
- 4 *Atropa belladonna-Hypericum hirsutum* community
- 5 *Agrimonia eupatorium-Origanum vulgare* community
- 6 *Corylus avellana-Geranium sanguineum* community

- 7 *Holcus mollis-Melampyrum pratensis* community
- 8 *Potentilla erecta-Holcus mollis* community
- 9 *Sambucus nigra-Urtica dioica* scrub
- 10 *Rhododendron ponticum* community
- 11 *Pinus sylvestris-Cladonia* woodland

The nature conservation value of scrub in Britain

Table 2.2 Scrub types in the NVC and their relationships with CORINE biotopes, Habitats Directive categories and Broad and Priority Habitats in the UK Biodiversity Action Plan.

CORINE code	NATURA 2000 code	Habitats Directive Annex 1	BAP Broad Habitats	BAP Priority Habitats	NVC types	Notes
17.3	1220	Perennial vegetation of stony banks	Supralittoral sediment	Coastal vegetated shingle	W22 W23 W24	
18.21	1230	Vegetated sea cliffs of the Atlantic and Baltic coasts	Supralittoral rock	Maritime cliff and slope	W21 to W25	
15.16	1420	Mediterranean and thermo-Atlantic halophilous scrubs (<i>Arthrocnemum fruticosae</i>)	Littoral sediment	Coastal saltmarsh	SM21 SM25	
16.25	2160	Dunes with <i>Hippophae rhamnoides</i>	Supralittoral sediment	Coastal sand dunes	SD18	Invasive species actively controlled in the UK
16.26	2170	Dunes with <i>Salix arenaria</i>	Supralittoral sediment	Coastal sand dunes	SD16	
16.29	2180	Wooded dunes of the Atlantic coast	Supralittoral sediment	Coastal sand dunes		Poor example by European standards
16.27	2250	* Dune juniper thickets (<i>Juniperus</i> spp.)	Supralittoral sediment	Coastal sand dunes		
31.4	4060	Alpine and subalpine heaths	Montane habitats	Montane habitats	M19	<i>Betula nana</i> stands
31.622	4080	Sub-Arctic willow scrub	Montane habitats		W20	
31.82	5110	Stable <i>Buxus sempervirens</i> formations on calcareous rock slopes (<i>Berberidion</i> p.)	Broadleaved, mixed and yew woodland		W13	UK examples are rare and restricted outliers
31.88	5130	<i>Juniperus communis</i> formations on heaths or calcareous grasslands	Calcareous grassland	Lowland calcareous grassland	W19 W21	
31.88	5130	<i>Juniperus communis</i> formations on heaths or calcareous grasslands	Calcareous grassland	Upland calcareous grassland	W19	
31.88	5130	<i>Juniperus communis</i> formations on heaths or calcareous grasslands	Dwarf shrub heath	Upland heathland	W19	
34.31-34	6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (* important orchid sites)	Calcareous grassland	Lowland calcareous grassland	CG1 to CG9	
52.1	7130	Blanket bog (*active only)	Bogs		M19	<i>Betula nana</i> stands
62.4	8240	* Limestone pavements	Inland rock	Limestone pavements	W21 W22	
42.51	91C0	* Caledonian forest	Coniferous woodland	Native pine woodland	W18 W19	
44A1-4	91D0	* Bog woodland	Broadleaved, mixed and yew woodland	Wet woodland	W1	
44.3	91E0	* Residual alluvial forests (<i>Alnion glutinosae-incanae</i>)	Broadleaved, mixed and yew woodland		W2 W3	

* indicates priority habitat types in the Habitats Directive

Table 2.3 Classification of scrub types found in the UK based on vegetation structure and texture (after Barkmann 1990).

<i>Photoperiodicity</i>	<i>Leaf form</i>	<i>Habit</i>	<i>Thorns</i>	<i>Scrub types</i>		
Evergreen, perennial leaves	Leaves scale-like				<i>Tamarix</i> *	
		Leaves needle-like	Stems creeping			<i>Pinus mugo</i> *
	Stems erect			With deciduous thorny shrubs		<i>Juniperus-Rosa</i> (W21d)
		Undergrowth mainly bryophytes			<i>Juniperus-moss</i> (W19)	
		Undergrowth mainly grasses			<i>Juniperus-grass</i> (W19)	
		Undergrowth mainly dwarf shrubs			<i>Juniperus-Myrtillus</i> (W19a)	
	Leaves broad		No thorns		<i>Buxus-Ligustrum-Taxus</i> (W13) <i>Rhododendron</i> *	
			Thorns		Not present in the UK	
	Deciduous, evergreen twigs		Branches erect		<i>Cytisus</i> (W23)	
			Branches divergent	No spines		<i>Euonymus</i> (W21)
Spines					<i>Ulex</i> (W23)	
Deciduous, no evergreen twigs	Creeping, decumbent				<i>Salix lapponum</i> (W20) <i>Betula nana</i> (M19)	
		Erect, fastigiate				<i>Myrica</i> (M15, M25)
	Straight, divergent		No spines	Wet scrub with erect leafy forbs		<i>Salix</i> (W1, W2, W3)
		Lianas abundant			<i>Cornus-Clematis</i> (W21d)	
		No lianas			<i>Ulmus suckers</i> (W8) Stunted <i>Quercus-Betula</i> (W10)	
		Spines			<i>Hippophae</i> (SD18) <i>Prunus</i> (W22)	
	Arcuate	No spines			<i>Sambucus</i> <i>Buddleja</i> *	
			Spines	Tall woody scrub		<i>Crataegus</i> (W21)
				Low trailing 'veil' scrub		<i>Rubus, Rosa</i> (W21, W24, W25)

* indicates introduced shrubs

The nature conservation value of scrub in Britain

Table 2.4 Treatment of scrub vegetation in various land cover classifications in use in the UK. Differences in precision are illustrated with reference to NVC communities. These land cover surveys use mapping units much larger than the stands used to define NVC communities. Consequently, no direct correlation between land cover classes and NVC communities is implied.

Classification:	NVC types: W1		W18 W19	W20	W21 W22	W23	W25 U20	others
	W2	W3						
Countryside Survey (satellite)	Deciduous/ Mixed Wood		Coniferous/ Evergreen Woodland; Deciduous/ Mixed Wood	Shrub Heath	Deciduous/ Mixed Wood	Shrub Heath	Bracken	
Monitoring Landscape Change (air photo)	Scrub; Peat Bog		Scrub	Scrub	Scrub	Gorse	Bracken	
National Countryside Monitoring Scheme (air photo)	Scrub (tall 3-5 m, low < 3 m)		Scrub (tall 3-5 m, low < 3 m)	Scrub (low < 3 m)	Scrub (tall 3-5 m, low < 3 m)	Scrub (tall 3-5 m, low < 3 m)	Bracken	
Land Cover Scotland (air photo)	Broadleaved Wood (>50% tree cover); Wet lands		Undifferentiated Low Scrub; Coniferous Woods (>50% tree cover)	Montane Vegetation	Undifferentiated Low Scrub; Smooth grasslands with low scrub	Undifferentiated Low Scrub; Smooth grasslands with low scrub	Bracken	Rhododendron Scrub
Northern Ireland Countryside Survey (field survey)	Fen Carr		Coniferous Woodland, semi-natural; Scrub (dense, scattered)		Scrub (dense, scattered)	Gorse Heath (continuous, scattered); Gorse Heath/ Bracken Mosaic	Gorse Heath/ Bracken Mosaic	Dune Scrub
National Parks Monitoring Scheme (air photo)	Scrub		Scrub	Scrub	Scrub	Scrub	Bracken	
Environmentally Sensitive Areas Monitoring (air photo)	Fen Carr		Scrub (dense, scattered)	Scrub (dense, scattered)	Scrub (dense, scattered)	Scrub (dense, scattered)	Bracken (continuous, scattered)	

Source: Wyatt *et al.* (1994)

2.2.3 Classification for conservation purposes

Classification schemes are tools for describing variation. The criteria used in the scheme depend on the use to which the classification will be put. Classifications of scrub stands for nature conservation purposes need to take account of two factors, the nature conservation value of the scrub concerned and the likely vegetation development of the stand through time, i.e. its successional status.

2.2.3.1 Classification of conservation value

Scrub vegetation may have high nature conservation value for one or more of the following reasons:

- *The conservation value of the shrub species present*
Some scrub types are dominated by shrub species that are of conservation importance because of their rarity, for example juniper *Juniper communis*, box *Buxus sempervirens*, or downy willow *Salix lanata*.
- *The conservation value of other species associated with the scrub type*
Scrub composed of woody species of low botanical interest may be of considerable value to particular rare species or groups of associated species, belonging to a range of taxa. For example, blackthorn scrub for nightingale or coastal hazel *Corylus avellana* scrub for lichen assemblages.
- *The conservation value of scrub as a landscape element in a mosaic including other habitats*
Scrub may form an important component of habitat mosaics in certain systems. Examples include the thermophilic saum vegetation of chalk grassland/scrub interface or scrubby birch *Betula* spp. and willow *Salix* spp. vegetation at the edge of wet heathland and mires. In upland areas, climax scrub represents an important component of the ecotone from woodland to montane heath with increasing altitude. The same is true for other situations where scrub forms part of a natural ecotone, for example the scrub and elfin woodland communities of exposed coastal areas.

2.2.3.2 Classification for management

In addition to identifying the intrinsic conservation value of biological components of scrub, management plans need to take account of two sets of factors, structural and temporal.

The vertical and horizontal structure of the scrub stand will determine whether the correct habitat components necessary for rare species or groups of associated organisms are present. The characteristics of scrub of high conservation value have been described for lowland grassland systems (see Figure 2.3, Crofts & Jefferson 1999) as:

- Mixed age structure
- Complex three dimensional structure
- Many clearings and glades
- High boundary/area ratio
- Well developed marginal vegetation ('saum').

The second consideration is the likely development of the scrub stand through time. The age structure of the woody species in a scrub stand provide an indication of its successional status and likely development through time. Characterisation of the age structure is, therefore, necessary in order to make informed management decisions. This is especially true for lowland seral and sub-seral scrub types. The presence of shrub seedlings, suckers or tree saplings will provide an indication of whether the stand will develop into woodland, remain as scrub, or degenerate to a herbaceous community.

In areas with climax scrub, such as in the alpine and sub-alpine zones of Scotland, other management considerations are important. Here problems of population survival in small isolated patches mean that factors such as patch size and position in relation to other semi-natural woodland are of paramount importance (D. Gilbert pers. comm.). For dioecious species such as juniper and willows, the presence of male and female plants is important for population persistence (Marriott 1997).



Closed scrub. Canopy closure results in the shading out of nearly all ground flora and conditions for plant growth are made even more difficult due to the build up of a deep litter layer. Even woodland plants find such conditions difficult.



Scrub of high nature conservation value is characterised by a diverse range of scrub species and a complex canopy structure. There are many gaps allowing the survival of grassland and 'saum' species.



Scrub of low nature conservation value consists of one or two scrub species and has a uniform canopy. Bushes are often evenly spaced and can close rapidly to shade out grassland species in the gaps. 'Saum' species are likely to be absent.

Figure 2.3 The conservation value of seral scrub in lowland grasslands in relation to canopy structure (reproduced from Crofts & Jefferson 1999 with permission of English Nature & The Wildlife Trusts).

2.3 Coastal scrub types

2.3.1 Scrub on shingle

2.3.1.1 Scrub communities

Scrub may develop on stable areas of large shingle structures, where stones are thrown beyond the reach of wave disturbance and fine material builds up between the pebbles. The exposed conditions of most extensive shingle areas in the UK result in a short scrub vegetation. Dwarf forms of broom *Cytisus scoparius* ssp. *scoparius* and blackthorn are found on the most exposed areas, with bramble *Rubus fruticosus*, elder *Sambucus nigra* and gorse *Ulex europaeus* in more sheltered areas. Juniper occurs on some vegetated shingle bars in north-eastern Scotland.

2.3.1.2 Zonation and succession

Scrub on shingle occurs in mosaics with open herbaceous shingle vegetation and, where fine material has built up, with maritime grassland or heathland vegetation. At some sites, where shingle adjoins areas of saltmarsh, zonation with halophytic drift line communities or shrubby sea-blite *Suaeda vera* stands are found.

The development of scrub on shingle occurs as a result of succession from open herbaceous communities. The succession of shingle scrub to woodland is not well documented, and exposure or disturbance may limit such a progression.

2.3.1.3 Conservation value

The UK has a significant component of European resources of large shingle areas (Sneddon & Randall 1993). Scrub forms an important part of the mosaic of habitats on larger sites. Several SACs containing extensive areas of shingle have been designated (see Appendix 3.2).

Perennial vegetation of stony banks

CORINE: 17.3 NATURA 2000: 1220

2.3.2 Scrub on sea cliffs

2.3.2.1 Scrub communities

In areas with soft cliffs, extensive stands of scrub may occur, especially on slumping undercliffs such as those at Lyme Regis, Dorset or St Catherine's Point, Isle of Wight. Scrub may also occur on harder cliffs, such as the Elgol Cliffs on Skye. On cliff tops, scrub stands occur which are similar to other lowland types on similar soils, but are usually much reduced in height as a result of the exposed conditions. Hazel, blackthorn, bramble, gorse and privet *Ligustrum vulgare* are particularly characteristic of such conditions. On limestone soils juniper and burnet rose *Rosa pimpinellifolia* occur. The limestone cliffs at Great Orme's Head are the only site for the endemic shrub wild cotoneaster *Cotoneaster cambricus*. Stands of stunted trees, or 'elfin woodland', also occur on cliff tops and slopes, having the structure and appearance of scrub. These form important sites for lichens on the west coast of Britain.

2.3.2.2 Zonation and succession

Scrub on cliff tops and associated slopes occurs in mosaics with open herbaceous sea cliff vegetation, grassland, heathland and, in less exposed conditions, woodland. On soft cliffs subject to slippage, dynamic mosaics of pioneer vegetation, grassland, heathland and woodland are maintained through periodic disturbance.

Scrub develops on cliffs and undercliffs as a part of primary succession from pioneer and other herbaceous communities. On cliff tops, scrub may develop in maritime grasslands or heathlands

after the relaxation or cessation of grazing. Succession of scrub to woodland occurs only in the most sheltered conditions, for example in small valleys and ravines. Generally, the exposed conditions or disturbance of the substrate limit progression to woodland.

2.3.2.3 Conservation value

Scrub has conservation value on cliff tops and slumping soft cliffs as part of vegetation mosaics including grassland, heathland and open pioneer vegetation. Scrub stands are especially valuable in areas with extensive undercliffs. Bryophytes and lichens can be important on western and northern cliffs. Scrub on sea cliffs can provide significant food resources and cover for migrating and breeding birds.

Vegetated sea cliffs of the Atlantic and Baltic coasts

CORINE: 18.21 NATURA 2000: 1230

2.3.3 Scrub on salt marshes

2.3.3.1 Scrub communities

Scrub vegetation composed of halophilous species typical of the Mediterranean region occurs in a few localities on the south and east coasts of England. Communities dominated by the shrubs shrubby sea-blite and sea-purslane *Atriplex portulacoides* are found on the upper fringes of saltmarshes. Such stands are found in the *Halimione portulacoides* and *Suaeda vera* salt-marsh communities of the NVC (SM14 and SM25 respectively, Rodwell 1999).

2.3.3.2 Zonation and succession

Low scrub vegetation with shrubby sea-blite and sea-purslane occurs along the upper fringes of extensive areas of salt marsh. The vegetation usually marks the upper limit of tidal inundation and lies between the saltmarsh and vegetation developing on sand dunes or shingle bars.

The community is maintained by the extreme edaphic conditions. Disturbance caused by wave action during storms leads to replacement by annual drift line vegetation, with species such as sea beet *Beta vulgaris* ssp. *maritima*. In the absence of inundation and disturbance, scrub replaces these annual communities.

2.3.3.3 Conservation value

In the UK, such scrubby vegetation is only found on sites with extensive areas of saltmarsh, sand dune or shingle on the south and east coasts (Burd 1989). Three SACs contain significant stands of halophilous scrub (see Appendix 3.2).

Mediterranean and thermo-Atlantic halophilous scrubs

(*Arthrocnemum fruticosum*)

CORINE: 15.16 NATURA 2000: 1420

2.3.4 Scrub on coastal dunes

2.3.4.1 Scrub communities

Scrub communities occur in more stable areas of dune systems, typically in dune slacks or on higher ground amongst areas of dune grassland or heathland. However, in dune hollows and on sheltered sides of dune ridges, sea-buckthorn *Hippophae rhamnoides* can form a characteristic dune scrub community (SD18 *Hippophae rhamnoides* scrub in the NVC). The shrub develops a dense cover, displacing herbaceous species, although mature stands are characterised by the presence of common nettle *Urtica dioica*. Sea-buckthorn is native in the UK only on the east coast from Dunbar to Dungeness (Stewart *et al.* 1994). The species has invaded many dunes outside of its native range, either through planting to stabilise sand dune movement or bird dispersal from gardens. Sea-buckthorn is considered a serious problem in some dune systems on the western coast.

In dune slacks, scattered individuals of creeping willow *Salix repens* (referred to in the Habitats Directive by its synonym, *Salix arenaria* L.) occur within herbaceous communities of species typical of moist soil conditions (SD13 *Salix repens-Bryum pseudotriquetrum*, SD14 *Salix repens-Campylium stellatum* and SD15 *Salix repens-Calliergon cuspidatum* dune slacks in the NVC). Erosion of areas with creeping willow leads to the characteristic 'hedgehog dunes' found at a number of sites in the UK. In some older, more stable, dune slacks, stands dominated by creeping willow occur (SD16 *Salix repens-Holcus lanatus* dune-slack, Rodwell 1999), comprising a low scrubby vegetation. In wetter areas, these stands may include alder *Alnus glutinosa*, bog-myrtle *Myrica gale* and grey willow *Salix cinerea*, whilst in dry areas creeping willow may be accompanied by other shrubs, such as privet.

On older dunes on the landward side of extensive dune systems, the balance of erosion and accumulation results in stable vegetation and allows the development of scrub. The scrub types found here are generally similar to other lowland types, depending on the base status of the substrate. On base-rich soils, blackthorn, elder, privet and hawthorn *Crataegus monogyna* are found, whilst bramble, gorse and broom *Cytisus scoparius* are found on more acidic dunes. Important stands of juniper scrub occur in mosaics with wet slack, dune grassland and heath on the coast of north-east Scotland.

2.3.4.2 Zonation and succession

Dune scrub occurs in the more stable areas of sand dune systems, on the landward side of ridges, in hollows, slacks and amongst dune grassland and heathland. The pattern of occurrence within associated vegetation types of different successional stage depends on the pattern of disturbance at the site. In mobile systems, cyclic

alternation of sand dune and dune slack occurs. In more stable areas, the type of scrub vegetation is controlled by rates of sand erosion and accumulation, and the level of the water table. For example, grey willow scrub (W1 in the NVC) may be found as a bordering fringe between wet dune slacks with creeping willow and dry dune grassland with scattered dry scrub. The role of grazing animals in maintaining dune grassland and heathland became obvious after the decrease in rabbit populations following the myxomatosis outbreak in the 1950s.

A number of other NVC woodland and scrub communities occur in sand dunes in Britain (Dargie 1993, 1995), these are covered in Sections 2.4 and 2.5. The succession of dune grassland and heathland, through scrub, to woodland is poorly understood, because in most extensive dune systems, the more stable areas on the landward edge are grazed or planted for forestry.

2.3.4.3 Conservation value

The most important areas of dune scrub for conservation in the UK are the dune juniper thickets of north-east Scotland, a priority habitat type in the Habitats Directive (Anon 1996). Dunes with *Hippophae rhamnoides* are included in the Habitats Directive and, whilst sea-buckthorn is native on the east coast, it is of widespread occurrence as an invasive Pearson & Rogers 1962, Stewart *et al.* 1994). Sea-buckthorn dune scrub has therefore not been considered a priority habitat type in the UK for the purposes of SAC designation. This situation may change as part of the SAC moderation process (S. Rees, pers. comm.).

Dune scrub forms an important component of many SACs with extensive sand dunes which have been designated because of the importance of their fixed dune habitats (CORINE habitat types 16.22, 16.23, 16.24). In areas of calcareous dune with extensive mosaics of dune grassland and scrub, important communities of thermophilic saum vegetation occur, often accompanied by an abundance of bloody crane's-bill *Geranium sanguineum* (J. Hopkins, pers. comm.). Scrub on sand dunes often provides very important food resources and cover for migrating birds. Populations of invertebrates and breeding birds can also be of considerable interest.

Dunes with *Hippophae rhamnoides*

CORINE: 16.25 NATURA 2000: 2160

Dunes with *Salix arenaria*

CORINE: 16.26 NATURA 2000: 2170

* Dune juniper thickets (*Juniperus* spp.)

CORINE: 16.27 NATURA 2000: 2250

2.4 Lowland scrub types on wet soils

2.4.1 Scrub on wet mineral soils

2.4.1.1 Scrub communities

Scrub occurring on wet mineral soils in lowland areas is usually dominated by grey willow. Downy birch *Betula pubescens* occurs occasionally in these stands. Other woody species occurring at lower frequency are alder, hawthorn and pedunculate oak *Quercus robur*. Scrub of this type is described as *Salix cinerea–Galium palustre* woodland (W1) in the NVC (Rodwell 1991a). Such willow carr occurs alongside ponds, lakes, rivers, canals, ditches and streams, and in damp hollows in places such as dune slacks. The prolific fruit production and widespread dispersal make grey willow a frequent colonist of damp ground in abandoned gravel and sand pits, and along roadsides. The understorey vegetation is patchy, reflecting differences in canopy closure and soil moisture, and lacks the swamp and fen dominants typical of fen carrs on more organic soils.

2.4.2.2 Zonation and succession

Grey willow scrub on wet mineral soils occurs as a component of several habitat complexes. Along the margins of ponds and lakes, this scrub type may be separated from open water by swamp vegetation dominated by species such as common reed *Phragmites australis*, branched bur-reed *Sparganium erectum* or bulrush *Typha latifolia*. In extensive wetland areas, tall-herb fen (e.g. S25 *Phragmites australis–Eupatorium cannabinum* or S26 *Phragmites australis–Urtica dioica*) may occur between the swamp and carr. On drier ground, the scrub community grades into *Alnus glutinosa–Urtica dioica* woodland (W6). Often, however, agricultural practices limit the development of woody vegetation and the willow carr gives way to wet grasslands (MG6 *Lolium perenne–Cynosurus cristatus* or MG10 *Holcus lanatus–Juncus effusus*) or has abrupt boundaries with arable land (Rodwell 1991a). Along roadside and other linear features, willow carr occurs as thin strips adjacent to mown grassland, usually *Arrhenatherum elatius* grassland (MG1).

Little published information exists on the successional development of grey willow stands on wet mineral soils. In sheltered situations, it is likely to develop into alder woodland (W6) with increases in cover of birch and alder above the willow canopy and expansion of bramble and common nettle in the understorey. On exposed western coasts of Britain, this scrub type may represent climax woody vegetation (Rodwell 1991a).

2.4.2.2 Conservation value

Whilst the botanical diversity of such scrub is low, this vegetation can form an important component of the landscape in areas with mosaics of open water, swamp and fen. It forms a component of wet woodland, a priority habitat in the UK Biodiversity Action Plan.

Residual alluvial forests (*Alnion glutinosae-incanae*)
CORINE: 44.3 NATURA 2000: 91E0

2.4.2 Scrub on wet organic soils

2.4.2.2 Scrub communities

Grey willow and downy birch also form the woody dominants in scrub on wet, organic soils such as those associated with fens and mires. In places, alder or alder buckthorn *Frangula alnus* can form a significant component of the shrub canopy. There is usually a distinct undershrub layer with species such as bramble and dog-rose *Rosa canina*. The understorey is usually dominated by graminoids typical of the preceding fen vegetation, of which common reed is the most frequent. Patches of tall forbs are also found, for example, hemp-agrimony *Eupatorium cannabinum* and meadowsweet *Filipendula ulmaria*. Scrub of this type is described as *Salix cinerea–Betula pubescens–Phragmites australis* woodland (W2) in the NVC (Rodwell 1991a).

2.4.2.2 Zonation and succession

Willow carr occurs on topogenous fen peats, on flood plain mires, valley mires and basin mires. It develops either as a result of direct invasion of fen, or by secondary succession following the abandonment of mowing marsh. Extensive open water transitions including this scrub type are most commonly found in East Anglia and in the meres of the Cheshire and Shropshire basin. In such areas, sequences from open water, through swamp and fen vegetation (e.g. S24 *Phragmites australis–Peucedanum palustre* or S25 *Phragmites australis–Eupatorium cannabinum*) to willow carr can be found (Rodwell 1995). Towards higher, drier areas, willow carr may be bordered by woodland with alder, birch or oak, or abut agriculturally managed areas.

Succession of this scrub community to woodland occurs with increased terrestrialisation. On base-rich substrates, willow carr is likely to develop to alder woodland (W6), with increases in the cover of alder and elder in the canopy and bramble and common nettle in the understorey. On more acid substrates, developing canopy cover of birch and increased dominance of purple moor-grass *Molinia caerulea* in the understorey mark the development of carr into *Betula pubescens–Molinia caerulea* woodland (W4). In places, degeneration of the birch canopy and increased cover of purple moor-grass suggest eventual development of an ombrogenous mire community.

2.4.2.3 Conservation value

This scrub type forms an important component of the landscape in areas with mosaics of open water, swamp, fen, mire and woodland. It forms a component of wet woodland, a priority habitat in the UK Biodiversity Action Plan.

*** Bog woodland**
CORINE: 44A1-44A4 NATURA 2000: 91D0

2.4.3 Bog myrtle scrub

2.4.3.1 Scrub communities

The nitrogen-fixing shrub bog myrtle *Myrica gale* is found in a wide range of wet heaths and mires in lowland areas and upland fringes of Britain. The shrub usually occurs as scattered bushes, but in places, forms a closed-canopy vegetation up to 2 m tall. Purple moor-grass is usually the dominant understorey species in bog myrtle stands. In the densest stands, the shade produced by the scrub canopy, combined with nutrient enrichment from the nitrogen-fixing shrub, result in an understorey of low botanical diversity. In the NVC, bog myrtle stands are included in *Scirpus cespitosus*–*Erica tetralix* wet heaths (M15) and *Molinia caerulea*–*Potentilla erecta* mires (M25) (Rodwell 1991b).

2.4.3.2 Zonation and succession

Bog myrtle scrub stands are found on wet acid-neutral peats and peaty mineral soils mainly in the cooler, wetter areas of western and northern Britain. Such vegetation usually marks areas of water movement on gentle slopes, soakaways and along the courses of streams. Stands of bog myrtle occur in mosaics with other mire and heath communities.

2.4.3.3 Conservation value

Bog myrtle forms a valuable component of the structural complexity of wet heath, mire, blanket bog and moorland habitats in the lowlands and upland fringes, especially in the southern and eastern parts of Britain. Along with patches scrubby birch and willow, it is an important component of the habitat requirements of several rare invertebrate species associated with these habitats.

2.5 Lowland scrub types on dry soils

2.5.1 Scrub on dry calcareous substrates

2.5.1.1 Scrub communities

Many shrub species are restricted to dry calcareous soils in the warmer, drier lowland areas of the UK. As a consequence, the botanical diversity of woody species in scrub types on such soils is high. However, the NVC includes such types within a single community, the *Crataegus monogyna*–*Hedera helix* scrub (W21). This community is found on a wide range of base-rich to circumneutral soils in lowland Britain, there being little variation in the dominant woody species over this range. Hawthorn, blackthorn, bramble and dog-rose form the core shrub species, and maintain dominance on all but the most shallow and dry soils. *Crataegus*–*Hedera* scrub is found on many types of unmanaged land: land slips, abandoned land, spoil tips, railway embankments, roadsides, and on grasslands after the relaxation of grazing or mowing.

Two sub-communities of *Crataegus*–*Hedera* scrub are associated with calcareous soils. The *Brachypodium sylvaticum* sub-community (W21c) is found on deeper soils and the shrub canopy is largely composed of hawthorn, blackthorn and bramble (Rodwell 1991a). In the understorey, false brome *Brachypodium sylvaticum*, wild strawberry *Fragaria vesca* and ivy *Hedera helix* are of frequent occurrence.

The *Viburnum lantana* sub-community (W21d) is found on shallow, infertile rendzinas and lithomorphous soils on harder limestones (Rodwell 1991a). Here, the abundance of hawthorn and blackthorn is diminished and a range of calcicolous shrubs add to the diversity of the canopy. This sub-community includes the so-called southern mixed shrub communities of Ward (1974) and Ratcliffe (1977). Shrub species such as dogwood, privet and wayfaring-tree *Viburnum lantana* are strong preferentials for this scrub type. Several rose species *Rosa* spp. are found in this scrub type, and the climbers traveller's-joy *Clematis vitalba* and black bryony *Tamus communis* are frequent. Lowland populations of juniper on the chalk are associated with this scrub type, occurring either as pure stands or mixed with southern shrubs. The trees whitebeam *Sorbus aria* and yew *Taxus baccata* supplement the diversity of woody species. In the north of Britain, similar scrub types occur, although the diversity of the shrub species declines as species reach their northern limits, with few examples north of Morecambe Bay and the River Tyne.

Box scrub occurs very locally at three sites in southern England on steep chalk or limestone slopes. Box is usually accompanied by yew, and the deep shade and dry soil conditions result in a very sparse ground flora. In the NVC, box scrub is placed in the *Taxus baccata* woodland (W13) or the *Taxus* sub-community of the *Fagus sylvatica*–*Mercurialis perennis* woodland (W12).

On limestone outcrops in western and northern Britain, several rare species of whitebeam *Sorbus* spp. occur, some of which are endemic (e.g. *S. eminens*, *S. wilmottiana*). These are found with calcicolous shrubs and trees growing on cliffs and steep rocky slopes, such as those of the Wye Valley, Avon Gorge and the Isle of Arran. Such scrubby vegetation is probably the climax vegetation in such conditions.

Hazel scrub also occurs on shallow calcareous soils on harder limestones in the west and north of Britain. Hazel usually prefers deeper, moister soils, but can persist in pockets of soil on limestone pavements, screes and cliffs. In Derbyshire, a distinctive type of hazel scrub is found in intimate mosaics with calcareous grassland. Associated with this scrub-grassland complex is a distinctive 'saum' community, with a characteristic mixture of herbaceous species. Such scrub is also considered part of the *Viburnum* sub-community of the *Crataegus*–*Hedera* scrub in the NVC. Hazel scrub also occurs on base-rich soils in coastal

areas of north and west Scotland. Important lichen assemblages are found on the stunted hazel trees in these situations.

2.5.1.2 Zonation and succession

Except on the most shallow soils or in extremely exposed conditions, scrub on dry calcareous soils in the lowlands of Britain is a sub-climax woody community. Zonation usually reflects a mosaic of different successional stages. Abrupt boundaries occur where fences limit grazing pressure. Such scrub also occurs as a linear feature along woodland edges, roadsides and railway embankments. Gradual transitions to herbaceous communities are found on abandoned or extensively managed land.

On disturbed sites, quarry floors and around rabbit warrens on the softer limestones of the Oolite and Chalk, scrub can develop in the absence of grazing by primary succession from open weedy tall herb communities. On the harder limestones in the north of Britain, scrub replaces fern-dominated communities and *Arrhenatherum elatius* grassland in primary successional sequences, the scrub developing into *Fraxinus excelsior*–*Acer campestre*–*Mercurialis perennis* woodland (W8).

Scrub dominated by dogwood is associated with secondary succession on disturbed land, such as that on abandoned arable or cleared woodland, on shallow calcareous soils. Dogwood often forms pure stands through vegetative spread and this invasive shrub can be difficult to control.

Scrub develops after the cessation or relaxation of grazing on calcareous grasslands. In the south and east, this is from Mesobromion grasslands (CG2-7), and in the cooler, wetter northern and western areas, from *Sesleria* grasslands (CG8, CG9). In coastal areas, *Festuca ovina*–*Carlina vulgaris* grasslands (CG1) can develop to scrub after the relaxation of grazing pressure, but in places exposure limits the development of scrub. In these secondary successions, increased shrub cover is accompanied by the development of tall grassland, dominated by rank species such as false oat-grass *Arrhenatherum elatius*, tor-grass *Brachypodium pinnatum* or upright brome *Bromus erectus*. The spread of scrub may be associated with the development of *Rubus fruticosus*–*Holcus lanatus* underscrub (W24).

The development of tree cover in scrub on lowland calcareous soils in southern Britain usually leads to beech woodland (W12), often with an intermediate stage dominated by ash. On steep slopes on the chalk in the warmer south-east, yew woodland (W13) may develop from southern mixed shrub communities. In cooler northern and western areas, scrub on calcareous soils develops into *Fraxinus*–*Acer*–*Mercurialis* woodland (W8).

The nature conservation value of scrub in Britain

2.5.1.3 Conservation value

Many species of rare plant and invertebrate are found in lowland scrub on calcareous soils. In addition, it forms an important landscape component for birds and mammals. Rich communities of birds and invertebrates can be supported, especially where the structural diversity of the scrub is high. The *Crataegus-Hedera* scrub (W21) of the NVC covers a large range of scrub varying in composition and species richness. Different stands will have different degrees of conservation value depending on botanical composition and structural complexity.

Two scrub types are of importance because of the rarity of the shrub species, namely box and juniper, the latter having a Species Action Plan. The rare, endemic whitebeams found on limestone outcrops in the west of Britain add to the conservation importance of scrub in these situations. Scrub forms an important component of 'Semi natural grasslands and scrubland facies on calcareous substrates', and several rare orchid species are associated with the scrub-grassland interface. The thermophilic saum communities of the mosaics of scrub and calcareous grasslands in the Derbyshire Dales are of particular importance.

In European terms W21 represents a subset of the Rhamno-Prunetea which is characteristically dominated by pruinose rosaceous shrubs. Similar broad community types have been described from Germany (Tüxen 1952, Ellenberg 1978) and The Netherlands (Westhoff & den Held 1969). There is no reason to believe that the British representatives of this compendious grouping are distinct from similar communities in nearby continental Europe.

Stable *Buxus sempervirens* formations on calcareous rock slopes (Berberidion p.)

CORINE: 31.82 NATURA 2000: 5110

Juniperus communis formations on heaths or calcareous grasslands

CORINE: 31.88 NATURA 2000: 5130

Semi natural grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (*important orchid sites)

CORINE: 34.31-34.34 NATURA 2000: 6210

2.5.2 Scrub on neutral substrates

2.5.2.1 Scrub communities

Scrub dominated by hawthorn is not restricted to calcareous soils. On fertile soils of moderate base status, such as clays and brown earths, hawthorn is accompanied by blackthorn, elder and elm *Ulmus* spp. These scrub types also lie within the *Crataegus monogyna-Hedera helix* scrub (W21). Common nettle and cleavers *Galium aparine* are usually the most frequent species in the understorey, accompanied by dog's mercury *Mercurialis perennis* on the more base-rich soils. Such communities occur on derelict land, abandoned arable land, neglected pastures, hedgerows and roadsides.

On deeper, moister, more fertile soils, blackthorn replaces hawthorn as the dominant shrub species. Communities dominated by blackthorn are included in the *Prunus spinosa-Rubus fruticosus* scrub (W22) of the NVC. Blackthorn is the dominant woody species in such vegetation, and is accompanied by gorse on more base-poor soils, and hazel and privet on soils with a higher base status. The understorey is impoverished, bramble and bracken *Pteridium aquilinum* occurring with some constancy. In the densest thickets there may be large areas of bare ground under the shrub canopy. Such scrub is found on a range of abandoned or extensively managed land. Blackthorn has a higher tolerance of salt than many shrub species, and it is frequently found on cliff tops, exposure limiting the scrub canopy to heights of less than 1 m in places.

On damp, disturbed, nutrient-rich soils on roadsides, railway embankments and wasteland, scrub dominated by elder is common. Elder may form pure stands, or be accompanied by other woody species, typically grey willow and sycamore *Acer pseudoplatanus*. These are usually fringed with bramble and herbaceous species such as common nettle and rosebay willowherb *Chamerion angustifolium*. A new NVC community, *Sambucus nigra-Urtica dioica* scrub, has been proposed by Rodwell *et al.* (1998) for such vegetation. Elder scrub is associated with rabbit warrens and badger setts on calcareous soils. The disturbed, fertile conditions favouring its spread. The low palatability of the shrub to rabbits also contributes to its success in these conditions.

The invasive shrub butterfly-bush *Buddleja davidii* is found in scrub communities in similar situations to elder. It can form pure stands on shallow, stony, fertile soils. Extensive areas can be found on abandoned railway sidings and cleared woodlands on chalk.

2.5.2.2 Zonation and succession

Scrub on neutral soils in the lowlands is a stage in succession from open ground or herbaceous communities to woodland. Only in the most exposed situations, such as on cliff tops, is scrub considered a climax vegetation. In successions on waste or derelict land, blackthorn, elder and hawthorn scrub occurs in mosaics with more open herbaceous vegetation and woodland, the patterning reflecting the history of disturbance at the site. On abandoned arable land or grassland, blackthorn or hawthorn thickets often have abrupt boundaries along fence lines. In extensively managed landscapes, the boundaries with grassland may be less distinct. Blackthorn scrub also occurs in linear formations along wood margins and woodland rides.

On abandoned grasslands, succession from mesotrophic grasslands (e.g. MG1 *Arrhenatherum elatius* grassland, MG5 *Cynosurus cristatus-Centaurea nigra* grassland, MG6 *Lolium perenne-Cynosurus cristatus* grassland) to blackthorn or hawthorn scrub occurs, often with *Rubus-Holcus* underscrub (W24) as an intermediate stage. This underscrub community also represents an early stage in succession on abandoned arable land. The succession progresses from scrub to oak (*Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodland W10) or beech (*Fagus sylvatica-Rubus fruticosus* woodland W14) woodland on soils of low base status, whilst on more base-rich, moist soils, *Fraxinus-Acer-Mercurialis* woodland (W8) may represent the end-point of succession.

2.5.2.3 Conservation value

This scrub type is common on disturbed fertile soils and abandoned land in the UK. However, mosaics of short turf, tall turf and scrub on neutral soils are extremely important for birds and invertebrates. In addition, patches of this scrub type may form important refugia for common species in intensively-farmed landscapes.

Prunus spinosa-Rubus fruticosus scrub characteristically contains fewer woody species than *Crataegus-Hedera* scrub but the three sub-communities encompass a similar range of species in the field layer. Similar scrub types have been described from northern France (Géhu 1964), from The Netherlands (Doing 1962, Westhoff & den Held 1969) and from Germany (Ellenberg 1978) and there is no evidence that the range of British stand types are distinct.

2.5.3 Scrub on acidic substrates

2.5.3.1 Scrub communities

Scrub stands dominated by gorse occur on dry, free-draining, base-poor, brown earths. Broom is often present, and can be the dominant shrub on drier, more acid soils. All such stands are

2. Definition and classification

placed in the *Ulex europaeus*–*Rubus fruticosus* scrub (W23) of the NVC. In dense stands, the understorey vegetation is poorly developed, but under more open canopies a grassy sward with species of acid grassland, such as common bent *Agrostis capillaris*, red fescue *Festuca rubra* and heath bedstraw *Galium saxatile*, is found. This scrub type is widespread on marginal land throughout the lowlands and upland fringes in the UK. Bryophyte cover may be high, *Rhytidiadelphus squarrosus* being the most frequent species.

On the driest and most acid heaths in the south-east of England, the introduced shrub shallon *Gaultheria shallon*, a garden escape, is becoming established.

The introduced shrub rhododendron *Rhododendron ponticum* is a vigorous invader of oak woods on acid soils at low altitudes in the west of Britain. This species also invades open vegetation in heathlands and bogs, forming dense scrub. The dense shade and thick leaf litter typical of such rhododendron thickets lead to severe impoverishment of the understorey. A rhododendron scrub community was proposed in the review of coverage of the NVC (Rodwell *et al.* 1998).

Juniper occurs as scattered bushes in heathlands at low altitude in northern England and Scotland but rarely forms true scrub vegetation. Juniper scrub on base-poor soils in the wetter areas of the UK is described in Section 2.6.4.

2.5.3.2 Zonation and succession

Gorse scrub occurs in mosaics with acid grasslands, heaths, and underscrub communities on marginal agricultural land. It is also found as a linear feature on woodland fringes and along hedgerows. The grasslands are typically *Festuca ovina*–*Agrostis capillaris*–*Galium saxatile* grassland (U4), or more acidophilous forms of mesotrophic grasslands (e.g. MG5, MG6). Many heath communities, dominated by dwarf gorse and ericaceous shrubs occur in intimate mixture with gorse scrub, the identity of the communities depending on geographical location. On sea cliffs, the scrub occurs in areas of maritime fescue grassland (MC9 *Festuca rubra*–*Holcus lanatus* maritime grassland, MC10 *Festuca*

rubra–*Plantago* spp. maritime grassland). In extensively grazed areas, there is usually an extensive fringe of *Pteridium aquilinum*–*Rubus fruticosus* underscrub (W25).

Gorse scrub occurs on patchy drift deposits in landscape characterised by neutral or calcareous soils. Here, this scrub type can show transitions to blackthorn or hawthorn scrub. It is in such localities that the so-called ‘chalk heath’ communities occur. Enrichment of the calcareous soils lying on the slopes beneath such deposits, combined with the ability of gorse to acidify its rhizosphere, allowing gorse and other calcifuges such as heather *Calluna vulgaris*, to coexist with calcicolous chalk grassland species.

Onward succession of gorse scrub to woodland is prevented by grazing or burning, resulting in a dynamic mosaic of this scrub type with acid grassland or heathland. Tall, eutrophic herb communities occur on fertile soils after burning or soil disturbance. The tree species which colonise gorse scrub are birch, oak and pine. Closure of the tree canopy results in oak woodland (W10 on fertile brown earths, W16 *Quercus* spp.–*Betula* spp.–*Deschampsia flexuosa* woodland on infertile, acid soils). In the upland fringes, such scrub is succeeded by mixed birch and oak woodland (W11 *Quercus petraea*–*Betula pubescens*–*Oxalis acetosella* woodland or W17 *Quercus petraea*–*Betula pubescens*–*Dicranum majus* woodland). On cliff tops, exposure may prevent further development of this scrub community.

2.5.3.3 Conservation value

This scrub type is widespread on suitable soils throughout lowland Britain. Although its botanical diversity is low, it is of considerable conservation value in the south because of the importance of its associated organisms or as part of habitat mosaic. For example, this scrub type is important for populations of stonechat *Saxicola torquata* and Dartford warbler *Sylvia undata*.

2.6 Upland scrub types

The definition of the upland zone used here follows that of Ratcliffe and Thompson (1988), that is, those areas lying typically above the limits of enclosed farmland. This section therefore includes scrub types found in areas at low altitudes where climatic conditions are particularly unfavourable, for example the exposed coasts of north-western Scotland.

2.6.1 Scrub on wet soils in the forest zone

2.6.1.1 Scrub communities

Willow carr is associated with open water transitions and mires in the wetter northern parts of Britain. Whilst not exclusively an upland scrub type, occurring as it does around lakes at low altitude, it is best considered a scrub type of the upland zone. In contrast to its southern counterpart, the *Salix–Betula–Phragmites* woodland (W2), alder and downy birch occur with lower frequency. In these conditions grey willow is joined by other *Salices* which have a northern montane distribution in Britain, most notably bay willow *Salix pentandra*. Many of the associated shrub species found in lowland willow carr are absent from these northern carrs. The understorey is heterogenous, with tall forbs such as meadowsweet, shorter forbs such as marsh-marigold *Caltha palustris* and sedges, the most frequent of which is bottle sedge *Carex rostrata*. Bryophytes may contribute significantly to the ground cover. In the NVC, such vegetation is described as *Salix pentandra–Carex rostrata* woodland (W3).

Three willow species are best considered with scrub types of the forest zone, although their distributions extend into the sub-alpine zone. Eared willow *Salix aurita* occurs widely in the Western Highlands, often with grey willow at lower altitudes. The ground flora of these stands resembles those of the *Betula pubescens–Molinia caerulea* (W4) or *Alnus glutinosa–Fraxinus excelsior–Lysimachia nemorum* (W7) woodlands of the NVC.

Upland scrub of tea-leaved willow *Salix phylicifolia* occurs in northern England and Scotland, usually on river banks. Stands can be found in Upper Teesdale, along the River Tyne and River Dee in Aberdeenshire. Such scrub stands form important refugia for a wide range of grazing intolerant plants such as wood crane's-bill *Geranium sylvaticum* and globeflower *Trollius europaeus* (Pigott 1956). The stands in northern England form the main location for shrubby cinquefoil *Potentilla fruticosa* in Britain (J. Hopkins, pers. comm.). Dark-leaved willow *Salix myrsinifolia* occurs in similar situations to tea-leaved willow, along river banks, lake shores and damp rock ledges.

Bog myrtle scrub also occurs in open mires in the upland fringes. This scrub type is similar to its lowland counterpart, described in section 2.4.3.

2.6.1.2 Zonation and succession

In open water transitions around lakes, willow carr is separated from open water by fen and swamp communities. On drier ground, the scrub can grade into woodland, often birch woodland (W4), or border wet pastures (Pearsall 1918, Tansley 1939, Pigott & Wilson 1978). In basin mires, willow carr occurs in complex mosaics with fen, mire and birch woodland communities, the vegetation patterns reflecting local variations in water levels and base status (Proctor 1974, Adam *et al.* 1975).

Succession of willow carr in these situations is likely to lead to birch (W4) or alder (W6) woodland. In some circumstances, woody vegetation may be a precursor to herbaceous bog, with Sphagnum increasing in abundance as terrestrialisation decreases the influence of the typically base-rich ground water on the vegetation of the mire surface (Rodwell 1991a).

2.6.1.3 Conservation value

Upland willow carr forms an important component of the landscape in areas with mosaics of open water, swamp, fen, mire and woodland. It forms a component of wet woodland, a priority habitat in the UK BAP.

Tea-leaved willow stands in northern England form important habitats for several rare plant species.

Residual alluvial forests (*Alnion glutinosae-incanae*)

CORINE: 44.3 NATURA 2000: 91E0

Bog woodland

CORINE: 44A1-44A4 NATURA 2000: 91D0

2.6.2 Scrub on dry soils in the forest zone

2.6.2.1 Scrub communities

Scrub dominated by hawthorn occurs widely in upland areas of western Britain (Tansley 1953). Other woody species present include blackthorn, grey willow, hazel, rowan and crab apple *Malus sylvestris* (Good *et al.* 1990). Such vegetation is not described in the NVC, but has similarities to the *Pteridium aquilinum–Rubus fruticosus* community (U20), and is best regarded as a treeless variant of the Quercion robori-petraeae.

2.6.2.2 Zonation and succession

Hawthorn scrub usually occurs as discrete patches on freely draining brown earth or brown podzolic soils on steeper slopes in upland pastures. These stands are surrounded by *Agrostis–Festuca* grassland or bracken (U20) communities. The patches may be formed by suckering or limited seed dispersal. The use of this scrub type by passerine birds for roosting may contribute to this patchiness.

Studies in Snowdonia have shown that individual hawthorn bushes in this vegetation type may be very long-lived. It is thought that colonisation of the grassland was the result of a past relaxation in grazing pressure, although some bushes may form a relict of previous woodland vegetation. Tree species are generally absent from the sward, so succession to woodland is unlikely to occur (Good *et al.* 1990).

2.6.2.3 Conservation value

Plant and animal communities associated with upland thorn scrub are generally of low diversity. This scrub type forms an important landscape element in upland areas, adding to their structural complexity. In these places, it provides important habitat for bird species such as stonechat *Saxicola torquata*, whinchat *Saxicola rubetra* and tree pipit *Anthus trivialis*.

This scrub type is rather uncommon on the continent of Europe and does not fall easily into European phytosociological systems. It may be regarded as a variant within the Querceta robori-petraeae lacking trees, for much of this bracken land can be shown to have been cleared of woodland in recent times.

2.6.3 Treeline scrub and scrub woodland

2.6.3.1 Scrub communities

Between the upper limit of the forest zone at the 'tree line', and the lower limit of the alpine zone, at the altitudinal limit of tree growth, lies the sub-alpine zone (MacKenzie 1997) or sub-montane zone (*sensu* Ratcliffe & Thompson 1988). Within this zone, tree and shrub species grow together and in places form a scrub woodland. Tree species including birch, hazel, oak, aspen *Populus tremula*, rowan *Sorbus aucuparia* and Scots pine *Pinus sylvestris* occur in this zone in stunted and wind-pruned forms.

For example, Scots pine becomes increasingly stunted towards the upper limit of its altitudinal range, above 600 m, through exposure to wind and low temperatures. Here, low-growing 'Krumholz' trees in excess of 200 years of age may be found. The understorey is usually composed of bilberries *Vaccinium* spp. with some heather and extensive bryophyte cover.

2.6.3.2 Zonation and succession

Treeline scrub woodland occurs very rarely in Britain, although scattered trees occur often in the sub-alpine zone zone, they seldom form scrub vegetation. Scots pine can be found growing at its altitudinal limit at only a very few places in the Scottish highlands. The most notable of these is at Creag Fhiaclach in the Cairngorms. Here, Scots pine scrub gives way to montane juniper scrub with increasing altitude. Below this altitude, pine forest consisting of patches of *Pinus sylvestris*–*Hylocomium splendens* woodland (W18 in the NVC) interspersed with open areas of heath with bilberry, heather and bearberry *Arctostaphylos uva-ursi* (H12 *Calluna vulgaris*–*Vaccinium myrtillus* heath, H16 *Calluna vulgaris*–*Arctostaphylos uva-ursi* heath). Succession of Scots pine scrub is prevented by the exposed conditions.

1.6.4.1 Conservation value

Scots pine scrub occurs in a few places at high altitudes in the Scottish highlands. These sites represent some of the only places in the UK where trees persist up to their altitudinal limit. Such scrub is a component of native pine forest, a Priority Habitat, and occurs in association with more open juniper formations.

* Caledonian forest

CORINE: 16.27 NATURA 2000: 2250

2.6.4 Upland juniper scrub

2.6.4.1 Scrub communities

Juniper forms scrub vegetation in the uplands of northern Britain, up to altitudes in excess of 650 m (Rodwell 1991a). Two subspecies of juniper occur in these situations, forming components of two different vegetation types. *Juniper communis* ssp. *communis* forms scrub vegetation that is a component of the *Juniperus communis* ssp. *communis*–*Oxalis acetosella* woodland (W19) of the NVC. This scrub type usually has a patchy spatial structure, with open areas and thickets of dense juniper. There are few other woody species associated with this scrub type, although stunted individuals of birch *Betula pubescens* occur infrequently. The open areas are characterised by vegetation composed of dwarf shrubs (e.g. bilberry), ferns (e.g. hard-fern *Blechnum spicant*), herbs (e.g. heath bedstraw, wood-sorrel *Oxalis acetosella*) and bryophytes (e.g. *Hylocomium splendens*).

Juniper communis ssp. *nana* occurs as a low growing shrub in mixed dwarf shrub heath (H15 *Calluna vulgaris*–*Juniperus communis* ssp. *nana* heath), on gentle slopes at the upper limits of the sub-alpine zone and lower limits of the alpine zone (Horsfield & Thompson 1997). It also occurs as isolated individuals in other alpine heaths such as *Calluna vulgaris*–*Arctostaphylos alpinus* heath (H17, Rodwell 1991b).

2.6.4.2 Zonation and succession

Upland juniper scrub occurs in zonations with a range of upland grassland heath and mire communities, the spatial patterning reflecting both edaphic conditions and grazing pressure. In areas where calcareous rock outcrops lead to base-rich soils, juniper scrub occurs alongside calcareous grassland (e.g. CG9 *Sesleria albicans*–*Galium sternerii* grassland, CG10 *Festuca ovina*–*Agrostis capillaris*–*Thymus praecox* grassland). On more acidic soils, juniper occurs with upland dwarf shrub heaths (e.g. H18 *Vaccinium myrtillus*–*Deschampsia flexuosa* heath). In this situation, boundaries between herbaceous vegetation with

scattered juniper bushes and true juniper scrub may be difficult to place. With increases in soil water logging, juniper scrub may give way to mire or wet heath communities (e.g. M10 *Carex dioica*–*Pinguicula vulgaris* mire, M15 *Scirpus cespitosus*–*Erica tetralix* wet heath)

Below the tree line, *Juniperus communis*–*Oxalis* scrub shows transition to woodland (usually W11, W17 or W18) with increasing cover of birch, oak or pine, scrub and woodland communities occurring in intimate mosaics. Above the tree line in the Scottish highlands, *Juniperus communis*–*Oxalis* scrub replaces pine scrub at the altitudinal limit of Scots pine.

At high altitudes, juniper scrub may represent a climax montane scrub community. However, at lower altitudes, it is likely that management factors, especially grazing pressure, limit colonisation by tree species. Here, juniper scrub is best considered a seral community (Rodwell 1991a).

2.6.4.3 Conservation value

The importance of juniper scrub for nature conservation is reflected in the fact that it is the most widely studied scrub type in the UK. Juniper has its own Species Action Plan in the UK BAP. Upland juniper scrub is one component of the juniper formations listed in the Habitats Directive. *Juniperus communis*–*Oxalis* scrub occurs in the forest zone in the Scottish Highlands and Southern Uplands. Stands occurring in the sub-alpine zone are rare and found mainly in the eastern Highlands. The total area of this montane scrub type is unlikely to exceed 100 ha in Britain (Horsfield & Thompson 1997). Scrub composed of *Juniperus communis* ssp. *nana* also has a restricted distribution, with an estimated area in Britain of 610 ha, occurring mainly in the northwest Highlands and Islands of Scotland (Horsfield & Thompson 1997).

The high altitude climatic climax stands of *Juniperus* - *Oxalis* scrub have close affinities with Scandinavian sub-alpine juniper scrubs such as the *Junipereto Betuletum nanae myrtilletosum* (Nordhagen 1928, 1943). However, the juniper in Scandinavia is *Juniperus communis* ssp. *nana* and there is a good representation of dwarf birch *Betula nana*, while in Scotland there is no evidence of an association between juniper and dwarf birch. Whether these differences are sufficient to merit the Scottish communities being treated as distinct is a matter for debate.

Juniperus communis formations on heaths or calcareous grasslands

CORINE: 31.88 NATURA 2000: 5130

2.6.5 Dwarf birch scrub

2.6.5.1 Scrub communities

Dwarf birch occurs as a constituent of blanket bogs, and forms clumps of scrub at some sites in the north and central Highlands. These dwarf birch bogs were first described by Poore and McVean (1957) and fall within the *Betula nana* variant of the *Calluna-vulgaris-Eriophorum vaginatum* blanket mire, *Vaccinium vitis-idaea*–*Hylocomium splendens* sub community (M19ci, Rodwell 1991b).

2.6.5.2 Zonation and succession

Dwarf birch occurs as stands in blanket bogs and as isolated individuals and small patches in other upland heath communities (M15 *Scirpus cespitosus*–*Erica tetralix* wet heath, M17 *Scirpus cespitosus*–*Eriophorum vaginatum* blanket mire). Dwarf birch is suppressed by grazing and burning, and within Britain it occurs primarily in situations where soil conditions limit these factors (Hester 1995).

The nature conservation value of scrub in Britain

2.6.5.3 Conservation value

Dwarf birch is a nationally scarce plant species in Britain (Stewart *et al.* 1994). Dwarf birch scrub is known from a limited number of sites in the north and central Highlands, but the exact extent of this scrub type is unknown. Similar communities occur in Scandinavia, often with dwarf birch attaining a greater height. Dwarf birch scrub forms part of the blanket bog habitat in Annex I of the Habitats Directive (Anon 1996).

Blanket bogs (* active only)

CORINE: 52.1-52.2 NATURA 2000: 7130

2.6.6 Sub-arctic willow scrub

2.6.6.1 Scrub communities

On wet base-rich soils in montane areas with low grazing pressure, Arctic-Alpine or Arctic-Subarctic species of willow may form a low scrub vegetation up to 1 m high. Downy willow *Salix lapponum* is the most widespread species and usually dominates, it is accompanied, and occasionally replaced, by mountain willow *S. arbuscula*, woolly willow *S. lanata* or whortle-leaved willow *S. myrsinites*. The understory contains sub-shrubs, grasses and bryophytes, but perhaps most notable is the abundance taller herbs which are intolerant of grazing and low-growing Arctic-Alpine herbs. The NVC places such vegetation in a single community (W20 *Salix lapponum-Luzula sylvatica* scrub).

2.6.6.2 Zonation and succession

Sub-Arctic willow scrub usually occurs as isolated stands on rocky knolls or cliff ledges in a mosaic of *Festuca-Thymus-Agrostis* calcareous grassland (CG10) or *Festuca ovina-Agrostis capillaris-Alchemilla alpina* grass heath (CG11). At high altitudes it is associated with *Festuca-Alchemilla-Silene* dwarf heath (CG12) and *Dryas octapetala-Silene acaulis* ledge communities (CG14).

In places where calcareous rocks form local intrusions into less base-rich substrates, Sub-Arctic willow scrub may occur on rocky knolls or ledges surrounded by a landscape dominated by calcifuge grasslands or heaths. Here, Sub-Arctic willow scrub grades with *Luzula sylvatica-Geum rivale* (U17) or *Luzula sylvatica-Vaccinium myrtillus* (U16) cliff ledge communities, which may contain isolated individuals of montane willows.

Rodwell (1991a) considers *Salix-Luzula* scrub to be sub-alpine climax vegetation on wet base-rich soils, replacing scrubby *Fraxinus excelsior-Sorbus aucuparia-Mercurialis perennis* woodland (W9) with increasing altitude. Such transitions may once have been widespread in the Scottish Highlands, but have been lost through increased grazing pressure.

2.6.6.3 Conservation value

Sub-Arctic willow scrub is one of the UK's rarest habitats, occurring as small discrete stands, nowhere larger than 0.5ha and largely confined to the Scottish Highlands. Many of the dominant shrubs are either Nationally Scarce or Red Data Book species. A Species Action Plan has been drawn up for woolly willow, a Priority Species in the UK BAP.

Within Europe, similar vegetation occurs only in Sweden and Finland. Selection of SACs in the UK has taken account of the association of this habitat with others listed in Annex I, namely Eutrophic tall herb, Alpine calcareous grassland, Alpine and subalpine heaths and Species-rich *Nardus* grassland (a priority habitat).

Based on the current much more widespread distribution of similar vegetation in Scandinavia, it is likely that it was once much more widely distributed in Scotland and has been brought to the verge of elimination by man's activities (Mardon 1991). The nearest equivalents to the *Salix-Luzula* scrub community in Europe are the various kinds of sub-alpine willow scrub described from Scandinavia by Nordhagen (1928, 1943) and Dahl (1956), particularly the *Salicetum geranium alpicolum* from Sikilsdalen and the *Rumiceto - Salicetum lapponae* from the Rondane area. According to Rodwell (1991a) there are distinct differences between these communities and our own montane willow scrub which generally has fewer tall herbs and does not spread into mire vegetation like its Scandinavian counterparts. More generally, the *Salix-Luzula* scrub belongs among the sub-alpine and alpine tall-herb communities in which Ellenberg (1978) has distinguished a *Salicion arbusculae* with prominent dwarf willows. It may be considered, as argued by Gilbert *et al.* (1997) that the differences between the Scottish and Scandinavian communities are sufficient to justify a special conservation effort for W20. The requirements to ensure its survival and expansion have been discussed by Mardon (1991) and Gilbert *et al.* (1997).

Sub-Arctic Willow scrub

CORINE: 31.622 NATURA 2000: 4080