Guidelines for the selection of biological Areas of Special Scientific Interest (ASSIs) on the Isle of Man

Volume 2: Detailed habitat and species criteria

Isle of Man Government

Reiltys Ellan Vannin

Volume 2
Detailed habitat and species criteria

Introduction

The following chapters describe natural and semi-natural vegetation communities on the Isle of Man, their relationship to established methods of classification such as the National Vegetation Classification, characteristics that will be taken into consideration when assessing a potential ASSI, and minimum criteria for selection. Where a habitat is rare or locally distributed on the Island, the most important known sites may be listed individually.

The habitat selection criteria are followed by criteria for site selection based on the presence of important species from a range of plant and animal groups. It should be noted that in many cases a site will qualify on both habitat and species grounds.

Both the habitat and species chapters contain an indication of the current level of knowledge about the subject. Where knowledge is limited, e.g. for some invertebrate and lower plant groups, there is an assessment of research needs and priority level.

Where there is a choice of several sites with the same important habitats or species present and a choice needs to be made about which site to select, the relative quality of the sites will be assessed using the Priority Sites Criteria in Part 3 of Volume 1.

Chapter index to Detailed Guidelines

Please note that in order to avoid duplication of habitat accounts some chapters – e.g. Upland habitats - may refer to sections of other chapters.

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Six-spot burnet moths *Zygaena filipendulae*

Part 4: Detailed selection guidelines

4.1 Woodland and scrub

Description

As with many offshore islands around the British and Irish coasts, the Isle of Man has no natural tree cover for the majority of its land surface. It is thought that most of the Manx native mature oak woodland was already cut down and exploited by the late Iron Age (Garrad 1972; Robinson & McCarroll 1990). Whilst it is possible for young trees and shrubs to regenerate naturally on ungrazed sites, the high levels of exposure to wind and sea spray tend to militate against the redevelopment of mature semi-natural woodland in any but the most sheltered valley locations. However, research into the ancient pollen and seed deposits in Manx soils has revealed that at one time the Isle of Man was almost entirely covered by woodland. Archaeological evidence of birch, hazel, juniper, willows, sessile oak, wych elm, Scots pine, common alder and ash has been found at varying abundances in the soil strata, indicating that different species have tended to dominate at certain periods in time: hazel, for example, being apparently more prevalent in the past than at present (Allen 1984; Robinson & McCarroll 1990).

Whilst pollen records indicate which Manx trees can reasonably be thought of as **native species**, the usefulness of trees to the human inhabitants of the Island has led to much importation, of "native" trees as well as exotics. Hence it can be very hard to assess whether a population of oak, for example, is truly of native origin, rather than from elsewhere in the British Isles or even further afield. The most confusing example of this is the case of Scots pine, which is present on the Island only as an imported species, but which was clearly once native and is still quite capable of setting seed in the wild and spreading from planted areas to form part of a semi-natural, regenerating woodland environment. Likewise, the woodland **ground flora** on the Island is by no means free from human modification, with many of the more ornamental plants either introduced to the Glens for decoration, escaped from adjacent gardens, or "helped" to spread from their preferred native habitats (Allen 1984). In general, though, the more well-established wooded valleys, glens and plantations support a moderately diverse ground flora similar to some of the semi-natural oak and ash woodland types described in the National Vegetation Classification.

Woodland and scrub are here taken to include all communities dominated by woody vegetation, except for dwarf shrub heath (such as heather- and Manx gorse-dominated habitats), which will be covered in the chapter on Heathland. **Veteran tree and dead wood habitats** will generally be most relevant to site selection on species criteria (e.g. for rare beetles), but they add value to woodland habitats in their own right; hence they are also considered here.

The distinctive, drooping native bluebell *Hyacinthoides non-scripta*, at Glen Rushen ASSI

Assessing woodland and scrub

On the Isle of Man, woodland and scrub vegetation is a broad habitat category which has probably been more drastically affected by human activities, both ancient and modern, than any other (see NCC 1975; Sayle *et al*, 1995; Allen, 1984). This, coupled with the effects of the Island's climate and maritime influences, has led to difficulties in comparing Manx woodland habitats with those in neighbouring countries. Substantial areas of semi-natural ancient woodland such as those in Wales or Scotland do not occur on the Isle of Man, and in some situations scrub communities appear to form a successional climax here. For these reasons, ground flora composition is likely to play an even more important role in the site assessment process than elsewhere, hence the most diverse semi-natural scrub communities will be given a status on a par with that of woodland.

All the Priority Sites Criteria listed in Part 3 of this document are relevant to woodland assessment; of these, the following are especially important when comparing similar woodland vegetation communities with a view to site designation:

Size

The overriding aim is to protect the largest areas available of the major woodland and scrub habitat types so that the largest possible populations of the species associated with each type can be protected. This presumption takes into account the fact that woodland ground flora is particularly vulnerable to "edge effects" on small, narrow and fragmented sites. This aim may however need to be qualified if the larger habitat stands are also the most disturbed, and where smaller examples are needed to compliment the features found in the largest areas (some woodland types, for example, are naturally limited to small areas). Sites with a mixture of vegetation communities, each of which occupy only a small area, are important in a different way because they may demonstrate the relationship between species distribution and historic or ecological factors. They may also be particularly species rich. Hence, although larger sites are desirable, smaller woodlands should not be ruled out without considering all the ecological factors involved.

Diversity

Within any given woodland, clearings, rides, variable topographical features (such as steep ground, rock outcrops or wet ground), variations in drainage and presence of veteran trees and/or dead wood will all increase the importance of a site through providing greater diversity. Likewise, woods which adjoin or are in mosaic with other habitats tend to be more valuable than those sharply abutted to arable or improved grassland, and diffuse open or bushy edges are better than sharp boundaries.

British woodlands generally have fewer species of trees, shrubs and herbaceous plants than their continental counterparts and as a whole have suffered more loss and fragmentation through human activity (Ratcliffe, 1977). This situation is even more extreme on the Island, where native woodland would have been even more impoverished in species, and almost all the original habitat had been lost or fragmented by the sixteenth century (Allen, 1984). All references to species–richness should be tempered by consideration of these factors.

In all cases, special features such as populations of uncommon species, well-developed scrub communities, extensive moss carpets or fern assemblages, boulder scree, and woodland ponds will be considered positive attributes. This includes small meadows or bits of rough grassland, remnant heath or moorland and any other features which could be of high importance for the overall invertebrate diversity of a site. Invasive introduced species, many of which are capable of severely reducing the diversity of both plants and invertebrates, should be treated as negative attributes.

In order to help with assessing the diversity and naturalness of woodland and scrub, the **Appendices** at the end of this Chapter provide a list of tree and ground flora species thought to be indicative of Manx woodlands with a high nature conservation value, along with some common introduced/escaped alien species which may indicate a modified flora and reduced overall diversity.

Rarity, fragility and vulnerability
The minimum criteria listed in the relevant section of this chapter (sections 4.1.1-4.1.4) each take into account the fact that some types of woodland are naturally more fragile and vulnerable to damage than others. In the case of the rare semi-natural woodland communities, **all** examples will qualify for selection as ASSIs provided that they are of sufficient size and fulfil the minimum criteria. In most cases, however, candidate sites will be selected from the best good examples of each woodland and scrub type. Sites will be considered to be "good examples" where they not only fulfil all the minimum requirements, but also one or more of the Priority Sites Criteria listed in Part 3.

Where rare species occur in a woodland, the site may qualify on species grounds alone, or may be considered a particularly good example of the habitat type. This applies to rare or locally distinctive woodland habitat features as well as individual species, particularly where the Isle of Man has a high proportion of such features that lend a distinctive character.

Local rarity is not the only category: for some species and features, the Island may have plenty of examples of a type that is rare or threatened elsewhere. In this case there is wider responsibility for protection. In woodlands this applies particularly to the Island's elm population, which has largely escaped the ravages of Dutch elm disease that have decimated elm populations elsewhere in the British Isles, and consequently is now of special importance.

Naturalness
It should be noted that, as with grasslands, very few woodland and scrub samples were taken from the Isle of Man to contribute to the original research that formed the basis of the National Vegetation Classification. Perhaps because of this, Manx vegetation communities do not always fit well within NVC categories. This does not mean that the NVC is worthless in the Manx context, but it has led to a situation where the NVC alone is not usually sufficient for assessing the nature conservation importance of a site. This is even more the case with woodlands than with grasslands (see **Section 1.3.4**, above, regarding the use of the NVC in the Manx context). In view of this, proportions of species likely to be native will be as important a defining characteristic as NVC types. Broadly speaking the higher the proportion of native species then the greater the nature conservation value. For lists of tree and ground flora species thought to indicate naturalness in a woodland, see Appendices A and B at the end of this Chapter.

Alien species in woodlands may threaten the native flora by displacement and/or hybridisation, resulting in a less diverse ecosystem overall. Commonly-occurring introduced woodland species are listed in Appendix C at the end of this Chapter – although it should be noted that the overall list of potential introductions to Manx woodlands is much greater. Such species may not cause a problem in plantation settings – such as the Manx National Glens – but in general, abundant and spreading exotic species, along with rubbish tips, grossly polluted streams, heavy grazing and forestry operations which eliminate over-mature timber, should all be considered negative attributes, to be excluded from selected areas wherever possible. Large blocks of coniferous plantation should also be excluded, the exceptions being:

- compartments within a larger site that is being considered for selection, where the rides and/or ground flora strongly reflect the surrounding, more diverse, habitats;
- small conifer stands within larger, more diverse woodlands, where exclusion of the stands would lead to an impractical boundary on the ground or for subsequent management;
- any areas which are vital for the survival of important species and hence qualify under the species criteria.

Position in ecological unit
Because most woodland tends to have quite distinct boundaries, it is usual to notify more or less complete units (NCC, 1989). If boundaries within woods are required, they should follow well-defined permanent features such as paths or streams. Major tree species changes (such as the edge of a coniferous area) may also be used as designation boundaries providing they fall within well-defined compartments – in which case care should be taken to ensure that only long-term compartment boundaries are chosen. For old sites, boundary banks should be included as they may have ancient trees and special flora.

Consideration should be given to the inclusion of fringes of recently-developed semi-natural woodland or scrub outside the main area of woodland. Such features provide additional diversity as well as the opportunity to examine woodland processes such as species colonisation. Fringe habitats also allow for the possibility of natural extension of woodland by gradual regeneration along existing margins. This is of particular value in or adjacent to upland areas (see Chapter 4.7 for details of upland site selection).

Large blocks of semi-natural vegetation adjacent to a wood should normally be considered on their own criteria. The exceptions are mosaic sites with habitat mixtures where no individual element reaches the minimum standard for ASSI selection, but which together form a valuable wildlife site. Each site can only be treated on its own merits, and where an atypical site is chosen, full reasons for the choice of site and boundary will be given.

Where areas of woodland are much smaller than the minimum recommended area for ASSI selection in their own right, but are attached to larger grassland or heath habitats, they may still be designated under the relevant grassland or heathland criteria as a valuable mosaic element.

Hart's-tongue fern *Phyllitis scolopendrium*, at Glen Maye ASSI

Woodland and scrub types

The types of woodland stand structure typically associated with traditional management of UK and Irish woodlands - wood pasture, coppice and so forth - are not usually evident on the Isle of Man, and cannot be used as a method of categorisation. There are, however, a range of broad woodland and scrub types on the Island, according to age, structure, ground flora composition and degree of human influence. For example, the DAFF Phase 1 Habitat Survey recognises 10 different "woody" categories, divided according to whether the vegetation is woodland or scrub, dense or scattered, broadleaved or coniferous (Sayle *et al*, 1995). For the purpose of the Criteria, woodland and scrub on the Isle of Man have been grouped more broadly, as follows:

Semi-natural broadleaved woodland
This consists of fragments of woodland/groups of trees which are believed to have grown or regenerated from native (post- Ice Age) sources (distinguished if possible through DNA analysis), and areas of semi-natural woodland which may have regenerated from planted and native sources. Truly semi-natural woodland with negligible modification from introduced species and human activities is rare; such habitats tend to occur within the sheltered confines of steep river valleys, or in a "dwarf" form on sea cliffs.

Plantations
Well-established woodland most commonly occurs in the **Manx National Glens** – most of which result from the Victorian desire for attractive outdoor leisure areas, but which may also support a range of naturally-occurring tree, shrub and ground flora species, some of which are likely to be of native origin. All Manx woodland has some semi-natural vegetation, if only in the ground layer. The best examples have a high proportion of native species in tree, shrub and ground layers.

Other plantations that may be of value for wildlife include areas of conifer or mixed plantation which are sufficiently old and well-established to have developed a diverse woodland ecosystem. Even less diverse conifer plantations may sometimes provide valuable habitat for particular groups, notably birds of prey. Forest structure may be more important than species.

Dry scrub
Whilst there are few unmodified tree habitats on the Island, semi-natural scrub is plentiful and can form a diverse habitat that approaches semi-natural woodland in its structural characteristics and species composition. Examples include bracken- and gorse-dominated sites on the rare occasions when they are allowed to develop into regenerating woodland, and coastal cliffs, where exposed conditions can result in a mix of typically short woody species alongside trees growing at scrub height, such as stunted sessile oaks, birch and rowan.

Curragh
The most distinctive Manx scrub habitat is willow-dominated scrub on wet, peaty soils, known generally as curragh. The majority of curragh has a relatively low, scrubby canopy, but the most well-established examples may have a species composition similar to wet woodland, with taller trees such as ash, alder and aspen. This represents an internationally restricted habitat type. Curragh is strongly associated with other peatland and open water habitats, e.g. fen and ditch systems, and its value as part of a mosaic of related habitats should always be taken into account.

Several examples of each type should be selected in order to account for the geographical variation in structure, floristic composition, animal assemblages and habitat associations that characterise Manx woodland and scrub. The higher the variability of plant and animal communities of any woodland type on the Island, the more examples should be considered. The same applies where the type is nationally rare or particularly well-represented on the Island as opposed to elsewhere. The overall range of sites selected should also encompass all the important special features which occur in that type of woodland or scrub.

The description, classification, status and distribution of each of the main woodland and scrub types are each treated separately here for reasons of clarity and ease of reference. However, when assessing a site in the field it should be borne in mind that this is an artificial separation. Sites which do not "fit" the broad categories are not necessarily poor examples of species-rich communities, and may be as important for wildlife as more "typical" sites.

Sections 4.1.1-4.1.4, below, give detailed descriptions, distribution and status accounts for each of the main types of woodland and scrub on the Island, alongside the National Vegetation Classification (NVC) categories they most closely resemble, and minimum criteria for selection.

4.1.1 Semi-natural broadleaved woodland

Description and Distribution

The natural climax woodland of the Manx lowlands is hard to discern now that so few semi-natural woods remain, but it seems likely that for most of the drier soils of the Island sessile oakwood is the natural dominant. Ash, wych elm and hazel also feature strongly in lowland woodland, frequently alongside sycamore (a non-native and often invasive species thought to have been brought to the Island "some time before 1760" (Allen, 1984)). Examples include relict oak-and-hazel woods in lower Glen Maye and upper Glen Auldyn. On higher ground, rowan is a common pioneer and a strong element of semi-natural regenerating woodland. Wet ground typically supports willows ("sallies"), birch, ash and alder. Whilst native woodland regenerates well on the more sheltered areas of the Island, it is virtually absent from the more extreme environments – the wettest and most exposed – which tend to support a climax of curragh or coastal scrub rather than tall woodland. These habitats are covered described separately in sections 4.1.3 and 4.1.4, below.

The Island's small remnants of semi-natural woodland are located mainly along the rivers and streams in small steep-sided valleys, often in comparatively inaccessible locations where surviving ancient woodland species could have persisted, out of reach of human clearance activities and most grazing animals. This woodland tends to be dominated by ash, wych elm and sycamore. There are also a number of isolated stands of sessile oak *Quercus petraea,* usually on steep coastal slopes beyond reach of most grazing animals. These have long been thought to be descended from native stock, and recent chloroplast DNA studies tend to confirm this hypothesis (Cottrell *et al*, 2002). It is also possible that "abbey land" oak woodland in Narradale, where evidence of large old oak stools can still be seen, has survived without ever being totally cleared (Garrad, *pers comm*.).

Semi-natural broadleaved woodland status

The 1994 Ecological Survey (based on Phase 1 Habitat Survey data) found 167ha of semi-natural broadleaved woodland on the Island – 3.6% of the Island's total woodland, 1% of all the semi-natural habitats recorded, and less than 0.3% of the total Island land use. The largest semi-natural broadleaved woodland site found was just 9ha, and the mean average size was around half a hectare (Sayle *et al*, 1995). This makes it one of the rarest and most vulnerable semi-natural Manx habitats. For this reason, the Manx Wildlife Sites Handbook (Keehan, 1999) states that *all* relict **oak wood**, and the majority of all other semi-natural broadleaved woodland, should be considered for Wildlife Site selection.

In the European context, Manx native woodlands are examples of British woodland types which are themselves western outliers of the larger distribution pattern of continental European forest.
Manx woodlands are particularly characteristic of Western Britain, with its mild, damp, oceanic climate. They are typified by species-rich and luxuriant communities of ferns, mosses and liverworts, with similarly oceanic lichen flora. This kind of woodland is very restricted in distribution, featuring in both the UK Biodiversity Action Plan (which lists Upland mixed ashwood, Wet woodland and Upland oak wood as Priority Habitats) and Annex 1 of the EU Habitats Directive (which includes both Dry oak-dominated woodland and Western acidic oak woodland).

Veteran trees and **dead wood** have both been recognised as having a high conservation status. A recent report states that European woodlands have around 5% of the volume of dead wood that might be expected under natural conditions, making it a critically low habitat resource – dead wood specialist species being the single largest group of threatened plants, animals and fungi in Europe. The report recommends that living veteran trees, standing dead trees, lying dead trees and dead-wood-rich litter are all elements of a healthy woodland which need to be encouraged and increased in volume in order to safeguard woodland biodiversity, especially in protected areas (WWF, October 2004).

Classification of semi-natural broadleaved woodland

Semi-natural broadleaved woodland on the Island may be classified broadly as outlined in **Table 4.1.a**.

Minimum selection criteria for semi-natural broadleaved woodland

Wet woodland

All examples of mature semi-natural wet woodland which fulfil at least one of the Priority Sites Criteria listed in Part 3 should be considered for selection, with special priority given to sites with the greatest size, naturalness and diversity, or best position within an ecological unit.

Lowland oak and ash woodland

- All examples of lowland oak and/or ash woodland over 2ha in extent should be considered for selection, even if their conservation condition is currently less than favourable.

- Smaller examples of lowland oak and/or ash woodland should *all* be considered for selection if they fulfil at least one of the Priority Sites Criteria listed in Part 3.

Upland oak and ash woodland

- All examples of upland oak woodland over 2ha in extent should be considered for selection, even if their conservation condition is currently less than favourable, whether or not they are part of a larger upland site designation.

- Smaller examples of upland oak woodland should *all* be considered for selection if they fulfil at least one of the Priority Sites Criteria listed in Part 3.

Upland woodland will usually be assessed according to the Upland Habitats criteria detailed in Chapter 4.7.

Dryad's saddle fungus *Polyporus squamosus* is one of the many organisms which benefit from veteran and dead trees; the large fruiting bodies form a micro-habitat for invertebrates

Table 4.1.a: Broad categories of semi-natural woodland on the Isle of Man

Type and Description	Species rich?	Closest NVC categories (see Rodwell, 1992[1])	Rarities present?	Protected species present?
Wet woodland Very restricted in distribution. Usually found in association with curragh, and containing some of the same elements and NVC types. Occasionally occurs on upland fringes. Birch-dominated examples are notable for the occasional presence of *B. pubescens ssp. tortuosa* – a small birch variety with fragrant foliage.	Not always botanically diverse, but may support diverse bird and invertebrate populations. Very species rich when found in association with related habitat eg. Open water, mire.	Mature W4 – *Betula pubescens-Molinia caerulea* woodland No Island NVC sample W7 – *Alnus glutinosa-Fraxinus excelsior-Lysimachia nemorum* woodland No Island NVC sample	Rare birds and invertebrates a possibility; rare plants possible in diverse examples	Yes. Several Schedule 1 birds. Noted for providing winter hen harrier roost
Lowland oak and ash woodland Oak and ash dominated woodland with a range of other native trees and shrubs, often indeterminate with upland woodland types and featuring sessile, rather than English, oak (although the two species are not always well-defined on the Island (Allen 1984)).	Yes	W8 – *Fraxinus excelsior-Acer campestre-Mercurialis perennis* (ash/field maple/dog's mercury) woodland Note that both *A. campestris* and *M. perennis* are absent from the Island as native spp. However, ash woodland on more base-rich Manx soils has other similarities to W8, mostly in the ground flora composition Two Island NVC samples. W9 – *Fraxinus excelsior-Sorbus aucuparia-Mercurialis perennis* (ash/rowan/dog's mercury) woodland Note: *M. perennis* is absent from the Island as a native species; however, other aspects of W9 woodlands are clearly evident in some of the ash/rowan/wych elm communities in steep stream valleys and on the edge of the uplands No Island NVC sample W10 – *Quercus robur-Pteridium aquilinum-Rubus fruticosus* (English oak/bracken/bramble) woodland One Island NVC sample	Strong possibility of plant, fungi, invertebrate, mammal and bird rarities	Strong possibility of Schedule 1 birds, Schedule 7 plants and bats

Type and Description	Species rich?	Closest NVC **categories (see Rodwell, 1992[1])**	Rarities present?	Protected species present?
Upland oak and birch woodland Diverse, often rather open woodland usually restricted to stream valleys and steep-sided gills. Often strongly associated with other upland habitats, and notable for lush fern and moss growth. All but the largest examples should be considered under the Upland habitats Criteria in Chapter 4.7. Note: There are places where birch will regenerate on valley sides when grazing is removed; this may be treated as a scrub community (see below) or as an immature upland oak and birch woodland, depending on the stage of development and the position in the surrounding ecological unit.	Yes, although sometimes less diverse than lowland oak woodland	W9 (see above) W11 – *Quercus petraea-Betula pubescens-Oxalis acetosella* (sessile oak/downy birch/wood sorrel) woodland One Island NVC sample W17 – *Quercus petraea-Betula pubescens-Dicranum majus* (sessile oak/downy birch/great fork moss) woodland No Island NVC sample	Possibility of plant, fungi, invertebrate, mammal and bird rarities	Possibility of Schedule 1 birds, bats and Schedule 7 plants eg. Beech fern *Phegopteris connectilis*, Wilson's filmy fern *Hymenophyllum wilsonii*.

4.1.2 Plantations

Description and Distribution

Many of the largest areas of broadleaved woodland are **Manx National Glens** (17 in total). These were planted largely in the latter part of the 19th century and usually contain mature stands of trees. The process of re-developing the Island's woodland began in the 18th century when landowners, most notably Bishop Wilson, began planting in the many glens and in private gardens. This continued into the Victorian period and the heyday of Manx tourism, when glens were planted with a wider variety of ornamental trees and shrubs and opened to the public as "pleasure grounds". The most commonly planted species are beech, wych elm, sycamore, and some oak, sweet chestnut and horse chestnut (Garrad 1972 & 2003). Such areas of broadleaved woodland can be of high value for wildlife.

Parkland is a special category of planted area that is not noted for its ground flora, but which can provide excellent invertebrate habitat due to the presence of large and over-mature specimen trees. This advantage is further increased by sympathetic management practices such as leaving large dead trees in situ, or keeping felled wood on site for the benefit of dead-wood invertebrates. There is very little classic parkland on the Isle of Man, although some estates have woodland landscaping which allows for the retention of large specimen trees. Any **veteran trees** are of value for wildlife, and the presence of such trees will be a material factor in ASSI selection for any site, whether woodland-dominated or not.

Well-established **beech woodland** is rare on the Island and not a native habitat, but it can have exceptional fungus diversity, and as such could fall within Priority Sites Criteria for particular species groups.

Much of the more recent broadleaved planting is composed of mixed broadleaved trees including wild cherry and other more decorative species. Such areas vary in ecological diversity depending on location and proximity of more diverse woodland. Large areas of young, native tree species adjacent to existing mature broadleaved woodland may offer bird and invertebrate territory even though the ground flora under the plantation is not particularly diverse.

Conifer plantation, mostly dating from the 20th century, accounts for well over half of all the woodland and scrub on the Island (*Sayle et al*, 1995). Dark, closely-spaced spruce plantations, which have little light reaching the field layer and a dense carpet of needles, tend to have the least ecological diversity. Plantations that have gaps or "failed" areas may however offer good localised heath or bog habitats, often sheltered by the surrounding trees. More mixed plantations, especially those with a proportion of larch and mixed scrub margins, tend to attract more birds and invertebrates, along with a few ground flora species that can take advantage of the slightly better light levels. Larch and pine plantations appear to attract better fungal communities than spruce (Hodgetts, 1996). All well-established conifer plantations can offer bird habitat, albeit for a more limited range of species than broadleaved plantations. In a few cases, conifer plantations may be significant nesting sites for rare species, notably birds of prey (Cullen & Jennings, 1996). Areas of young or failed conifer plantation can provide valuable bird habitat for hen harrier *Circus cyaneus* and short-eared owl *Asio flammeus,* where the canopy remains very open*,* providing shelter and perches.

Classification of plantations

Plantations are usually classified simply as broadleaved, mixed or coniferous. These categories do not relate closely to the National Vegetation Classification, but it should be noted that in the case of well-established broadleaved plantations the ground flora is likely to have features and species in common with semi-natural woodland types as listed in **Table 4.1.a**, above. For the purpose of the Criteria, species-rich broadleaved plantations are considered as a separate category to other broadleaved and mixed plantations, as detailed in **Table 4.1b**.

Table 4.1.b: Broad categories of plantation on the Isle of Man

Type and Description	Species rich?	Closest NVC category (see Rodwell, 1992[1])	Rarities present?	Protected species present?
Species-rich broadleaved plantation Characterised by at least three of the following attributes: • mature canopy and varied understory structure consisting predominantly of native species (listed in Appendix A); • a range of Manx native ground flora species (listed in Appendix B); • absence or minimal presence of introduced species (listed in Appendix C); • other features indicative of a thriving woodland ecosystem, eg. good fungal assemblages	Yes	May have ground flora species in common with any of the NVC categories listed in **Table 4.1a**	May support rare plants, invertebrates, bats and birds	Possibly, particularly bird and invertebrate species
Parkland Collections of large mature, over-mature and veteran trees dating from Victorian or earlier planting	Possibly rich in certain species groups		May support rare invertebrates, lichens and fungi	May support protected birds and invertebrates
Other broadleaved and mixed plantation Recently replanted conifer blocks, amenity planting areas etc.	Not usually		Not usually	May support protected birds
Conifer plantation	No		Not usually, although rare birds such as crossbill may use plantations	May support protected birds

Plantation status

The majority of plantations on the Isle of Man consist of structured compartments of commercial conifers such as larch, lodgepole pine, Scots pine, Sitka spruce and Western red cedar. The 1994 Ecological Survey also shows 1.11 % of the Island to have broadleaved and mixed plantation – a small proportion compared with the quantity of conifer plantation, but still more than three times the amount of semi-natural broadleaved woodland (Sayle *et al*, 1995).

Well-established broadleaved plantations such as the more diverse Manx National Glens do not attract the same attention from conservationists as semi-natural woodland, but are recognised nevertheless as providing a good habitat for woodland birds, mammals and invertebrates. They may also form a reservoir for native woodland ground flora species and regenerating native trees and shrubs, which, together with the more ornamental planted species, form a comparatively diverse woodland ecosystem. An example of this is the presence of good populations of woodland fungi in glens such as Glen Helen and Dhoon Glen, and plantations such as the Montpelier beech wood (Garrad, 1972). Planted glens also have the great advantage of accessibility and public appeal, making them especially well-suited to field trips and environmental education. This combination of valuable features has led to the protection of Manx glens as a national asset, and as such they have a higher status in terms of local recognition and protection than most other woodland on the Island.

Parkland trees are often protected for their great visual importance by registering them under the Tree Preservation Act 1993. Other areas of broadleaved plantation attract less protection, and their conservation status will depend to a large extent on their position within a more diverse ecological unit. In the wider context, the significance of parkland trees for invertebrate communities in particular has been recognised in the UK Biodiversity Action Plan, where Lowland wood pasture and Parkland are Priority Habitats.

Stands of wych elm in both glen and parkland settings have a special importance, as the Isle of Man as a whole now has one of the best collections of elm in the British Isles, most of which is likely to be of native British stock (see http://www.gov.im/daff/crops/trees/elm/welcome.xml). This is chiefly due to the relatively low incidence of Dutch elm disease on the Island, compared with e.g. England, where native elm species have been devastated by the disease. We therefore have a special responsibility to ensure that this threatened reservoir of biodiversity is protected.

Conifer plantations similar to those on the Island are to be found throughout commercial forestry areas in the northern hemisphere, with large areas of Scotland, Wales and to a lesser extent England all having plantations of similar structure and composition. Birds such as siskins, redpolls and goldcrests benefit from conifer plantations, and some birds of prey may take advantage of the nesting vantage points they provide. Spruce and pine plantations may also attract rare crossbills (Cullen & Jennings, 1986). In general, though, these habitats are not noted for their biological diversity and their status as wildlife areas is usually linked only to the presence of particular rare species, or their useful accessibility for public access and educational visits.

Minimum selection criteria for plantations

Species-rich broad-leaved plantation (as defined in Table 4.1b)
Areas of species-rich broad-leaved plantation of 2 or more hectares in extent will be considered for selection where they fulfil one or more of the Priority Sites Criteria listed in Part 3; priority will be given to sites which fulfil several Priority Sites Criteria and form part of a larger woodland unit which includes semi-natural broadleaved woodland.

Parkland
There is currently insufficient data to assess the importance of parkland on the Island for the conservation of rare dead wood and mature tree species. Parkland will usually be selected only where it forms part of, or lies adjacent to, an area of habitat that merits designation as a whole, *or* on individual species criteria where it is known to be a vital habitat for rare invertebrates or other groups.

However, the designation of an exceptionally large and/or diverse parkland tree collection as a habitat in its own right should not be ruled out, if it can be shown to fulfil one or more of the Priority Sites Criteria listed in Part 3.

Other broadleaved and mixed plantation
Other broadleaved and mixed plantations will usually be selected only where they form part of a broadleaved woodland that merits designation as a whole, or on individual species criteria where they form a vital habitat for rare birds or other groups.

Conifer plantation
Conifer plantations will usually be selected only where they form part of a broadleaved woodland or other (e.g. heathland) habitat that merits designation as a whole (eg at the Ayres), or on individual species criteria where they form a vital habitat for rare birds or other groups.

4.1.3 Dry scrub

Description and Distribution

Scrub is a widespread habitat on the drier soils throughout the Isle of Man, providing extensive areas of cover for common bird and mammal species. Typically, dry scrub results from encroachment of hedging species, such as hawthorn, blackthorn and European gorse, onto ungrazed grassland and ruderal vegetation. Scrub communities may also spread naturally from woodland onto suitable adjacent land, or colonize naturally if ruderal vegetation such as dense bracken is left ungrazed.

At its most diverse, dry scrub offers good bird and invertebrate habitat, and a sheltered environment for species more typical of woodland ground flora, such as bluebells and common dog's-violet, which are revealed as a striking flush of colour on brooghs and coastal slopes in spring. Dense scrub also forms a useful habitat corridor where thick woody hedgerows link otherwise isolated semi-natural habitats. Typical species include hazel, holly, immature elm, downy birch and elder in addition to the ubiquitous gorse, hawthorn and blackthorn.

Naturally regenerating areas of scrub, such as bracken areas on which young ash, mountain ash/rowan and oak are starting to grow up, represent the start of a process of semi-natural woodland regeneration that will eventually result in mature woodland communities if allowed to grow up in the long-term absence of clearance or grazing pressure. This process is a crucial element of diverse woodland ecosystems, and for this reason semi-natural scrub communities adjacent to semi-natural broadleaved woodland have an important role to play in woodland conservation.

Classification

Dry scrub on the Island may be classified broadly as outlined in **Table 4.1.c.**

Table 4.1.c: Broad categories of dry scrub on the Isle of Man

Type and Description	Species rich?	Closest NVC categories (see Rodwell, 1992[1])	Rarities present?	Protected species present?
Hawthorn scrub This is mostly concentrated in the base-rich south of the Island Although very commonly planted in hedges and occasional in broadleaved woodland, extensive hawthorn scrub is uncommon, possibly because it favours base-rich soils. There is much doubt as to whether hawthorn has ever been truly native to the Island (see Allen, 1984).	No	W21 – *Crataegus monogyna-Hedera helix* scrub Note: scrub categories in the NVC are considered ubiquitous throughout, hence no sample maps were given	Not usually	May support Schedule 1 birds
Coastal scrub Characteristic of coastal slopes, where it may take a very low, wind-sculpted form. Usually dominated by blackthorn, although stunted oaks, birch, hawthorn, rowan and other scrub species may also occur. Bracken and/or bramble underscrub is common, and may have a striking bluebell-dominated "ground flora" in Spring.	Variable; may be quite diverse, especially if woodland ground flora species are present in the underscrub.	W22 – *Prunus spinosa-Rubus fruticosus* scrub W25 – *Pteridium aquilinum-Rubus fruticosus* underscrub	Not usually; however, coastal bracken underscrub with common dog's violet may support Dark green fritillary butterflies	May support Schedule 1 birds or bush crickets.
European gorse scrub Generally regarded as a nuisance, but may provide nitrogen-rich litter and protection from grazing, both of which may offer cover for regenerating native woodland.	No	W23 – *Ulex europaeus-Rubus fruticosus* scrub W25 – *as above*	Not usually	May support Schedule 1 birds;

Type and Description	Species rich?	Closest NVC **categories (see Rodwell, 1992[1])**	Rarities present?	Protected species present?
Hedgerows Ancient hedgerows are not a feature of the Manx countryside, and sod hedges are more prevalent than woody hedges; however, there are some examples of well-established species-rich woody hedgerows, especially in the North of the Island, which have a diverse ground flora and offer excellent bird and invertebrate habitat.	Variable; not usually very diverse, but exceptional examples may have good ground flora and invertebrate diversity	Usually dominated by hawthorn, blackthorn or European gorse, so related to any of the above NVC categories. May also have a ground flora with some elements of semi-natural broadleaved woodland types listed in Table 4.1.a	Not usually	May support Schedule 1 birds, bush crickets in coastal sites, or, rarely, Schedule 7 plants

Note: dwarf heath shrub communities, including Manx gorse habitats, may also approach scrub height on suitable sites; these are covered in Chapter 4.3 Lowland heathland, and Chapter 4.7 Upland Habitats.

Hazel *Corylus avellana* at Glen Maye ASSI

Dry scrub status

The 1994 Ecological Survey indicates that around 6% of the Island's semi-natural habitat consists of scrub (over 1000ha) (Sayle *et al*, 1995). However, the Survey did not distinguish between dry and wet scrub; the exact proportion of curragh is therefore unclear. What is obvious is that dense scrub is far more prevalent on the Island than semi-natural broadleaved woodland, a fact which suggests, perhaps, that one way in which scrub should be valued is as a naturally regenerating precursor to more semi-natural woodlands in the future.

The importance of scrub as a diverse habitat has not historically received much recognition from conservationists pre-occupied with trying to save dwindling semi-natural woodland. However, the value of scrub as a habitat in its own right appears to be increasingly recognised, particularly in the case of ancient and/or species-rich hedgerows, which are now a UK Biodiversity Action Plan Priority Habitat. Scrub is also referred to in the Habitat Action Plan for another Priority Habitat, Maritime cliffs and slopes (covered in Chapter 4.6 Coastal Habitats).

Minimum selection criteria for dry scrub

Areas of **dense dry scrub** which support a range of native species as listed in Appendices A and B, and which are not adversely affected by introduced species (Appendix C), will be considered for selection where:

- The area of scrub concerned is larger than 4ha and fulfils at least one of the Priority Sites Criteria listed in Part 3; or
- The area of scrub is immediately adjacent to a semi-natural broadleaved woodland or species-rich broadleaved plantation which is also under consideration as an ASSI, regardless of the size of the area of scrub concerned; or
- The scrub forms part of an upland or coastal habitat group which is under consideration as an ASSI, regardless of the size or the area of scrub concerned.
- Sites where dry scrub is thought likely to form a viable precursor to naturally regenerating native woodland will usually be given the highest priority for selection.

Species-rich hedgerows which support a range of native species as listed in Appendices A and B, and which are not adversely affected by introduced species (Appendix C), will be considered for selection where:

- The hedgerow in question fulfils at least two of the Priority Sites Criteria listed in Part 3, one of which must be Size; or
- The hedgerow forms part of a larger designation area (eg. adjacent to a semi-natural broadleaved woodland) as for dense dry scrub (above).

4.1.4 Curragh

Description and Distribution

The term "curragh" is an old Manx word for bog; however, it has come to be used to describe the willow-dominated wet scrub which forms a very characteristic element of the Manx landscape on wet, peaty soils. It is restricted to lowland areas, principally the Ballaugh Curragh (an ancient basin mire) and the Central Valley Curraghs, which include Greeba Curragh and similar, smaller areas of wet willow scrub in the central lowlands. Small areas of curragh also form elsewhere where drainage is impeded, often in association with open water and swamp habitats, but not on the same scale as the Ballaugh or Greeba curraghs.

Curragh usually occurs within a mosaic of interrelated wetland habitats such as fen mire and bog pools. It may also contain ditch systems related to ancient and modern agricultural activities. These associated habitats may support rare and/or locally-distributed plant and invertebrate communities. In the case of invertebrates, research is incomplete, but mollusc, beetle and spider records all suggest that open water habitats in association with curragh are an important element of Manx biodiversity (BDIS). Curragh is perhaps most well-known for its value as a habitat for songbirds, water birds and birds of prey such as the hen harrier, which roosts on undisturbed wet ground in the winter. High numbers of bird species can be found in areas of curragh.

Classification

Manx curragh forms a single category in its own right. It is overwhelmingly dominated by one species – Grey willow, *Salix cinerea ssp oleifolia* ("sallies"). In this respect it most resembles NVC type W1 *Salix cinerea-Galium palustre* (grey sallow/marsh bedstraw) woodland, for which there are two Isle of Man type samples mapped in the British Plant Communities volume relating to woodland and scrub (Rodwell, CUP 1991). However, it also has affinities with wet ash, alder or birch woodland such as W4 *Betula pubescens-Molinia caerulea* (downy birch/purple moor-grass) woodland, or W8 *Alnus glutinosa-Fraxinus excelsior-Lysimachia nemorum* (alder/ash/yellow loosestrife) woodland (Rodwell, 1992[1]).

Curragh status

Because of its association with diverse wetland habitats and its potential for abundant bird life, curragh has a well-documented place in Manx cultural history Areas such as the Ballaugh Curragh provide an invaluable archaeological resource and important pollen records, in addition to its high importance for nature conservation. This importance has long been recognised in the case of the Ballaugh Curragh, the central part of which is under the protection of Manx National Heritage. Other areas of curragh have no such protection, and the relatively rich soils which underlie the willow scrub make these areas popular targets for agricultural reclamation. The area of mature curragh outside MNH land is therefore considered to be under threat. For these reasons, The Manx Wildlife Sites Handbook recommends that all areas of alder carr and all good examples of willow scrub over 2ha in extent should be considered for Wildlife Site selection (Keehan, 1999).

In the wider context, wet woodland, including wet willow habitat like Manx curragh, is recognised in the UK Biodiversity Action Plan as a Priority Habitat. Two other strongly related habitats, Floodplain alder woodland and Bog woodland, are listed in Annex 1 of the EU Habitats Directive. The diverse and complex mosaic of wetland habitats contained within large areas of Manx curragh, and its importance for birds, make it a potential candidate for Ramsar site selection as well as national designation.

Minimum selection criteria for curragh

- All areas of curragh over 10ha in extent should be considered for selection;
- All areas of curragh over 2ha in extent which occur in association with at least one other wetland habitat should be considered for selection where they are not adversely affected by negative factors such as invasive introduced species (see Appendix C), tipping, heavy stock poaching or other long-term damage;
- All other areas of curragh should be considered for selection where they fulfil at least one of the Priority Sites Criteria listed in Part 3 and form part of a larger habitat mosaic such as wet woodland and fen mire;
- Other curragh areas may be selected on the grounds of individual species criteria.

See also: semi-natural broadleaved woodland criteria (Section 4.1.1) and especially the criteria for wet woodlands.

Appendices to Chapter 4.1: Diagnostic species lists

Appendix A: Tree and shrub species thought to be native to the Isle of Man

Scientific name	English name	Manx name	Notes
Alnus glutinosa	common alder	farney	A good tree for wet places, except where the soil is very acid.
Betula pendula	silver birch	beith argid; billey veih	Prefers well-drained sites.
Betula pubescens ssp pubescens	downy birch		Tolerates wetter, more acid soils than *B. pendula*. The commonest birch on the Island.
Betula pubescens ssp tortuosa	downy birch		As above, but a more shrubby, upland subspecies. Has distinctive aromatic foliage.
Corylus avellana	hazel	couyll	Thrives in most habitats, esp. richer soils on sheltered sites.
Fraxinus excelsior	ash	unjin	Thrives in most habitats, esp. richer soils.
Ilex aquifolium	holly	cullyn; hollin	Thrives best on fairly dry sites.
Lonicera periclymenum	honeysuckle	ullaagagh	Hedges and scrub; tolerates coastal conditions.
Malus sylvestris	crab apple		Native trees (thought to be very rare) occur in sessile oakwood; otherwise much-planted.
Populus tremula	aspen	chengey ny mraane; cron craaee	A good tree for wet or rocky places.
Prunus spinosa	blackthorn; sloe	drine airn	Tolerant of coastal conditions and native to most of the Island - hence more suitable than hawthorn for most native planting.
Quercus petraea	sessile oak	darrag	Sessile oak occurs on wetter, more upland areas and more acidic soils than English oak, and is the more typical oak on Man; however, hybridisation between the two species makes it difficult to find "100% sessile" trees.
Quercus robur, Quercus robur x petraea hybrids	pedunculate or English oak; oak hybrids	darrag	English oak is more typical of drier, lowland areas than sessile oak. It has been planted extensively, and many oaks on the Island are intermediate in characteristics between the two species. These hybrids are themselves variable.
Rosa canina	dog rose		A group of closely-related wild roses, of which the Isle of Man tends to have types which are typical of north-west England. In general these are downier than the dog-roses found in southern England.
Rosa sherardii	Sherard's downy-rose		A fairly common scrub and hedge species.
Rubus fruticosus agg.	brambles	dress smeyr	Very variable, with lots of varieties indigenous to Man. Bramble usually spreads by itself. If it is to be planted, the use of stock local to the area is strongly recommended (with cultivated varieties, many of which are over-vigorous, to be avoided).

Rubus idaeus	raspberry	berrish yu croaw gharey	Usually occurs on the edges of woodland and heath.
Salix aurita	eared willow		A bushy, low-growing sallow of wet, acid moorland and curragh. Forms good bird habitat.
Salix caprea ssp caprea	goat willow; pussy willow		Uncommon on the Island. Prefers drier, more calcareous soils than the common grey "sallie".
Salix cinerea ssp. oleifolia	common sallow	shellagh	Common in wetland habitats throughout the Island. Some doubt as to how native this species is on the Island.
Sambucus nigra	elder	tramman	Tolerant of coastal conditions; strong cultural significance.
Sorbus aucuparia	rowan	cuirn	strong Manx cultural significance
Ulmus glabra	wych elm	lhiouan	Much-planted; possibly native (hard to tell). Suitable for sites with base-rich soils.

Appendix B: Woodland ground flora species associated with semi-natural woodland

Ferns

Scientific name	English name	Manx name	Distribution/Notes
Athyrium filix-femina	Lady fern		Shady places; very common
Dryopteris aemula	Hay-scented buckler-fern		Glens, shady banks; rare and virtually confined to the east
Dryopteris affinis	Scaly male fern		Glens and hedge banks; frequent
Dryopteris carthusiana	Narrow buckler-fern		Damp woods; very rare, mostly confined to glens along the west coast but found more recently further inland
Dryopteris dilitata	Broad buckler-fern		Shady places; common
Dryopteris filix-mas	Male fern		Shady places; common
Hymenophyllum wilsonii	Wilson's filmy fern		Boulders on moist upland glens; very rare
Oreopteris limbosperma	Lemon-scented fern		Glens, stream sides; common in hills
Phegopteris connectilis	Beech fern		Glens, damp shady rocks in hill areas; rare.
Polystichum aculeatum	Soft shield-fern		Hedge banks and glens esp. in wetter areas; rare and very scattered.
Polystichum setiferum	Hard shield-fern		Sheltered lanes, banks, glens; occasional, plentiful around Glen Maye

Herbs

Scientific name	English name	Manx name	Distribution/Notes
Ajuga reptans	Bugle	Lus ny Chayrn	Glens, roadsides etc; common
Allium ursinum	Wild garlic	Garleyd Feie	Distribution likely to have been modified by human activities
Anemone nemorosa	Wood anemone	Lus ny Geayee	(glens in south introduced – Summerhill, Colby and Silverdale – Allen) Locally abundant in Northern and Eastern Glens
Arctium minus	Lesser burdock	Bollan-dhoa	Woodland; very rare
Chrysosplenium oppositifolium	Opposite-leaved golden saxifrage		Damp shady places; common
Conopodium majus	Pignut	Curlan	Fields, shady places; common

Digitalis purpurea	Foxglove	Sleggan-sleeu	Hedges, glens; common
Equisetum sylvaticum	Wood horsetail		Glens, swamps and boggy fields; local mainly in east central area
Fragaria vesca	Wild strawberry	Soo Halloin	Glens, banks and other shady places; local
Geranium robertianum	Herb Robert	Crouw Yiarg	Hedge banks glens; common
Geum urbanum	Wood avens		Glens, plantations, shady roadsides and cliff faces; local
Glechoma hederacea	Ground ivy	Ard Losserey	Glens, hedges. Locally abundant esp. west and north coasts
Hyacinthoides non-scriptus	Bluebell	Gleih-vuc	Beware of confusion with Spanish and hybrid bluebells – see Appendix C
Hypericum androsaemum	Tutsan		Damp places in light shade, wet rocks; frequent - sometimes locally abundant in the moister districts
Lathyrus linifolius	Bitter-vetch		Sea cliffs, grassy banks, glens (normally within a mile of sea). Very local - mainly SW coast and Douglas bay area
Lysimachia nemorum	Yellow pimpernel		Glens, stream sides, wet woodland; frequent but locally distributed.
Melampyrum pratense	Common cow-wheat		Wet acid woodland below 600 ft. Rare
Oxalis acetosella	Wood sorrel	Bee Cooag	glens and hedge banks locally abundant
Potentilla sterilis	Barren strawberry		Glens, dry banks; common
Primula vulgaris	Primrose	Sumark	Hedge banks; common
Ranunculus ficaria ssp. ficaria	Lesser celandine	Lus ny Mlainyn	Shady places, banks hillsides; very common (Note: the ssp. is without bulbils – in contrast to the garden ssp *R. ficaria ssp bulbifera*)
Sanicula europaea	Sanicle		Shady glens. Local mainly between Laxey and Ramsey
Silene dioica	Red campion	Lus ny Ferryghyn	Glens, hedges; common
Stellaria holostea	Wood stitchwort	Lieen ny Ferrishyn	Hedge banks, glens; common
Teucrium scorodonia	Wood sage	Lys y Toar Vrein	Hedge banks, glens; common
Veronica montana	Wood speedwell		Very rare – one known site adjacent to Sulby Claddagh
Vicia sylvatica	Wood vetch		Damp, sheltered hollows opening onto the sea; rare and very local
Viola riviniana	Common dog's violet		Glens, hedge banks; common

Grasses and sedges

Scientific name	English name	Manx name	Notes
Carex remota	Remote sedge		Damp shady places; local. Southern streams and some East coast glens
Luzula pilosa	Hairy woodrush		Glens, shady places, open moors; occasional. The moorland occurrences (woodland relics ?) are all in the south west (also Glen Maye on open cliffs)
Melica uniflora	Wood melick		Glens, shady hedge banks; local. Perhaps accidentally introduced at some sites.
Festuca altissima	Wood fescue		Rocky woods; very rare
Carex sylvatica	Wood sedge		Glens, typically by waterfalls; rare

Brachypodium sylvaticum	Lesser wood-brome		Glens, hedge banks etc; locally abundant
Luzula sylvatica	Great woodrush		Shady places etc; locally abundant. A hardy survivor of deforestation
Bromopsis ramosa	Hairy-brome		Shady places on basic rocks; very rare
Carex laevigata	Smooth-stalked sedge		Moist, shady places esp. by waterfalls Locally distributed.

Appendix C: Plants not of native origin which may indicate unfavourable condition

Scientific name	English name	Manx name	Notes
Montia sibirica	Pink purslane		A rapidly increasing garden escape, capable of reducing native ground flora diversity by invading existing vegetation communities, esp. on damp sites.
Fallopia japonica	Japanese knotweed		A highly invasive notifiable weed; spread of this plant into the wild is an offence under the Wildlife Act 1990. Especially invasive along shady stream banks.
Rhododendron ponticum	Rhododendron		Well-established parkland escape known to reduce scrub layer and ground flora diversity by invading woodland on more acid soils
Saxifraga spathularis x S. umbrosa	London pride		A garden escape which may indicate a modified ground flora; can invade existing native ground flora in suitable sites
Circaea lutetiana	Enchanter's nightshade		A native of woodlands over much of the British Isles; not known to be invasive but may indicate a modified ground flora
Symphoricarpum album	Snowberry		Planted as game cover and as a parkland ornamental. May invade native scrub layer and reduce ground flora diversity; widespread on the Isle of Man but usually slow to invade new sites.
Crocosmia aurea x C. pottsii	Montbretia		A popular garden plant, increasingly spreading into open, rocky woodland sites and coastal brooghs. May displace native ground flora.
Fuchsia magellanica	Fuchsia		A characteristic Manx escaped garden plant, not usually invasive. May indicate modified conditions, often found with Montbretia and other escapes.
Hyacinthoides hispanica	Spanish bluebell		A large-flowered, scentless bluebell often grown in gardens; hybridises with and displaces native bluebell *Hyacinthoides non-scripta*
Hyacinthoides hispanica x non-scripta	Hybrid bluebell		A vigorous, rapidly-spreading hybrid between native and Spanish bluebell. Known to displace native ground flora; lack of scent and different flower-shape mean that this plant cannot provide the same ecological niche as native bluebells, leading to effects on invertebrate diversity and abundance.
Prunus spp., especially *P. cerasus, P. cerasifera* and *P. laurocerasus*	Non-native ornamental cherries, especially dwarf cherry, cherry plum and cherry laurel		All of these species are capable of invading native scrub and woody hedgerows, and are regularly planted as ornamental trees throughout the Island.

List references: Allen, 1984; BDIS; Clement & Foster, 1994; Garrad, 1972; Preston et al, 2001.

4.2 Lowland grasslands

Description

Grasslands are here taken to mean low- to medium-height, herbaceous vegetation communities which are strongly characterised, if not dominated, by grasses. This includes patches within larger areas of habitat mosaic as well as more obviously-defined meadows and pastures. A site does not therefore have to have a homogeneous turf in order to be classified as grassland.

The very wide range of exposure levels, topography, hydrology, geology and farming methods on the Isle of Man has led to a correspondingly wide range of grassland types, often occurring in complex mosaics with heathland, scrub, marsh and upland or coastal habitats. The degree to which a grassland may support rare plant and/or animal species, and the degree of vulnerability of the grassland, is dependent on all these location-related factors and more. This, combined with the fact that grassland is often a successional stage which naturally tends to progress swiftly towards more woody vegetation communities, makes species-rich grassland one of the most challenging habitats to conserve (see NCC 1989 Ch3 and Crofts & Jefferson 1999).

This chapter covers typical lowland grasslands; **upland pastures** are subject to special ecological and management issues, and are treated separately - see **Chapter 4.7: Upland Habitats**. Because grasses are such a ubiquitous element of Manx habitats, this chapter may also relate closely to the chapters on lowland **heathland**, bogs, **fens** and flushes, and **coastal habitats**.

Assessing lowland grasslands

All of the points on the Checklist of Priority Sites Criteria listed in **Part 3** are relevant to grasslands. Because of the wide range of grassland types and associated management issues on the Island, the description, classification, status and distribution of the four main grassland types are each treated separately here, for clarity and ease of reference. However, when assessing a grassland it should be borne in mind that this is an artificial separation. Sites which do not "fit" the broad categories are not necessarily poor examples of species-rich communities, and may be as important for wildlife as more "typical" grassland types. Many sites of nature conservation importance support a range of different grassland types, sometimes grading into each other, sometimes distinct, and quite possibly from more than one of the four main categories. Indeed, some grassland types on the Island are *only* present as small patches within larger habitat mosaics. For this reason, **the assessment process should aim to recognise good examples both of large areas of a single grassland type, and patches of grassland within larger mosaics of different habitats.**

The majority of the grasslands which have a higher-than-average nature conservation value share factors which favour less vigorous and competitive plants - for example, low nutrient status, high exposure levels, very wet or very dry conditions, extreme pH levels, or heavy exposure to salt spray. Situation and management history (e.g. continuity of traditional farming methods) are therefore of special concern. The position of the grassland within the surrounding ecological unit can also make a big difference to its importance for wildlife, especially where invertebrate species are concerned. Other factors, such as size, level of disturbance, and adjacent land use should all be taken into account when assessing the potential merits of designating a grassland site.

In the case of very rare grassland communities, **all** good examples will qualify for selection as ASSIs provided that they are of sufficient size and fulfil the minimum criteria as listed in the relevant section of this Chapter. In most cases, however, candidate sites will be selected from the best good examples of each grassland type and variant. Grasslands will be considered to be "good examples" where they not only fulfil all the minimum criteria described in this chapter, but also one or more of the Priority Site Criteria listed in Part 3.

Lowland grassland types

For the purpose of these Criteria, grasslands on the Isle of Man have been grouped as follows:

Acid grassland: Dry grassland and pastures on base- and nutrient-poor soils, usually grazed and/or subject to exposed conditions. Also known as **calcifugous** grassland. Often in association with heath and/or bog. The commonest grassland type on the Island.
Note: Upland pastures are treated separately in **Chapter 4.7: Upland habitats**.

Neutral grassland: Dry or wet species-rich grassland, wet rush pastures and a range of semi-improved and improved grasslands, on neutral soils. Also known as **mesotrophic** grasslands. These may be grazed, cut for hay, or unmanaged. These sites generally have good potential for agricultural improvement, hence neutral, species-rich grasslands are now a rarity on the Island.

Calcareous grassland: Dry grassland, often very species-rich, on base-rich soils, usually grazed (at least by rabbits if not by livestock) and/or subject to exposed conditions. Also known as **calcicolous** grassland. Calcareous soils are limited to the limestone areas in the south east of the Island, and provide some of the better agricultural land on the Island. Species-rich calcicolous grasslands are therefore both rare and local, and usually restricted to exposed, coastal or inaccessible sites. For this reason Manx calcicolous grasslands often have affinities with coastal grassland and sea cliff and slope habitats.

Coastal grassland: Cliff-top and slope communities, often extending some way inland ("sub-maritime"). Sometimes grazed, always subject to heavy exposure to wind and salt deposition. *Note*: in the *UK Guidelines for selection of biological SSSIs,* sub-maritime grassland is covered under Coastal Habitats rather than Lowland Grassland. The island nature of Manx ecology means that sub-maritime grassland tends to occur further inland and more in conjunction with other lowland grassland types - and hence with similar management issues - than in the UK. It has therefore been treated here alongside other lowland grassland types. More strictly maritime habitats with grassland affinities include cliff crevice, saltmarsh and dune vegetation, but as these have a different ecology to most grasslands they are treated separately under **Chapter 4.7: Coastal habitats**.

These Manx grassland types, and the National Vegetation Classification (NVC) categories they most closely resemble, are listed in detail on **Tables 4.2a-4.2d**, below. It should be noted when assessing a site that some characteristic UK grassland species are naturally absent from the Isle of Man; to help with assessment, the full range of vascular plants which typically occur in species-rich lowland grassland communities on the Island are listed in **Table 4.2e**.

"Similar communities"

Very few grassland samples were taken from the Isle of Man to contribute to the original research that formed the basis of the National Vegetation Classification (Rodwell, 1992). Perhaps because of this, Manx vegetation communities do not always fit well within NVC categories. This does not mean that the NVC is worthless here, but it has led to a situation where the NVC alone is not usually sufficient for assessing the nature conservation importance of a Manx site. See **Section 1.3.3**, above, regarding the use of the NVC in the Manx context.

In order to take into account the shortcomings of the NVC with respect to classifying Manx vegetation, most of the detailed selection criteria for grasslands refer to an NVC type and "similar communities". Similar communities are here defined as vegetation communities which have the majority of species in common with the NVC type, but which may lack some of the determining species from the relevant Floristic Table in the NVC for any of the following reasons:

- due to local conditions, some species are typically missing from this habitat on the Island;
- some NVC determinant species don't occur on the Island at all due to the general paucity of flora compared with the UK;
- due to local conditions, one or more determinant species of the NVC type in the UK are typically "replaced" by different species on the Island (e.g. because they fit a similar niche in the community and are more tolerant of maritime conditions; or e.g. because they represent a "western British" variant).

As a general guide, any community which supports a good range of the species listed in **Table 4.2e** will be considered for selection as a species-rich grassland. If sites selected in this way support vegetation communities that aren't a good "fit" for the NVC categories listed in the main selection criteria, the reasons for the choice will be made clear in the ASSI citation details.

4.2.1 Acid grasslands

Description and Distribution

Acid grassland, or calcifugous, communities consist of species which are capable of tolerating base-poor, acidic conditions. Such vegetation is common on the Isle of Man because the predominant bedrock is Manx slate, which naturally tends to form fairly acidic, podzolic soils when weathered, whilst the cool, wet climate keeps the soil pH low, with an average of pH 5-6. Additional organic deposits which are also acid in nature often form over these soils, mostly derived from heather and gorse litter, but also from other accumulated vegetation. In some areas this humus layer is thin, but it may reach 30cm or more in depth, and is usually present to a greater or lesser degree in all upland situations (Fullen, Harris & Kear 1999). Where the topography is such that dead vegetation becomes too waterlogged to decompose away, true peat layers can build up which may reach over a metre in depth (Robinson & McCarroll 1990 Ch5). These unusual areas commonly form a basin, with curragh, bog and swamp communities on the wetter peat at the centre, and grasslands around the edges. Due to this range and prevalence of acidic habitats, the majority of grassland on the Island is more or less acidic in character (see Sayle *et al*, 1995). Such grassland is naturally less species-rich than grassland on base-rich soils because of the more challenging conditions.

Heavy leaching, particularly in the uplands where rainfall levels are very high, can result in peaty "mor humus" topsoil with very low levels of nutrients available to plants, and a pH as low as 3.2, i.e. very acidic (Fullen, Harris & Kear 1999). Upland pasture on this kind of soil is frequently interspersed with bog and/or heath; for this reason, the assessment of very acid, upland grasslands cannot usually be divorced from consideration of associated upland habitats, with which grassland will often form one part of a complex mosaic. **Acid upland pastures are therefore treated separately - see Chapter 4.7: Upland habitats.**

The two commonest types of lowland acid grassland on the Island are:
- mainly dry, extensive sheep pasture on the margins of the uplands; and
- mainly wetter pastures, often rather scattered and isolated in the modern farming landscape, and often associated with heath and bog.

Both the main types of lowland acid grassland are the result of habitat modification by human activities, and both tend to "revert" to other vegetation types if left unfarmed. In less exposed areas, dry acid grassland is frequently subject to agricultural improvement such as drainage, liming and re-seeding. Wetter and more acid areas are not usually considered worth a lot of agricultural effort, but may still receive drainage and control of unwanted species. In both cases the dominance of grasses is maintained by grazing, as almost all the calcifugous grassland on the Island tends towards heathland if left unmanaged, and is very prone to encroachment from European gorse and bracken. These issues mean that farming activities are a very important factor in all acid grassland conservation. It should be noted, however, that whilst calcifugous grasslands will disappear if taken over completely by heathland, bracken or gorse, the presence of any of these is not necessarily a sign that the conservation status of the grassland is poor. For example, stands of bracken may support a "ground flora" of species which flower in spring and complement the grassland habitat early in the year.

Classification of lowland acid grasslands

Lowland acid grassland on the Island may be classified broadly as outlined in **Table 4.2.a**.

Lowland acid grassland status

Acid grassland is common throughout most of the Isle of Man, making up around 7% of the Island's land use total. This equates to over a quarter of all the semi-natural habitat present, and nearly half of all the grassland (Sayle *et al*, 1995). The mean average size of mapped, unimproved acid grassland area is 12ha (BDIS). However, this figure includes upland grassland (which is covered in Chapter 4.7). Unimproved lowland acid grasslands were not mapped separately, but correspond more closely with the next category, semi-improved acid grassland, which has a mean average size of 1.8ha and is much more scattered in distribution (BDIS). Good examples of lowland acid grassland generally occur singly or in small groups of fields which have been spared agricultural intensification for reasons of inaccessibility, high water-table, exposed conditions or other obstacles to farming. The situation with the uplands is rather different, as several specific areas of key ecological importance have long been recognised, all of which support a complex mosaic of interrelated habitats. Uplands are therefore dealt with separately in **Chapter 4.7**.

The Manx Wildlife Sites Handbook states that all lowland acidic grassland of at least 2 hectares, or 1 hectare if in association with other semi-natural habitats, are eligible for Wildlife Site selection if the site supports a good range of characteristic vascular plant species (Keehan 1999). The importance of lowland acid grassland is recognised in the UK by the inclusion of Lowland dry acid grassland as a Biodiversity Action Plan Priority Habitat – as with other dry lowland grassland types. The importance of this habitat for birds is also noted (UK Biodiversity Group 1998 Vol II – see UKBAP.org.uk).

Minimum selection criteria for lowland acid grassland

U2 – Wavy hair-grass *Deschampsia flexuosa* grassland
Examples of U2 grassland or similar communities will qualify for selection if they are over 10ha in total extent and fit at least one of the Priority Sites Criteria as listed in **Part 3**. Further priority will be given to examples which form part of a habitat mosaic.

U4 - Sheep's fescue/common bent grass/ heath bedstraw *Festuca ovina- Agrostis capillaris-Galium saxatile* grassland - outside of upland areas
Examples of U4 grassland or similar communities will qualify for selection if they are over 10ha in total extent and fit at least one of the Priority Sites Criteria as listed in **Part 3.** Further priority will be given to examples which form part of a habitat mosaic.

Sheep's-bit scabious *Jasione montana*

Table 4.2.a: Broad categories of acid grassland on the Isle of Man

Type and Description	Species rich?	Closest NVC categories (see Rodwell, 1992[3])	Rarities present?	Protected species present?
Lowland acid grassland The commonest lowland grassland type on the Island, often occurring as a heath/grass mosaic or in conjunction with bog and upland pasture. May occur in flat lowland farmland or lower and middle slopes of hills. Usually grazed; sometimes cut for hay.	Generally fairly species-poor due to the poor nature of the substrate, but may have quite a good mix of herb species, particularly where it forms part of a grass/ heath mosaic.	U2 - *Deschampsia flexuosa* grassland Frequent but not particularly extensive on the Island; patches may occur throughout "heathy" U4 grassland and in between patches of heather on upland margins. Often quite diverse, but vulnerable to burning, liming, fertilizing, scrub invasion and overgrazing, all of which can adversely affect the species diversity. No Island sample in NVC maps. U4 - *Festuca ovina- Agrostis capillaris-Galium saxatile* grassland One of the commonest grassland types, often covering extensive areas especially on upland fringes. See also Chapter 4.7. One Island NVC sample.	A possibility of invertebrate rarities. May form part of a feeding territory for some upland waders and birds of prey, especially in conjunction with heath mosaic.	Protected birds of prey such as hen harrier and peregrine may use as feeding territory; also a possibility of lapwing. Species-rich acid grassland may also support orchids, notably heath-spotted orchid, *Dactylorhiza maculata ssp ericetorum,* and northern marsh orchid *Dactylorhiza purpurea*.
Upland pasture	see Chapter 4.7 - Upland Habitats			

4.2.2 Neutral grasslands

Description and Distribution

Neutral, or mesotrophic, grassland communities do not show a distinctive dominance by either acid- or lime-loving species. They are generally associated with enclosed agricultural land on neutral or slightly acid soils. Throughout the Isle of Man the majority of neutral grasslands are found on the more productive agricultural land in lowland areas, away from the more acid soil conditions in the hills.

The main types of neutral grassland on the Island are:

- Improved rotation and permanent pasture dominated by perennial ryegrass and white clover;
- Semi- or un-improved species-rich permanent pasture and hay-meadows;
- Rough grassland with little or no grazing, dominated by false oat-grass.

Semi-improved and unimproved pastures, which result from extensive farming practices, are becoming increasingly rare (BDIS). Most of the potential sites for species-rich neutral grassland have long since been improved to support arable, rotation grassland or silage crops, replacing diverse vegetation communities with more productive ryegrass leys, which are now overwhelmingly prevalent. Such improved pastures are not generally considered to have any value for wild plant conservation, but may be important in the conservation of farmland birds, particularly choughs (see www.rspb.org.uk/birds/guide 2005).

As with other grassland types, neutral grassland is closely associated with scrub which, if allowed to develop, will overtake the low-growing grasses and herbs. This can reduce the species richness of grassland quite rapidly, especially where a stand of one particular shrub comes to dominate the whole site. However, the presence of occasional scrub such as hawthorn, sallows, blackthorn or gorse does not automatically indicate that grasslands have a low conservation status. Scattered scrub can add considerably to the conservation value of grasslands, providing a diversity of structure that offers a richer habitat for birds and invertebrates, especially where there are young shrubs and a good variety of species. Butterflies in particular are known to benefit from a mix of scrub patches in otherwise open grassland (Asher et al, 2001 Ch2). This needs to be borne in mind when assessing the quality of a potential ASSI.

Although neutral grassland is primarily dependent on farming activities, mesotrophic species also occur on alternative habitats such as road verges and "brownfield" sites, where farming activities are either limited or non-existent. Road verges in particular form an important habitat refuge on the Island, and may support a rich diversity of herb species more commonly associated with traditional hay-meadows (Scott 1997 Ch4). Hence the conservation of neutral grassland species is not entirely dependent on farming methods; however, whether on farmland or not, the biological diversity of any neutral grassland will ultimately depend on carefully-timed management practices and the maintenance of low nutrient levels.

Classification of neutral grasslands

Neutral grassland on the Island may be classified broadly as outlined in **Table 4.2.b**.

Neutral grassland status

Unimproved neutral grassland is one of the rarest semi-natural habitats on the Island, occupying just 0.13% of the total grassland habitat area. Indeed, only 11ha of unimproved neutral grassland was identified during the Phase 1 Habitat Survey. Even semi-improved neutral grassland is rare compared to calcifugous (acid grassland) communities, amounting to only 634ha or 7.37% of the total grassland area (Sayle et al, 1995).

Although semi-improved sites have been modified to a certain extent by agricultural improvements, many are quite diverse and constitute some of the more species-rich grasslands on the Island (BDIS). The Criteria have therefore been designed to reflect this.

In the wider context of habitats throughout the British Isles, neutral grasslands have undergone a severe decline, particularly traditional hay-meadows. In the UK *Guidelines for Selection of Biological SSSIs* (NCC 1989) it was stated that less than 3% of such meadows remained; this figure has been steadily decreasing since then, and the majority of UK examples of the habitat are now confined to SSSIs and other protected areas. Consequently this habitat features in the UK Biodiversity Action Plan as a Priority Habitat – Lowland meadows. Some of the best and largest examples of the type are protected by international as well as national designations.

Minimum selection criteria for neutral grassland

MG1 False oat-grass *Arrhenatherum elatius*-dominated rough grassland
Examples of the most species-rich variants of MG1 grassland or similar communities will qualify for selection if they are over 1ha in extent and fit at least one of the priority sites criteria as listed in Part 3. Further priority will be given to examples which form part of a habitat mosaic and/or which are known to have important invertebrate populations.

MG5 Crested dog's-tail and knapweed *Cynosurus cristatus - Centaurea nigra* grassland

- **All** examples of MG5 grassland and similar communities greater than 1ha will qualify for selection, with greatest priority given to sites in regular hay-meadow management;
- Examples of MG5 grassland and similar communities on roadside verges or other permanent linear sites (e.g. disused railway lines) will qualify for selection if the total extent of the grassland is greater than 0.1ha and the site fits at least two of the Priority Sites Criteria as listed in **Part 3.** Priority will be given to Conservation and Sensitive Verges as identified in the DoT/MNCT Road Verge Survey (Scott, 1997).

Note: 0.1ha is equivalent to a roadside verge 4m wide and 250m long; or a green lane 10m wide and 100m long; or 250m of 2m verge along both sides of a road.

MG6 Perennial ryegrass and crested dog's-tail *Lolium perenne-Cynosurus cristatus* grassland
Examples of the most species-rich MG6 grasslands, i.e. those which share some determinant MG5 species, or similar communities, will qualify for selection if they are over 1ha in extent and fit at least one of the priority sites criteria as listed in Part 3. Further priority will be given to examples which are known to have important invertebrate populations and/or significant populations of wild orchids.

MG7 Perennial ryegrass *Lolium perenne* leys
Grasslands dominated by perennial ryegrass and cultivated clover obviously do not warrant protection on the grounds of semi-natural habitat importance, but may occasionally provide crucial feeding areas for significant populations of choughs. Sites which are exceptional in this respect may therefore qualify for inclusion within an ASSI under bird protection criteria - see **Chapter 4.9.**

MG 9, 10, 11, 13 – poor semi-improved wet and inundation grasslands
As with MG7 leys, these species-poor grassland types will not be considered for selection on the grounds of semi-natural habitat importance, but they may form part of important bird territories which are covered under bird protection criteria – see **Chapter 4.9**.

Table 4.2.b: Broad categories of neutral grassland on the Isle of Man

Type and description	**Species-rich?**	**Closest NVC category** (see Rodwell, 1992[3])	**Rarities present?**	**Protected species present?**
Arrhenatherum elatius -dominated rough grassland, often unmanaged	not usually botanically rich; one sub-type MG1e may be fairly diverse in plants; all types may have good invertebrate diversity but only if the sward structure is suitable.	MG1 *Arrhenatherum elatius* grassland One Island NVC sample	not usually	Rough MG1 grassland provides feeding territory for owls; damper sites may rarely support common orchid species; sites reverting to scrub may form valuable songbird or bush-cricket habitats; undisturbed sites may form important lizard feeding areas.
Semi-natural neutral grassland, characterised by grasses such as *Festuca rubra*, *Cynosurus cristatus, Koeleria cristata, Anthoxanthum odoratum*, and *Poa pratensis*. Has frequent meadow flower species such *as Centaurea nigra, Prunella vulgaris, Succisa pratensis* and *Lotus corniculatus*. May also support a rich assortment of sedges such as *Carex caryophyllea*, *C. flacca*, and, in damper areas*, C. panicea*. May be traditional hay meadows or pastures.	potentially very species-rich in both plants and invertebrates.	MG5 *Cynosurus cristatus-Centaurea nigra* grassland No Island NVC samples	Several rare plant and invertebrate species rely on this habitat.	Damper sites may support common orchid species; hay meadows may support corncrakes.
Semi-improved, often re-sown grasslands where a long-term perennial ryegrass and white clover crop is accompanied by grasses more typical of an MG5 grassland, such as *Cynosurus cristatus, Agrostis capillaris* and *Festuca rubra*. May support a range of herb species, such as *Lotus corniculatus, Achillea millefolium* and *Leontodon autumnalis*. If left unimproved, may approach MG5 in character.	not usually; however, low-input and/or organic examples with short swards may support a good range of fungi	MG6 *Lolium perenne-Cynosurus cristatus* grassland Three Island NVC samples	not usually; however, low-input and/or organic examples with short swards may support unusual fungi	Short MG6 grassland may form valuable chough feeding areas provided animal husbandry is appropriate.
Perennial ryegrass leys, often with white clover (usually in rotation with arable crops).	no.	MG7 *Lolium perenne* leys and related grasslands	no.	Short MG7 grassland may form valuable chough feeding areas provided animal husbandry is

				suitable.
Poor semi-improved wet pasture, dominated by *Holcus lanatus* and with frequent *Juncus effusus* and/or *Deschampsia cespitosa*, usually forming rough clumps and tussocks. A few herb species such as *Ranunculus repens* and *Cardamine pratensis* may be present, usually as a small overall proportion. A tough and persistent grassland resulting from grazing on poorly-drained ground. *Deschampsia cespitosa* may occur with or instead of *Juncus effusus* in less consistently wet soils; *J. effusus* is generally the more common constituent. Frequently a target for drainage and/or reseeding to improve productivity. May be found in association with more species-rich mire and swamp areas.	no.	MG9 *Holcus lanatus-Deschampsia cespitosa* grassland No Island NVC samples MG10 *Holcus lanatus-Juncus effusus* rush pasture (more frequent) No Island NVC samples	May occasionally attract winter waders such as redshank, especially if near the coast.	May support breeding and feeding lapwing, especially if kept short. May support curlew and snipe if allowed to become tussocky. Tussocky and varied wet pasture may form a good habitat for a wide range of invertebrates; more research is needed regarding its importance for invertebrates on the Island.
Poor semi-improved periodically flooded pasture, characteristic of low-lying, free-draining floodplain and coastal areas. Dominated by a mat of *Festuca rubra*, *Agrostis stolonifera* and *Potentilla anserina*. Waterlogged, freshwater patches may also be dominated by *Alopecurus geniculatus*. Often rather short and with a flattened appearance, and subject to periods of inundation interspersed with intense drying. May grade into strandlines and saltmarsh, or into more permanently wet or dry grassland.	no.	MG11 *Festuca rubra-Agrostis stolonifera-Potentilla anserina* grassland frequent, especially near the coast; No Island NVC samples MG13 *Agrostis stolonifera-Alopecurus geniculatus* grassland frequent, especially in occasionally-flooded patches in inland pastures. No Island NVC samples.	not usually.	May support lapwing, especially if kept short. May offer valuable feeding areas for winter waders when flooded, especially near the coast.

4.2.3 Calcareous grasslands

Description and Distribution

The term "calcareous grassland" covers a range of plant communities in which low-growing, calcicole (lime-loving) plants are prominent. It is also referred to as **calcicolous** grassland. Grassland calcicoles are typically short herbs and fine-leaved grasses that only thrive where lime or other basic (alkaline) soil chemicals are present, and competition from coarser and more vigorous species is low. The habitat is commonest on shallow, well-drained soils which are base-rich (principally in calcium carbonate) due to the weathering of chalk and other types of limestone or base-rich rock. For this reason the habitat is commonly referred to as "chalk grassland" or "limestone grassland" depending on the underlying rock.

The "Manx Group" geology that underlies the majority of the Isle of Man does not provide a base-rich substrate, and lime-loving plant communities are typically restricted to rock and soils on the small areas that fall outside this zone. Typical calcareous grassland therefore occurs only in the south of the Island, centred on Castletown and Billown, in places where the underlying Carboniferous limestone is at or close to the surface. Chalk does not occur on the Isle of Man; all the examples of typical calcareous grassland occur on limestone areas. In general, these sites have a soil pH of 6.5 to 7.6 (Harris, Fullen & Hallett, 2001).

Limestone grassland is a famously attractive habitat, rich in colourful flowers and supporting a wide range of butterflies and other invertebrates. Unfortunately it is known to be declining throughout the British Isles, with a high proportion of all calcareous grassland now lost - either through farm improvement on the best and flattest land, or due to lack of grazing on the poorest and least accessible sites (UK Biodiversity Group, 1998; also see http://www.jncc.gov.uk/ProtectedSites/SACselection/habitat.asp?FeatureIntCode=H6210, 2005). The Isle of Man is no exception to this, hence most examples of calcareous grassland are restricted to well-drained slopes, quarries or rocky outcrops, as is the case in the UK.

The main types of calcareous grassland on the Island are:

- Dry grassland on rock outcrops and old limestone quarries;
- Coastal turf on limestone cliffs and rock outcrops;
- Calcareous dune vegetation

Localised variations in rock type and soil depth can also produce a mosaic of grassland types, with scattered small calcicole-dominated patches within predominantly neutral grassland. This mirrors the situation in the UK, where calcicolous species are commonly confined to very small and isolated patches, often surrounded by more nutrient-rich, improved grassland: "*Zonations through various grades of improved sward have become a common feature of almost every tract of calcicolous grassland in the southern lowlands of Britain"* (Rodwell, 1992[3] p114). Manx calcareous grasslands, like those in the UK and Eire, may therefore have a mixture of strict calcicoles and more neutral grassland species.

Calcicoles are not confined to typical calcareous grasslands. Plants characteristic of limestone grassland may additionally be found on a range of shallow, well-drained soils with neutral grassland and coastal turf, wherever low nutrient levels and/or exposure have led to a severe reduction in competition from more vigorous plants. The Manx coast has narrow but extensive sections of very exposed, red fescue-dominated coastal turf, which may also contain calcicoles. Calcicolous vegetation also occurs on the most base-rich of the dune grasslands at the Ayres, where the sand is shell-derived and rich in calcium. Both these communities are somewhat different in ecological requirements to typical grasslands, and are consequently covered in other parts of the Criteria - see **4.2.4**, below, and Chapter **4.6: Coastal Habitats.**

Scrub is frequently associated with calcicolous grassland, and can contribute to local biodiversity by providing shelter, food and scrub/grassland margin conditions suitable for invertebrates such as ground beetles. Scrub also provides breeding habitat for birds such as linnet (*Carduelis cannabina*) and nectar for a range of flying insects, hence a small amount of scrub is usually beneficial to wildlife (see Cullen &

Jennings, 1986; www.rspb.org.uk, 2005; Asher et al, 2001). However, many scrub species will encroach onto grassland, including blackthorn *Prunus spinosa*, hawthorn *Crataegus monogyna*, and old man's beard *Clematis vitalba*, and the scrub cover can quickly overtake short calcareous turf to the exclusion of low-growing calcicoles. Scrub control is therefore a management concern on the majority of calcareous grassland sites.

Classification

Calcareous grassland on the Island may be classified broadly as outlined in **Table 4.2.c:**

Table 4.2.c: Broad categories of calcareous grassland on the Isle of Man

Type and Description	**Species rich?**	**Closest NVC category** (see Rodwell, 1992[3])	**Rarities present?**	**Protected species present?**
Limestone grassland Restricted to the south of the Island, and often closely associated with coastal habitats. Other examples are restricted to road verges and quarries.	Yes. Species richness is a distinctive characteristic.	CG2 *Festuca ovina-Avenula pratensis* grassland Note: several spp. typical of this category in the UK do not occur on the Isle of Man. One NVC sample for CG2d) (*Dicranum scoparium* sub-community)	Plant and invertebrate rarities are both likely.	Several orchid species including Bee orchid *Ophrys apifera,* and Pyramidal orchid *Anacamptis pyramidalis*. Choughs in coastal areas, but only on closely-grazed sites.
Coastal grassland on limestone cliffs	Restricted to the Castletown area. This habitat is treated separately in Section 4.2.4 - Coastal grassland			
Calcareous dune grassland	Restricted to shell-sand derived dunes on the Ayres. This habitat is treated separately in Chapter 4.6: Coastal Habitats			

Calcareous grassland status

Calcareous grassland is the rarest grassland type on the Island, and is restricted to such small areas that it was not assessed as part of the DAFF Phase 1 Habitat Survey report (Sayle *et al*, 1995). However, there are some notable examples of calcicole-rich grassland, usually in conjunction with other grassland types. At a non-statutory level, the Manx Wildlife Sites Handbook contains criteria for Wildlife Sites selection in which, due to the rarity of the habitat, **all** examples of lowland calcareous grassland will be eligible; this mirrors many Wildlife Sites criteria publications for counties in the UK.

Elsewhere in the British Isles, the potential for calcareous grasslands to support a very rich plant and invertebrate diversity has resulted in widespread protection of many of the best examples. At a local level, calcareous grasslands feature in the UK network of Local Nature Reserves, reflecting the importance of this kind of habitat within areas which are enjoyed by the public. Nationally, the sharp decline in the extent of lowland calcareous grasslands has led to them being made a UK Biodiversity Action Plan Priority Habitat, whilst the majority of the best sites are covered by statutory protection (UK Biodiversity Group, 1998). Calcareous grasslands therefore feature strongly in the UK SSSI system, with an estimated 60-70% of sites in both England and Wales falling within SSSIs. The value of the habitat is also recognised in the National Nature Reserve series, with a total of 30 NNRs in England and Wales in which calcareous grassland makes up a major habitat constituent (www.jncc.gov.uk , 2005).

In the wider context of European law, lowland calcareous grassland is included within the *Festuco-Brometalia* grassland identified in Annex 1 of the EC Habitats Directive as of "Community interest". The habitat is a further priority if important orchid populations are present. The international importance of lowland calcareous grasslands is recognised in the UK , where the best calcareous grassland examples also form part of the Natura 2000 network (www.jncc.gov.uk, 2005).

Minimum selection criteria for calcareous grassland

CG2 Sheep's fescue and meadow oat-grass *Festuca ovina - Avenula pratensis* grassland

- **All** examples of CG2 grassland and similar communities greater than 0.5ha will qualify for selection;
- Sites which have a mosaic of grassland types in which CG2 grassland or similar communities feature as a proportion of the overall vegetation will qualify for selection if their total extent is greater than 1ha and they fit at least one of the Priority Sites Criteria as listed in Part **3;**
- Examples of CG2 grassland and similar communities on roadside verges or other permanent linear sites (e.g. disused railway lines) will qualify for selection if the total extent of the grassland is greater than 0.1ha and the site fits at least one of the Priority Sites Criteria as listed in Part **3.** Priority will be given to Conservation and Sensitive Verges as identified in the DoT/MNCT Road Verge Survey (Scott, 1997).

Note: 0.1ha is equivalent to a roadside verge 4m wide and 250m long; or a green lane 10m wide and 100m long; or 250m of 2m verge along both sides of a road.

4.2.4 Coastal grassland

Description and Distribution

Coastal grassland differs from inland grassland communities because of the influence of salt spray and strong maritime winds. The harsh conditions limit the range of species which would normally be able to colonise similar rock and soils elsewhere, resulting in a distinctive flora that grades into more typically inland vegetation communities as soon as the terrain becomes less exposed. A cliff and cliff-top may therefore support a range of grassland types, with more maritime communities on the exposed parts and typical inland grasslands in more sheltered gullies and ledges, or on parts of the cliffs which face away from the prevailing winds (Ratcliffe, 1997 Ch4). Both inland and maritime type communities can occur very close to the strandline if conditions are suitable; or they may occur at a field's distance, or more, from the sea.

Around one tenth of all the strictly coastal habitat around the Isle of Man is grassland, almost always dominated by red fescue *Festuca rubra* (BDIS). This distinctive fine-leaved grass forms a cushion-like mat where ungrazed, or a short, fine turf where grazed by sheep and/or rabbits. Ungrazed examples of coastal grassland are often rather species-poor, but shorter turf may support a colourful range of wild flowers, especially where it grades into other species-rich grassland types on calcareous rocks and soils. These include typical seaside species such as thrift *Armeria maritima*, sea plantain *Plantago maritima*, kidney vetch *Anthyllis vulneraria*, and sea campion *Silene uniflora*. Other species which thrive in the absence of competition from larger, coarser plants (which cannot stand the exposed conditions) may also occur. These include calcicoles such as purple milk-vetch *Astragalus danicus,* and dry grassland species such as mouse-ear hawkweed *Pilosella officinarum,* English stonecrop *Sedum anglicum,* and wild thyme *Thymus polytrichus*.

The vertical nature of much of the habitat means that, when mapped, coastal grassland appears to cover a very small area in a thin strip around the coast of the Island; however, in practice it can represent a much larger available habitat due to the surface area of the sloping land not being fully represented on the map.

The diversity of the grassland is dependent to a certain extent on the nature of the coastline concerned. Soft, crumbling cliffs do not offer a stable habitat for perennial turf, and consequently favour more open vegetation communities. Cliffs of Manx slate are generally surrounded by acid-loving communities such as coastal heath, bracken stands (often with a woodland-like ground flora) and acid grassland, all of which may influence the species composition of the coastal turf. Likewise, the most species-rich coastal

grassland on the Island occurs in conjunction with limestone rocks in the area around Castletown, where it grades into more typical calcareous grassland. The areas which catch the highest rainfall tend to have a lower salinity, so stretches of coastline, whether of slate or limestone, can vary in the proportion of characteristic salt-tolerant plants present, depending on the level of rainfall they receive. These varied factors all contribute to the great diversity of Manx coastal vegetation types, even within relatively short stretches.

Coastal grassland may occur on sites where there is no grazing pressure at all, maintained only by the extremely exposed conditions within range of salt spray and maritime gales. In general, such communities are not very rich in plant species, although they may provide a sheltered mat of vegetation in which invertebrates can thrive. Areas which are closely grazed by sheep or rabbits or both usually support a much wider range of plants, and offer a warm, open, flower-rich turf which favours sun-loving invertebrates. Small amounts of scrub - particularly in association with coastal heath - can enhance the value of coastal grassland for wildlife. However, on the most diverse sites invasion by taller species can become a management concern, as gorse, bracken and bramble can rapidly take over the more delicate species if grazing pressure is removed, resulting in the loss of rare maritime herbs that cannot withstand competition.

When assessing the species richness of Manx coastal grassland it should always be borne in mind that some characteristic UK coastal and lowland grassland species are naturally absent from the Island. In general, a species-rich example of a Manx grassland might be expected to have slightly fewer species than its equivalent in the UK, even where other factors appear to be equal. Coupled with the close proximity of small patches of different vegetation types on the varied coastal terrain, this means that Manx coastal grassland tends not to express the typical makeup of NVC grassland categories. As a guide to assessing the species richness of a coastal grassland, the same approach is taken here as with Woodlands in Chapter 4.1. As an aid to site assessment Table 4.6.e) lists plant species typical of semi-natural grassland around the Island, with a guide to those species particularly associated with calcareous coastline (the rarest grassland category on the Island).

Classification

Coastal grassland on the Island may be classified broadly as outlined in **Table 4.2.d.**

Coastal grassland at Dalby

Table 4.2.d: Broad categories of coastal grassland on the Isle of Man

Type and Description	**Species rich?**	**Closest NVC category** (see Rodwell, 1992[3+5])	**Rarities present?**	**Protected species present?**
Maritime cliff and cliff-top grassland, generally dominated by Red fescue *Festuca rubra agg.* Note that cliff crevice communities are covered in **Chapter 4.6: Coastal habitats.**	Very species-rich when in conjunction with calcareous grassland habitats; otherwise variable. See Table 4.2.e for a list of species typical of species-rich coastal grassland	MC8 Red fescue and thrift *Festuca rubra-Armeria maritima* maritime grassland One Island NVC sample. MC9 Red fescue and Yorkshire fog grass *Festuca rubra-Holcus lanatus* maritime grassland No Island NVC sample. MC10 Red fescue and plantain *Festuca rubra-Plantago spp*. maritime grassland No Island NVC sample.	Plant and invertebrate rarities may occur.	Orchids may be present. Short coastal turf may also form a feeding territory for protected bird species, notably choughs, and forms the habitat of the lesser mottled grasshopper *Stenobothrus stigmaticus*.
Dune and saltmarsh communities	In some cases dunes and saltmarsh may be dominated by grasses, but they exhibit a different ecology to most grasslands, with different management issues. They have therefore been treated separately – See Chapter **4.6: Coastal habitats**.			

Coastal grassland status

Although the Isle of Man naturally has a high ratio of coastal to inland habitats, the overall proportion of unimproved coastal grassland is low: just 0.1% of the total Island area and 0.34% of semi-natural habitats. Mapped coastal grassland areas range in extent from 0.12 – 4.2ha, with a mean size of 0.8ha (Sayle et al, 1995). Even amongst coastal habitats, unimproved coastal grassland amounts to only 0.67% (Lamb/MWT 1999). Unimproved neutral grassland was mapped at 2.17% of all coastal habitats, i.e. also scarce compared with improved or poor semi-improved grassland. One reason for the relatively small area of semi-natural coastal grassland is the presence of improved farmland right up to the edge of cliff-tops in some areas. Another reason is that suitable sites for the development of a coastal turf are scarce, with many semi-natural areas supporting more ephemeral vegetation, or more overgrown habitats, or coastal heath. It should also be noted that the areas of habitat in question have been derived from orthographic mapping, which will not have measured the full surface area of the land involved due to the steepness of the terrain around much of the coast.

The importance of maritime cliff and slope grassland is recognised in the UK Biodiversity Action Plan, which listed Maritime Cliff and Slopes as a Priority Habitat. The Action Plan also notes that another Priority Habitat, Lowland Calcareous Grassland, may occur in coastal locations. In the European context, coastal grassland is recognised as a component of *Vegetated sea cliffs of the Atlantic and Baltic coasts,* which is listed in Annex 1 of the EC Habitats Directive.

Minimum selection criteria for coastal grassland

- Coastal sites which have a mosaic of grassland types in which calcareous grassland communities of type CG2 or similar (see chapter 4.2.3, above) feature as a proportion of the overall vegetation will all qualify for selection where they fit at least one of the Priority Sites Criteria as listed in Part **3;**
- **All** examples of species-rich coastal grassland (i.e. grassland which support more than half of the typical Manx coastal species listed in Table 4.2e below) greater than 0.5ha will qualify for selection;
- Smaller, fragmented and/or linear examples of unimproved or species-rich semi-improved coastal grassland will qualify for selection if the total extent of the grassland is greater than 1ha and the site fits at least one of the Priority Sites Criteria as listed in Part **3;**
- Priority will be given to sites which have a naturally-occurring range of coastal habitat features, e.g. ephemeral soft cliff communities, hard cliffs, coastal heath and adjacent shingle banks.

In some parts of the British Isles, Harebells *Campanula rotundifolia* have distinctive large "bells". This is due to a minor genetic variation. Manx harebells often have this characteristic, especially near the coast. Protected habitats help to maintain this kind of locally distinctive diversity.

Table 4.2e: Vascular plants characteristic of semi-natural grassland on the Isle of Man

Scientific name	English name	Manx name	Typical grassland type/Notes
Achillea millefolium	Yarrow	Ayr lossey	Neutral, calcareous, coastal
Achillea ptarmica	sneezewort		Wet grasslands
Agrimonia eupatoria	Agrimony		Neutral, calcareous, coastal Rare, protected under Schedule 7 of the Wildlife Act 1990
Agrimonia procera	Fragrant agrimony		Neutral, calcareous, coastal. Hard to tell apart from agrimony, and likely to be mis-recorded for fragrant varieties of agrimony. May escape from gardens
Agrostis capillaris	Common bent	Shaslagh lheannagh	Neutral, acid
Agrostis stolonifera	Creeping bent		Neutral, calcareous, coastal
Agrostis vinealis	Brown bent	Shaslagh	Neutral, acid
Aira caryophyllea	Silver hair-grass		Acid, coastal, thin sandy soils
Aira praecox	Early hair-grass		Acid, coastal, thin sandy soils
Alopecurus geniculata	Marsh foxtail		Wet
Anacamptis pyramidalis	Pyramidal orchid		Neutral, calcareous, coastal protected under Schedule 7 of the Wildlife Act 1990
Anagallis tenella	Bog pimpernel		Acid, wet
Anthoxanthum odoratum	Sweet vernal grass	Faiyr sonnys	Neutral
Anthyllis vulneraria	Kidney vetch		Neutral, calcareous, coastal
Arenaria serpyllifolia	Thyme-leaved sandwort		Neutral, calcareous, coastal
Armeria maritima	Thrift		Coastal
Astragalus danicus	Purple milk-vetch		Calcareous, coastal
Campanula rotundifolia	Harebell	Clag ferrish	Neutral, acid. NB. conspicuously large-flowered harebells may be hexaploid, rather than the more usual British tetraploid plants.
Cardamine pratensis	Cuckooflower		Wet
Carduus tenuiflorus	Slender thistle		Coastal
Carex arenaria	Sand sedge		Coastal, sandy ground
Carex binervis	Green-ribbed sedge		Acid
Carex caryophyllaea	Spring sedge		Neutral, calcareous, coastal
Carex echinata	Star sedge		Acid, wet
Carex flacca	Glaucous sedge	Shast (sedge)	Neutral
Carex hirta	Hairy sedge		Neutral, wet
Carex nigra	Common sedge	Shast dhoo	Neutral
Carex ovalis	Oval sedge		Neutral
Carex pallescens	Pale sedge		Neutral Rare; protected under Schedule 7 of the Wildlife Act 1990
Carex panicea	Carnation sedge		Neutral
Carex pulicaris	Flea sedge		Acid, wet
Carex viridula subsp viridula	Yellow-sedge		Acid, wet

Carlina vulgaris	Carline thistle		Calcareous, coastal, dry ground Rare, protected under Schedule 7 of the Wildlife Act 1990
Catapodium marinum	Sea fern-grass		Bare to thin soils, coastal only
Catapodium rigidum	Fern-grass		Bare to thin soils, coastal
Centaurea nigra	Common knapweed	Lus ny gramman	Neutral
Centaurium erythraea	Common centaury		Coastal, well-drained soils
Centaurium littorale	Seaside centaury		Coastal only; only one doubtful record for the Isle of Man, but possibly present on coastal turf.
Cerastium arvense	Field mouse-ear		Thin, well-drained soils, coastal
Cerastium diffusum	Sea mouse-ear		Coastal only
Cerastium semidecandrum	Little mouse-ear		Thin, well-drained soils, coastal
Cirsium palustre	Marsh thistle		Wet
Cochlearia danica	Danish scurvy-grass		Coastal
Cochlearia officinalis	Common scurvy-grass		Coastal
Conopodium majus	Pignut	Corlan	Neutral
Crepis capillaris	Smooth hawksbeard		Neutral
Cuscuta epithymum	Dodder		Acid, coastal – a parasite of heather, thyme and legumes, mostly found on the coast Rare, protected under Schedule 7 of the Wildlife Act 1990
Cynosurus cristatus	Crested dog's-tail	Connane	Neutral, coastal
Dactylorhiza fuchsii	Common spotted-orchid	Bwoid saggart	Neutral protected under Schedule 7 of the Wildlife Act 1990
Dactylorhiza incarnata	Early marsh orchid		Neutral protected under Schedule 7 of the Wildlife Act 1990
Dactylorhiza maculata ssp. ericetorum	Heath spotted-orchid		Neutral protected under Schedule 7 of the Wildlife Act 1990
Dactylorhiza purpurella	Northern marsh orchid		Neutral protected under Schedule 7 of the Wildlife Act 1990
Danthonia decumbens	Heath grass		Acid, coastal
Daucus carota	Wild carrot		Neutral, calcareous, coastal
Deschampsia cespitosa	Tufted hair-grass		Neutral, wet
Deschampsia flexuosa	Wavy hair-grass		Acid
Erodium cicutarium	Common stork's-bill		Sandy, very dry soils, coastal
Erodium maritimum	Sea stork's-bill		Sandy, very dry soils, coastal
Erophila verna	Whitlow grass		Calcareous, coastal, thin dry soils
Euphrasia spp.	Eyebright		Short, permanent grassland, coastal. A complex aggregate of related species, often hard to tell apart. Semi-parasitic on roots of a range of other

			plants. Indicative of relatively nutrient-poor, well-established grassland.
Festuca ovina	Sheep's fescue		Acid, calcareous, coastal
Festuca pratensis	Meadow fescue		Neutral, damp meadows; native but may sometimes be sown in grassland mixes
Festuca rubra	Red fescue		Neutral, calcareous, coastal
Filago minima	Small cudweed		Neutral, acid, rather bare ground
Filipendula ulmaria	meadowsweet		Wet
Galium palustre	Marsh bedstraw		Wet
Galium saxatile	Heath bedstraw		Acid
Galium verum	Lady's bedstraw	Lus y volley	Neutral, coastal
Gentianella campestris	Field gentian		Neutral, acid, coastal. Intolerant of over-grazing.
Hydrocotyle vulgaris	Marsh pennywort		Wet
Hypochaeris radicata	Common cat's-ear	Cleaysh chiyt	Neutral, coastal
Hypochoeris glabra	Smooth cat's-ear		Acid, sandy, dry ground. Rare, protected under Schedule 7 of the Wildlife Act 1990
Jasione montana	Sheep's-bit	Bossan gorrym	
Juncus acutiflorus	Sharp-flowered rush		Wet
Juncus articulatus	Jointed rush		Wet
Juncus bufonius	Toad rush		wet
Juncus conglomeratus	Compact rush		wet
Juncus effusus	Soft rush		Wet
Juncus foliosus	Leafy toad rush		Wet
Juncus squarrosus	Heath rush		Acid
Knautia arvensis	Field scabious	Lus ny gramman gormey	Neutral
Koeleria macrantha	Crested hair-grass		Calcareous, coastal
Lathyrus linifolius	Bitter-vetch		Acid, damp ground
Lathyrus pratensis	Meadow vetchling	Pishyr bwee	Neutral
Leontodon autumnalis	Autumn hawkbit	Croag phartan	Neutral
Leontodon taraxacoides	Lesser hawkbit		Dry turf, coastal
Listera ovata	Common twayblade		Shady, damp ground. Protected under Schedule 7 of the Wildlife Act 1990
Lotus corniculatus	Common bird's-foot trefoil		Neutral, calcareous, coastal
Lotus pedunculatus	Greater bird's-foot trefoil		Damp grassland
Luzula campestris	Field woodrush	Leaghyr cheylley	Neutral
Luzula multiflora	Heath woodrush		Neutral A species with two types: *Luzula multiflora ssp. multiflora* and a subspecies with clustered fruiting heads, *Luzula multiflora ssp congesta.* The two are not always easy to tell apart, and may grow together on similar sites.

Lychnis flos-cuculi	Ragged robin		Wet
Mentha aquatica	Water mint		Wet
Mentha arvensis	Corn mint		Wet (but prefers drier grassland to *M. aquatica*)
Mentha pulegium	Pennyroyal		Wet, seasonally inundated grassland. Very rare, protected under Schedule 7 of the Wildlife Act 1990
Molinia caerulea	Purple moor-grass		Acid, wet
Myosotis discolor	Changing forget-me-not		Dry short turf, coastal
Myosotis ramosissima	Early forget-me-not		Dry, thin, infertile soils, coastal
Myosotis secunda	Creeping forget-me-not		Wet
Mysotis laxa	Tufted forget-me-not		Wet, often on trampled ground
Nardus stricta	Mat grass		Acid
Odontites vernus	Red bartsia		Short, often trampled grasslands, coastal
Ononis repens	Rest harrow		Neutral, calcareous, coastal
Ornithopus perpusillus	Bird's-foot		Thin, dry soils, coastal
Pedicularis palustris	Marsh lousewort		Wet
Pedicularis sylvatica	Lousewort		Acid, wet
Phleum arenarium	Sand cat's-tail		Sandy ground, coastal
Phleum pratense	Timothy grass		Neutral
Pilosella officinarum	Mouse-ear hawkweed		Calcareous, thin dry soils, coastal
Pimpinella saxifraga	Burnet saxifrage		Neutral, calcareous, verges Rare, protected under Schedule 7 of the Wildlife Act 1990
Plantago coronopus	Buck's-horn plantain		Thin dry soils, coastal, bare ground
Plantago lanceolata	Ribwort plantain		Any semi-improved grassland, coastal
Plantago maritima	Sea plantain		coastal
Platanthera chlorantha	Greater butterfly orchid		Neutral Rare, Protected under Schedule 7 of the Wildlife Act 1990
Poa pratensis	Smooth meadow-grass		Neutral
Polygala serpyllifolia	Heath milkwort		Acid, coastal
Polygala vulgaris	Common milkwort		
Potentilla anglica	Trailing tormentil		Neutral, acid, damp ground
Potentilla anserina	Silverweed		Disturbed and/or seasonally damp ground, sometimes coastal
Potentilla erecta	tormentil		Acid
Potentilla palustris	Marsh cinqefoil		Wet
Potentilla reptans	Creeping cinquefoil		Neutral, calcareous, coastal
Potentilla x mixta and P. x suberecta	Hybrid cinquefoils		Neutral, acid, verges and banks. Various crosses between tormentil, trailing cinquefoil and creeping cinquefoils (the hybrids are hard to tell apart). Abundant in some unimproved grasslands, even where one or both

			parent species is absent.
Prunella vulgaris	Selfheal	Lus y choine cast	Neutral
Pulicaria dysenterica	Fleabane		Damp grassland
Ranunculus acris	Field buttercup	Cass feeagh	Neutral
Ranunculus flammula	Lesser spearwort		Wet
Ranunculus repens	Creeping buttercup		Heavy soils, disturbed pastures, often damp
Rhinanthus minor	Yellow rattle	"Clabberey traagh"	Neutral Characteristic of traditional hay crop management.
Rosa spinosissima	Burnet rose		Calcareous, coastal
Rumex acetosa	Sorrel		Neutral, acid, damp ground
Rumex acetosella	Sheep's sorrel		Acid, coastal, well-drained thin soils
Sagina subulata	Heath pearlwort		Dry, open ground, coastal
Scilla verna	Spring squill		Coastal
Sedum anglicum	English stonecrop		Dry ground, coastal
Senecio aquaticus	Marsh ragwort		Damp soils. Treated as ragwort (above).
Senecio jacobaea	Ragwort	cushag	Dry, often disturbed sandy soils. Of ecological importance, but poisonous to stock and listed under the Weeds Act
Silene uniflora	Sea campion		Coastal
Spergularia rupicola	Rock sea-spurrey		Coastal
Spiranthes spiralis	Autumn ladies'-tresses		Calcareous, coastal. Manx record for this plant is the northernmost in the British Isles. Very rare, protected under Schedule 7 of the Wildlife Act 1990
Stachys palustris	Marsh woundwort		wet
Stellaria graminea	Lesser stitchwort		Neutral, acid, damp ground
Stellaria uliginosa	Bog stitchwort		Acid, damp ground
Succisa pratensis	Devil's-bit scabious	Bit y jouyll	Neutral, wet
Thymus polytrichus	Wild thyme		Thin soils, coastal
Trichophorum cespitosum	Deer-grass		Acid pasture and heath
Trifolium fragiferum	Strawberry clover		Damp ground, coastal
Trifolium ornithopodioides	Bird's foot clover		Thin soils, coastal
Trifolium pratense	Red clover	Shamrag ny gabbil	Neutral
Trifolium scabrum	Rough clover		Thin soils, coastal
Trifolium striatum	Soft clover		Dry ground, coastal
Trifolium suffocatum	Suffocated clover		Thin soils, coastal. Manx records are the most northerly in the British Isles.
Trifolum arvense	Hare's-foot clover		Dry sandy ground, coastal Rare, protected under Schedule 7 of the Wildlife Act 1990
Triglochin maritimum	Sea arrowgrass		Saline wet ground, coastal only
Triglochin palustris	Marsh		Usually calcareous or neutral, wet

	arrowgrass		
Valeriana officinalis	Valerian		Neutral, usually on wet sites
Vicia cracca	Tufted vetch	Pishyr lughag	Neutral
Vicia lathyroides	Spring vetch		Thin, sandy soils; coastal
Viola canina	Heath dog-violet		Acid, coastal
Viola lutea	Mountain pansy		Acid, usually upland. Very rare, possibly extinct. Protected under Schedule 7 of the Wildlife Act 1990
Viola tricolor ssp curtisii	Seaside pansy		Sandy ground, coastal. Rare.
Viola tricolor ssp tricolor	Heartsease		Acid, sandy ground, coastal
Wahlenbergia hederacea	Ivy-leaved bellflower		Acid, heathy, damp pastures

Moonwort *Botrychium lunaria*, a tiny fern of short grassland, with a pound coin for comparison

4.3 Lowland heathland

Description

Lowland heathland is restricted to the more acid, nutrient-poor soils of the British Isles and parts of North-west Europe, where woodland has been cleared in the past and the resultant low-growing shrub layer is maintained by human activities – usually extensive grazing and rotational burning. This management favours species such as heathers, whose ecological niche would otherwise be limited to exposed coastal sites, or woodland areas which are recovering from wildfire. Like other habitats which have formed as a result of very long-established human activity, lowland heathland supports a range of distinctive ecological communities with plants and animals which rely on the managed habitat for their survival. The majority of lowland heaths therefore occupy areas which would have supported woodland in prehistoric or historic times, and which still have a strong tendency to revert to woodland in the absence of management.

For most of the UK, "lowland" is defined as altitudes less than 300m; in the case of northerly and coastal regions, the vegetation tends to progress to upland types at a lower altitude. Thus, in the case of the Isle of Man, 250m is a more useful cut-off point for defining lowland as opposed to upland habitats. Most land above this altitude has not recently been subject to enclosure, and consists of upland heathland types, semi-improved grassland, and plantations. Some areas of upland type moorland do occur at lower altitudes, but such instances are generally limited to the lower margins of larger, upland blocks of heather. For the purposes of these criteria, the upper defining altitude for lowland heathland will therefore be taken as 250m.

Most lowland heathland consists of a low to medium growth of heather *Calluna vulgaris*, with varying amounts of bell heather *Erica cinerea*, cross-leaved heath *Erica tetralix*, gorse *Ulex spp* and bilberry *Vaccinium myrtilus*. Specialised local conditions may also give rise to abundant lichen and/or moss communities. In the Isle of Man, the native gorse is *Ulex gallii* ("Western" or "Manx gorse"), but the introduced European gorse *Ulex europaea* also occurs in profusion on some lowland heathland areas, especially in places where there has been some enrichment of the soil for agricultural purposes. Heathland management is usually aimed at maintaining a high proportion of heather species rather than either type of gorse, heather having a generally higher value for extensive grazing as well as for conservation and the landscape. However, lowland heathland needn't just consist of a carpet of heather: interspersed areas of developing trees and scrub, and microhabitats such as seepages and bogs, are important elements of a diverse site.

Heathland in general is not very floristically diverse (Ratcliffe, 1977), but this is partly because management efforts tend to encourage single-stage heather growth. Where heathlands support a range of habitat types, particularly wet habitats, along with a diverse structure of different stages of heather growth, they may have a striking range of birds, plants and invertebrates, some of them rare and restricted in range. Details of some of the species which occur on the best examples of lowland heathland on the Island are listed below in Sections 4.3.1-4.3.3.

In European terms, lowland heathland is largely oceanic in distribution, occurring where the temperature range is steady and the climate relatively mild in terms of temperature and dryness. The maximum altitude of lowland heathland, as opposed to upland and upland margins, is variously defined as between 250m and 300m (RSPB, 2005; English Nature 2002). In the British Isles, lowland heathland tends to occur further inland as well as at the coast, probably due to the generally temperate conditions (Ratcliffe, 1977). In this respect the Manx situation mirrors that of the British Isles as a whole (BDIS).

Lowland heathland is a priority for nature conservation because it is a rare and threatened habitat. The UK has an important proportion (about 20%) of the international total of this habitat - 58,000ha, of which the largest proportion (55%) is found in England. However, even in England only one sixth of the heathland present in 1800 now remains (UK BAP).

The range of European heathland types has been categorised by different organisations in different ways, leading to a multitude of overlapping descriptions, criteria and statistics (see **Types of lowland heathland**, below). For the sake of clarity, this chapter covers all lowland heathland types, including coastal and dune heathland, and both wet and dry habitats. Other coastal habitats – which may occur in conjunction with coastal and dune heathland – are covered in **Chapter 4.6: Coastal habitats. Upland heathland** is treated alongside related upland habitats in **Chapter 4.7**.

Assessing lowland heathland

In general, the same principles of site assessment apply to lowland heathland as to grasslands: all of the Priority Site Criteria listed in Part 3 are relevant. Of these, the following are particularly important when assessing the quality of lowland heathland:

Size

The suitability of much of the Island's lowland heathland for agricultural improvement has led to loss and fragmentation of the habitat just as it has in the UK (see JNCC Annex 1 habitat descriptions). Thus it may not always be possible to protect the kind of extent of habitat that would be possible with upland heathland; indeed, it may be necessary to protect relatively small lowland heathland areas just in order to represent all the types and species which are associated with this habitat on the Island. However, larger sites are more likely to contain the diversity of microhabitats and conditions which favour biodiversity, and for this reason it is always desirable to select the largest available examples.

Location

The varied geology, topography and climate on the Island has led to a perhaps surprising range of heathland types given the limited extent of the land. In order to represent this range in full, the ASSI series should include lowland heathland examples from both coastal and inland sites, and from the full range of geological and hydrological situations. Natural climax heathlands are regarded as having especially high scientific value (Ratcliffe, 1977), so sites such as established dunes at the Ayres, where the heathland at least on the seaward side is likely to be a natural climax vegetation, are particularly important.

Another location consideration is the presence of species or habitat sub-types which are known to be at the edge of their natural range. Such species are of value in monitoring the effects of climate change, as well as being of interest in their own right. The geographic position of the Isle of Man and the ameliorating influence of the sea on its climate have resulted in the development of several habitat types which otherwise tend to occur further south. This is particularly marked in the case of lowland heathland, most types of which are largely confined to England and South-west Wales (see **http://www.forestry.gov.uk/forestry/Lowlandheath**). Conversely, some species may be at the southernmost end of their range in the Isle of Man. Such species are at risk of losing their Island station if climate change forces them further north. Details of some of the habitat sub-types and species which are thought to be at the edge of their native range on the Isle of Man are listed in sections 4.3.1 – 4.3.3, below.

Diversity

Diversity of habitat and micro-habitat is one of the most important features of good lowland heathland examples. The natural cycle of heather is one of structural, and hence ecological, development over a period of twenty years or more, with young, vigorous shoots giving way to uniform bushes which then gradually grow more "leggy", to collapse and be overgrown by new shoots. Each stage is of importance for different bird, invertebrate and lower plant species. Regenerating woodland is also a natural feature of lowland heath, although most management efforts will aim to prevent the heather layer from disappearing altogether.

Other features which lead to greater biodiversity include pools and mires, streams, mature hedgerows, and patches of grassland. With this in mind, **the assessment process should aim to protect the full range of Manx lowland heathland biodiversity by recognising good examples of varied mire/heath/grassland mosaic habitats as well as the best large areas of a single heathland type.**

Rarity, fragility and vulnerability
The rarity of lowland heathland, and the limited distribution of types such as dune heathland, make this a prime habitat for rare and local species on the Island. Even if the overall site is small, it may therefore be important to protect it if it contains the sole or dominant population of a rare species. Other factors to take into account are the presence of rare micro-habitats – e.g. pools which support breeding dragonflies – and the vulnerability and fragility of the site – e.g. lichen heath, which may take a very long time to regenerate if damaged. Heathlands are particularly vulnerable to changes in nutrient status and can be lost through gradual changes to grassland through inappropriate grazing management.

Naturalness and representativeness
Selecting the most natural and representative lowland heathland depends a lot on assessments of habitat diversity on site (see Diversity, above). The most natural examples are likely to have a range of stages of heather growth, a mix of different hydrological features, and some associated habitats such as regenerating woodland and scrub. A clue to the naturalness of a lowland heathland might be the presence of a range of hydrological features such as wet heath patches and pools; this would indicate that the area has not been subject to drainage recently. Sites with single-age "monoculture" stands of heather, whilst important for some bird species, are less likely to fulfil the diversity and naturalness criteria.

Ecological position
The tendency of heathland to form an "intermediate" stage between cleared areas and woodland means that it often occurs amidst other habitats, particularly grassland and scrub. A mosaic of habitats, particularly those which represent a natural gradation from one heathland type to another, can greatly increase the biodiversity of a lowland heathland site, offering opportunities for species to shift and adapt with changes in conditions, and providing valuable "edge" habitats, such as the interface between drier heathland and mire. Sites which exhibit good gradients of microhabitat types should be a priority for selection, as these features are often indicators of the most natural lowland heathland sites.

History
Although there are probably small examples of naturally-occurring climax heathland on the Island, the majority of both lowland and upland heathland appears to have developed in response to human activities. A history of appropriate management is therefore likely to have a bearing on the current quality of a lowland heathland site, and may also indicate where the most natural areas – e.g. those which have not been ploughed, drained or limed in the past – remain. Conversely, sites where the management has plainly not been supportive of high biodiversity are likely to need some remedial management if their full conservation potential is to be achieved; such sites may be an important part of any action plan to increase the resource of lowland heathland on the Island, but they should not normally be prioritised for protection ahead of heathlands which have a history of good management.

Types of lowland heathland
A straightforward classification of lowland heathlands and their status is difficult. The range of heathland types around the British Isles has led to a number of classification approaches, some of which refer to vegetation communities, whilst others relate to distribution and altitude.
This can lead to problems when attempting to compare the conservation status of heathland types. For example, in the case of coastal heath:

- The National Vegetation Classification (NVC) includes dune heath dominated by heather and sand sedge *Carex arenaria*, and describes it as a vegetation type of coastlines and also some inland dune systems (Rodwell, 1992[5]);
- Annex 1 of the EC Habitats Directive lists *Atlantic decalcified dunes* as a category which includes some heathland elements along with other species more typical of mobile and semi-fixed dunes;
- The UK Biodiversity Action Plan lists Lowland heathland as a Priority Habitat, regardless of whether it is coastal or inland, wet or dry, but also lists Coastal dune systems as a separate Priority Habitat, which may have some heathland elements present;
- The DAFF Phase 1 Habitat Survey treats Dry dwarf shrub heath as a category regardless of whether it is upland or lowland, but treats coastal heath as a separate category even though it, too, is strictly a type of dry dwarf shrub heath.

Remaining areas and rates of loss have been calculated for several of the classes of habitat above, but determining how these statistics relate to practical categories such as "all coastal dune heath" or "all dry lowland heath" can be difficult. Perhaps because of the choice of ways in which lowland heathland has been categorised, most of the available statistics about the status of the habitat are general, rather than for individual sub-types such as dune or wet heathland. Given that several broad types of heathland may occur adjacent to each other in any case, this document also takes a broad view of lowland heathland status – see **Overall status of lowland heathland**, below.

For the purpose of determining detailed minimum criteria for site selection, and bearing in mind the above points about other ways of classifying heathland, lowland heathlands on the Isle of Man have been grouped as follows:

Dry lowland heathland – heather-dominated habitats, found in scattered inland areas up to the edge of the hill-land, often on enclosed fields and up to an altitude of around 300m;

Wet lowland heathland – heather and cross-leaved heath-dominated habitats, often in conjunction with mires, restricted to small, poorly-drained areas of drier heaths, valley mires, and amongst marshy grassland.

Coastal heathland – heather- and Manx gorse-dominated habitats on cliffs and adjacent to coastal slopes, and heather- and lichen-dominated fixed, decalcified dunes.

These heathland types, and the National Vegetation Classification (NVC) categories they most closely resemble, are listed in detail in sections 3.4.1 – 3.4.3 below.

Overall status of lowland heathland

"Open heathland is rarer than rainforest. In the UK we have only about 16% left of the area that existed in 1800. That means that from an area similar to the size of Cornwall, only the equivalent of the Isle of Wight remains. The process of loss and disintegration has been particularly fast in recent decades. However, this country still holds 20% (more than 60,000 hectares) of the whole world's lowland heathland. Thus there is a need, not only to preserve and improve our remaining heathlands, but if possible, to re-create them in areas where they have recently been lost.
There is a special case for linking small fragments of heathlands, where the few remaining species are stretched for space and risk disappearing in the event of a fire, to create areas which can maintain a wider range of wildlife and can survive in the future."
(from English Nature, 2002)

Lowland heathland on the Isle of Man tends to be restricted to small, often isolated patches of inland farmland, or narrow zones along the coastline. The DAFF Phase 1 Habitat Survey does not distinguish between upland and lowland dwarf shrub heath, but the area of heathland below 250m may be ascertained from the mapping as less than one tenth of the overall heathland area (BDIS). Dry dwarf shrub heath is one of the commonest semi-natural habitats on the Island, but a glance at the habitat maps reveals that very little of this falls within lowland areas – around 6% is estimated to occur at altitudes under 250m. Wet dwarf shrub heath is rare in any case, with just 310ha, or 0.55% of the Island, in total (much of which also appears to be in the uplands) (Sayle *et al*, 1995). Only coastal heaths were measured separately, accounting for 322ha, most of it dune heathland at the Ayres. It may therefore be inferred that the rarity of both wet lowland heath and coastal heath throughout Europe is mirrored on the Island. The importance of these habitats is reflected in the Wildlife Sites Handbook, where all areas of lowland heathland which have at least 10% cover of heathers, preferably over 1ha in extent, should be considered for selection as Wildlife Sites (Keehan, 1999), along with **all** examples of coastal heathland which have more than 25% dwarf shrub cover.

Lowland heathland is vital for four bird species of high UK conservation concern: stone-curlew, nightjar, woodlark and Dartford warbler. Other birds of importance on heathlands include linnet (a Red List species), and stonechat, short-eared owl and curlew (Amber List species). The latter species all occur on heathland on the Isle of Man; short-eared owl and curlew are both protected under Schedule 1 of the Wildlife Act 1990. Heathland is also very important for insects, some of which are dependent on the

habitat. Heathland pools and streams support most of the UK's 38 species of dragonfly (RSPB, 2005). Manx invertebrate species of interest include lesser bee-fly *Bombylius minor* on coastal heathland and lesser mottled grasshopper *Stenobothrus stigmaticus* on coastal heathland/grassland, both of which are protected under Schedule 5 of the Wildlife Act 1990.

In the past, heathland in the UK was lost primarily to agriculture, forestry, mineral extraction and development. Uncontrolled burning has also been a particular threat to bryophyte and lichen-rich heathland. The UK Biodiversity Action Plan lists Lowland heathland as a Priority Habitat, and gives the main factors affecting the habitat at present as:

- Encroachment of trees and scrub and the simplification of vegetation structure due to a lack of conservation management such as light grazing, controlled burning and cutting.
- Nutrient enrichment, particularly deposition of nitrogen compounds emitted from intensive livestock farming, or from other sources.
- Fragmentation and disturbance from developments such as housing and road constructions.
- Agricultural improvement including reclamation and overgrazing, especially in Northern Ireland.

These factors apply in varying degree to the Isle of Man and indeed other parts of Europe (JNCC).

The scarcity of lowland heathland in the British Isles, and the responsibility of protecting one of the world's rare habitats, has led to a corresponding amount of conservation effort. For example, the Ministry of Defence – who own around 30% of the remaining UK lowland heathland - is represented on the UK Lowland Heathland Habitat Action Plan Steering Group, and has produced a Lowland Heathland Biodiversity Action Plan. A relatively high proportion of the lowland heathland resource in the UK has been notified as a Site of Special Scientific Interest SSSI under the Wildlife and Countryside Act 1981.

In the European context, both upland and lowland heaths are well-represented in the SAC series, and there is a high proportion of the rarer and more species-rich lowland types, which are particularly threatened by human activities (JNCC). Whilst not treated as a single habitat type (unlike the UK BAP), the EU Habitats Directive lists the following types, of which some or all occur on lowland heathlands:

- **European dry heaths** (much of this habitat is in the uplands)
- **Northern Atlantic wet heaths with *Erica tetralix*** (much of this habitat is also upland)
- **Atlantic decalcified fixed dunes** (usually occurs at around sea-level)

Lowland heathland may also be found within Ramsar Sites, especially where they form part of a lowland wet peatland system.

Where information is available for individual lowland heathland types, they are noted in the Status sections of parts 4.3.1 – 4.3.3, below.

Bell heather *Erica cinerea*, growing with "Spaghetti lichen" *Cladonia portentosa* in coastal heath

4.3.1 Dry lowland heathland

Description and Distribution

Dry lowland heaths typically occur on well-drained, acidic to circumneutral soils with low nutrient content. Heathers and other dwarf-shrubs dominate the vegetation. The most common is heather *Calluna vulgaris*, which often occurs in combination with gorse *Ulex* spp., bilberry *Vaccinium myrtillus* or bell heather *Erica cinerea*, though other dwarf-shrubs are important locally. Nearly all dry heath is semi-natural, being derived from woodland through a long history of grazing and burning. Most dry heaths are still managed as extensive grazing for livestock. Criteria for dry heaths in upland areas – which make up a high proportion of all the semi-natural vegetation on the Island – are listed in **Chapter 4.7: Upland habitats.**

At low to moderate altitudes in warm oceanic parts of southern Britain, the typical NVC form of the habitat is H8 heather-gorse *Calluna – Ulex* heath, characterised by abundant heather *Calluna*, Western/"Manx" gorse *U. gallii* and bell heather *Erica cinerea*. Western gorse becomes scarce in the cooler oceanic climate further north. It should be noted that this particular species of gorse is an important constituent of oceanic and southern heath in the British Isles (NCC, 1989), hence site selection on the Isle of Man needs to ensure that it is well-represented despite its apparent abundance here, not least because it is near the edge of its northerly native range.

Heather and bell heather are abundant together in H10 *Calluna – Erica* heath, especially on more southerly-facing slopes; bell heather *E. cinerea* becomes dominant in the hyper-oceanic fringes of the north-west, but in most cases appears to be the less prevalent species in Manx lowland heaths. In this respect they can resemble those of England, and as such are probably also at the northernmost limit of their range.

Dry lowland heathland is of high importance for birds. Many moorland birds feed and/or breed on dry lowland heathland, including hen harrier, nightjar, kestrel, merlin and short-eared owl – all of which are protected under Schedule 1 of the Wildlife Act 1990.

Classification of dry lowland heathland

Dry lowland heaths on the Island may be classified broadly as outlined in **Table 4.3.a:**

Status of dry lowland heathland

The DAFF Phase 1 Habitat Survey does not distinguish between dry dwarf shrub heath on lowland as opposed to upland areas. Overall, it is a common habitat on the Island; however, lowland examples only comprise around 6% of the total habitat resource (BDIS). Dry lowland heathland on the Isle of Man is not only rare, but also exceedingly fragmented. Whilst the DAFF Phase 1 Habitat GIS records 365 individual parcels of dry lowland heathland (i.e. under 250m altitude), over three-quarters of the total area of the habitat on the Island occurs within just twenty sites – only five of which are greater than 10ha. Added together, the hundreds of examples which are less than 0.5ha in extent (often much less) only make up 10% of the total area of the habitat. The Island is not alone in this respect: whereas dry heaths occur throughout the UK, and are particularly abundant in the uplands, where they may dominate the landscape, they are more localised and fragmented in lowland areas, especially in south and central England, where they have declined in extent due to afforestation, agricultural improvement and other factors (JNCC).

European dry heaths are an Annex 1 habitat under the EU Habitats Directive. They are found in every EU Member State except for Greece, but are only extensive in the western oceanic fringes of Europe. A high proportion of the EU resource of European dry heaths occurs in the UK, although this proportion is not as high as that of the other Annex 1 habitat, Northern Atlantic wet heaths with *Erica tetralix* (see 4.3.2, below). Dry heaths in the UK exhibit exceptional diversity in comparison with examples found elsewhere in the EU. (www.JNCC.gov.uk, 2005).

For more details see **Overall status of lowland heathland**, above.

Table 4.3.a: Broad categories of dry lowland heathland on the Isle of Man

Type and Description	Species rich?	Closest NVC categories (see Rodwell 1992[2])	Rarities present?	Protected species present?
Manx gorse heath – often found near the coast, especially in the south of the Island, but not necessarily right next to the sea.	Not usually	H8a &b *Calluna vulgaris* – *Ulex gallii* (heather and western or "Manx" gorse) heath Six Island NVC samples, all within the species-poor or *Danthonia decumbens* (a moss) sub-communities. One other sub-community may be present on the coast – see Table 4.3.c, below.	Not usually	Yes. Protected bird species are likely, including, kestrel, merlin and possibly feeding chough.
Heather heath – occurs throughout, including upland fringes. Often subjected to burning and liming.	Not usually	H10 *Calluna vulgaris* – *Erica cinerea* (heather and bell heather) heath One Island NVC sample	Not usually; rarely supports unusual clubmosses such as fir clubmoss *Huperzia selago* and stag's-horn clubmoss *Lycopodium clavatum*	Yes. Protected bird species are likely, including hen harrier, kestrel, merlin and short-eared owl. Potential for nightjar though records rare now.

Minimum selection criteria for dry lowland heathland

- All areas of dry lowland heath greater than 5ha in extent should be considered for selection;
- Any smaller areas of dry lowland heath should be considered for selection where they form part of a mosaic of semi-natural habitats of 2ha or more in extent, and the site as a whole satisfies at least one of the Priority Site Criteria listed in Part 3.

4.3.2 Wet lowland heathland

Description and Distribution

Wet heathland usually occurs on acidic, nutrient-poor substrates, such as shallow peats or sandy soils with impeded drainage. The vegetation is typically dominated by mixtures of cross-leaved heath *Erica tetralix*, heather *Calluna vulgaris*, grasses, sedges and *Sphagnum* bog-mosses. It is highly likely to occur in conjunction with other habitats such as dry lowland heath, marshy grassland, mire and bog.

M15 *Scirpus – Erica* wet heath is found in areas with a moderate to high rainfall, and is the typical form of wet heath in the north and west of the UK. *E. tetralix* and *Calluna* are typically accompanied by abundant deer grass *Trichophorum cespitosum* and purple moor-grass *Molinia caerulea*. Where there is movement of mildly base-rich water through the peat, sedges *Carex* spp. and a wide range of species favoured by flushing occur. The latter include distinctive variants that are often characterised by abundant bog-myrtle *Myrica gale*, or black bog-rush *Schoenus nigricans*. These habitat variants are rare on the Island, as elsewhere.

M16 bell heather/Sphagnum moss *Erica – Sphagnum* wet heath is characteristic of drier climates in the south and east of the UK, and is usually dominated by mixtures of cross-leaved heath *Erica tetralix*, heather *Calluna* and purple moor-grass *Molinia caerulea*. The bog-moss *Sphagnum compactum* is typically abundant. Both the above habitats are relatively diverse and colourful compared with many dry heaths, and may support good populations of protected species such as heath-spotted orchid *Dactylorhiza maculata ssp ericetorum*.

Wet heaths occur in several types of ecological gradient. In most lowland areas they are very local, and often restricted to the transition zone between dry lowland heaths and constantly wet valley mires. This effectively means that the majority of wet lowland heathland on the Island is restricted to many very small patches within larger semi-natural areas. Similar habitat in the uplands occurs most frequently in gradients between dry heath or other dry, acid habitats and blanket bogs – **see Chapter 4.7: Upland habitats**.

Classification of wet lowland heathland

Please note that in upland margin areas, some wet heathland types may occur which are more typical of uplands; these may be important habitats to include as part of the gradient between lowland and upland heathlands on some sites. They are described in more detail in Chapter 4.7: Upland habitats.
Strictly lowland wet heathland on the Island may be classified broadly as outlined in **Table 4.3.b:**

Table 4.3.b: Broad categories of wet lowland heathland on the Isle of Man

Type and Description	Species rich?	Closest NVC categories	Rarities present?	Protected species present?
Cross-leaved heath wet heath Actually both NVC types listed here are a type of mire; other mire types with less heathy characteristics may occur nearby (see **Chapter 4.4 Bogs, fens and flushes**).	Yes, often	M15 *Scirpus cespitosus – Erica tetralix* (deer grass and cross-leaved heath) wet heath No Island NVC sample M16 *Erica tetralix-Sphagnum compactum* (cross-leaved heath and Sphagnum moss) wet heath No Island NVC sample	May support rare invertebrates and/or plants	Protected birds of prey such as hen harrier and peregrine may use as feeding territory; also a possibility of lapwing. A likely habitat for cranberry *Vaccinium oxycoccus,* heath-spotted orchid *Dactylorhiza maculata ssp ericetorum* and pale butterwort *Pinguicula lusitanica*.

Wet lowland heathland status

The DAFF Phase 1 Habitat Survey does not distinguish between wet dwarf shrub heath on lowland as opposed to upland sites; hence it is difficult to discern the total extent of the habitat on the Island. Unlike dry dwarf shrub heath, which is concentrated in the uplands, wet heath occurs in roughly equal amounts in both upland and lowland habitats, if "upland" is taken as any habitat over 250m. Wet lowland heathland is a very fragmented habitat on the Island, with just 11 out of 81 sites containing 75% of the total habitat area. The remaining 25% is scattered throughout 70 separate blocks of wet lowland heathland, all under 2ha in extent, and most under 1ha (BDIS).

Wet heath is extensively developed in western Britain and there are large areas of poor-quality habitat which do not meet the criteria for SAC selection; however, the vast majority of this is in upland areas. One exception is **Northern Atlantic wet heaths with *Erica tetralix***, which are an Annex 1 habitat under the EU Habitats Directive. They are restricted to the Atlantic fringe of Europe between Norway and Normandy. A high proportion of the EU resource occurs in the UK, where it is restricted to highly localised sites in parts of southern and central England (JNCC). Small fragments of this habitat type occur on lowland sites around the Isle of Man, usually in conjunction with valley mires and fens.

Wet heath is an important habitat for a range of vascular plant and bryophyte species of an oceanic or Atlantic distribution in Europe, several of which have an important part of their EU and world distribution in the UK. The UK is one of the most important parts of the world for Atlantic bryophytes, and this is the most important habitat for many of these oceanic species of restricted world distribution (www.JNCC.gov.uk, 2005). The location of the Island would suggest that it may contribute to the UK's high proportion of bryophyte-rich wet heath; however, the full extent of bryophyte diversity in wet heaths on the Isle of Man is not well known at present. It is therefore an area which requires further study.

Minimum selection criteria for wet lowland heathland

- All areas of wet lowland heathland over 0.5ha in extent which fulfil at least one of the Priority Site Criteria listed in Part 3 should be considered for selection;

- Smaller areas of wet lowland heathland which occur in conjunction with other semi-natural habitats totalling 1ha or more should be considered for selection where the site as a whole satisfies at least one of the Priority Site Criteria listed in Part 3. Sites which consist of a range of related wetland habitats should here be considered a top priority.

4.3.3 Coastal heathland

Description and Distribution

Coastal heathland around the Isle of Man usually takes one of two forms: dune heathland on fixed, decalcified dunes (i.e. those where the calcium content of the shell sand has been leached out by rain, leaving an acidic sandy soil), or gorse-dominated heath on rocky cliffs and slopes adjacent to the sea.

Dune heathland occurs on mature, stable dunes where the initial calcium carbonate content of the dune sand is low. The surface soil layers rapidly lose their remaining calcium carbonate through leaching, and become acidified. The most characteristic community is dune heath in which heather *Calluna vulgaris* is found in combination with sand sedge *Carex arenaria*. The main species present vary considerably throughout the UK. Bell heather *Erica cinerea* is abundant in dune heath on west coast sites, but much scarcer in the east, where heather *Calluna vulgaris* predominates. Manx dune heathland appears to be more or less intermediate in this respect. Associated with the heathland in drier conditions, and forming transitions with it, is acidic dune grassland. This is often a precursor to heath development and in these drier conditions is usually characterised by a combination of the fine-leaved grasses such as sheep's-fescue *Festuca ovina* and common bent *Agrostis capillaris*, with sand sedge *Carex arenaria*.

On very nutrient-poor sand that is also subject to severe drought, dune heath tends to be dominated by lichens, which form a continuous grey carpet over the ground. Such low-growing habitats may depend on rabbit-grazing for their survival, and can become overgrown quite rapidly if grazing pressure is reduced. The Isle of Man has an unusual regional example of this kind of lichen heath: for a short section of the Ayres coastal dune system, the shorter areas of heath are dominated by lichens, principally *Cladonia* spp., and sausage lichen *Usnea articulata* – a delicate species, listed as Near threatened in the UK (JNCC), and more usually found growing on trees in sheltered woodland and orchard margins. The relatively mild conditions on the Manx coastline appear to suit it. As such it represents both a unique sub-type of habitat, and a valuable indicator of low background pollution levels, as *U. articulata* is highly sensitive to sulphur dioxide, and is now extinct in most of its former range in England (DEFRA air pollution factsheet, 2005).

Dune heathland almost always occurs in a gradient with other coastal dune habitats, flanked on the inland side by other dry lowland heathland types, or by cultivated farmland. This chapter may therefore need to be read in conjunction with **Chapter 4.6: Coastal habitats.**

Rocky coastal heathland consists of maritime heather *Calluna vulgaris* and spring squill *Scilla verna* heaths. These are usually characterised by abundant Western or "Manx" gorse, *Ulex gallii*. Whilst a familiar and common species on the Island, Manx gorse is actually a key element of one of the more restricted types of coastal heath in the UK, represented here at the northernmost end of its natural range. This kind of coastal heath is at its most diverse when in conjunction with other, related habitats, with which it often forms a gradient – such as coastal grassland and scrub.

Classification of coastal heathland

Bearing in mind the comments about classification made in the introduction above, coastal heathland on the Island may be classified broadly as outlined in Table 4.3c.

Table 4.3.c: Broad categories of coastal heath on the Isle of Man

Type and Description	Species rich?	Closest NVC categories	Rarities present?	Protected species present?
Rocky coastal heath A type of heath which is notable for being a natural climax community in most of the places where it occurs; often found on cliff tops and slopes within range of sea spray.	May be species rich, especially where found in conjunction with coastal grassland on base-rich sites.	H7 *Calluna vulgaris – Scilla verna* (heather and spring squill) heath No Island NVC sample H8d *Calluna vulgaris – Ulex gallii* (heather and Manx gorse) heath, *Scilla verna* (spring squill) sub-community No Island NVC sample; likely to be at the northern limit of its range	Yes, especially when in conjunction with coastal grassland; species may include species such as purple milk-vetch *Astragalus danicus*, and see right.	May form part of chough feeding territory. Possible protected plants include Autumn ladies tresses *Spiranthes spiralis*, Portland spurge *Euphorbia portlandica*, and spring sandwort *Minuartia verna*. Lesser mottled grasshopper *Stenobothrus stigmaticus* in coastal heathland/grassland.
Dune heath Heathland generally forms at some distance from the sea; lowland heathland types, including coastal heath, are described in more detail in **Chapter 4.3.**	Yes – particularly in lichens and invertebrates, but also in vascular plants.	H11 *Calluna vulgaris – Carex arenaria* (heather and sand sedge) heath One Island NVC sample – at the southern end of the range of this habitat. May grade into H10 *Calluna vulgaris – Erica cinerea* (ling and bell heather) heath on the landward side.	A very specific lichen habitat, supporting unusual species such as sausage lichen *Usnea articulata*. Unusual plants include suffocated clover *Trifolium suffocatum*, and see right.	Offers good habitat for lizards *Lacerta vivipara*. Hare's-foot clover *Trifolium arvense*, and orchids may be present. Protected invertebrates known to occur on this habitat include heath bee-fly *Bombylius minor.*

Coastal heathland status

Coastal heath is listed separately from other lowland heathland types in the DAFF Phase 1 Habitat Survey. The actual overall area of coastal heath measured is very low; dune heathland, restricted to the Ayres, amounts to just 0.55% of the Island (311ha), and lichen/bryophyte heath (defined there as having less than 30% vascular plant cover) is only 3.12ha in total. Other coastal heath is restricted to rocky cliff tops and slopes, and comes to 11.44ha. Whilst this last figure may partly be low due to false representation of steep habitats on the orthographic mapping system, it is nevertheless clear that coastal heath is not common on the Island, and is restricted to narrow strips. Nor is it a continuous feature as might be expected, many areas of coastline having now been cultivated right up to the edge of the cliff-top. In recognition of the rarity and vulnerability of coastal heathland of all kinds, the Manx Wildlife Sites Handbook recommends that all areas of coastal heath should be eligible for Wildlife Site selection.

In the UK, both sand dunes and other coastal heath have been recognised as important, with a high proportion of sand dune sites designated as SSSI, or ASSI in Northern Ireland. All coastal sand dunes are a UK BAP Priority Habitat.

In the European context, Atlantic decalcified fixed dunes (*Calluno-Ulicetea*) are not just an Annex 1 habitat under the EU Habitats Directive, but are also listed as a Priority Feature. Atlantic decalcified fixed dunes are widespread in Europe, and the UK lies at the centre of the north – south range of this habitat type (JNCC). The dune heathland at the Ayres fits this category.

Minimum selection criteria for coastal heathland

- All examples of dune heath should be considered for selection; top priority should be given to lichen-rich examples, with the aim of protecting all examples of lichen heath with *Usnea articulata* as ground cover;

- All examples of coastal heath on rocky cliffs and slopes should be considered for selection where the site in question satisfies at least one of the Priority Site Criteria listed in Part 3; further priority should be given to sites where the heathland occurs in natural proximity to other coastal habitats such as coastal grassland and scrub.

Coastal heathland at Langness ASSI

4.4 Bogs, fens and flushes

Description

Bogs, fens and flushes are all types of **mire** - a broad term used to describe waterlogged habitats where water is permanently at or just below ground level. Mires may result from a constant flow of surface water, or, more commonly, impeded drainage. In either case, the waterlogged conditions can lead to a range of problems for plants, such as low soil oxygen levels, high acidity and limited nutrient availability. Because of this, mires tend to contain specialised vegetation communities which are well adapted to the difficult conditions, but very sensitive to change - and hence vulnerable to loss through agricultural improvement and drainage. In spite of all this, mires can support a surprisingly high degree of biodiversity. They are of importance for many rare and delicate plants, and they also provide a home for specialised invertebrates and a range of upland and lowland birds, most notably waders.

Mire habitats contribute a very distinctive element to both upland and lowland landscapes, with purple moor-grass pastures full of bog asphodel and heath spotted-orchids, cotton-grass bogs, and their resident calling curlews all ranking amongst the most popular and evocative elements of the Manx countryside. Unfortunately, mires throughout the British Isles are vulnerable to loss and damage, particularly from commercial peat extraction and agricultural improvement. The high rate of loss of these very special communities has led to their inclusion in both the EC Habitats Directive and the UK Biodiversity Action Plan as priority habitats for conservation.

Because the term "mire" is such a general one, it is usually split into bogs, fens or flushes, depending on the type of water source involved:

- True **bogs** receive all their nutrient input from rainwater, and tend to have a very nutrient-poor, acid environment, often characterised by abundant *Sphagnum* mosses;

- **Fens** are different, in that they additionally receive groundwater input, either from the surrounding water table, or from springs, seepages and surface water runoff. The nature of a fen depends a lot on the source of the groundwater: base-rich groundwater (e.g. from limestone bedrock) offers more plant nutrients than a true bog, whereas acidic groundwater (e.g. from Manx slate) tends to create fen conditions that are similar to bogs fed by rain alone;

- If a patch of fen results from a localised source of surface water flow (a spring, for example), it is usually classed as a **flush**. Flushes result in the familiar "bright green patches" on hillsides.

The different categories of bog, fen and flush vegetation known to occur on the Isle of Man are detailed in **Types of Mire**, below. For the purpose of these Criteria, bogs, fens and flushes are taken to include all waterlogged habitats, whether seasonal or permanent, *except*:

curragh - which is covered under the Woodland and Scrub criteria;
inundation grassland - which is covered along with other Grassland types; and
swamp - which is associated with aquatic habitats, as opposed to mire which has waterlogged s oil but little actual standing water. Swamp is covered under the Freshwater and Swamp criteria.

Note: Bogs and fens are treated separately in the UK *Guidelines for Selection of Biological SSSIs*. However, many of the most distinctive types of fen found in the UK do not occur on the Island, whilst the bogs and fens that do occur are often closely interrelated and can be hard to tell apart. For these reasons bogs, fens and flushes have here been included within the same set of Criteria.

Assessing bog, fen and flush habitats

In general, the same principles of site assessment apply to mires as to grasslands: all of the Priority Site Criteria listed in Part 3 are relevant. As with grasslands, the position of a mire within the surrounding ecological unit can make a big difference to its importance for wildlife, especially where bird and invertebrate species are concerned. Other factors, such as size, level of disturbance, presence of rare species and extent of the associated peat should all be taken into account when assessing the potential merits of designation.

In particular, the question of water source in relation to nutrient input into the site may be crucial to the current and ongoing nature conservation value of a mire. Hydrology and adjacent land use (e.g. traditional low-input farming methods) are therefore of special concern.

Because of the considerable range of mire habitats known to occur on the Island, their detailed descriptions, classification, status and distributions are treated separately here for reasons of clarity and ease of reference. However, as when assessing a grassland, it should be borne in mind that this is an artificial separation. In fact, the majority of mires contain more than one type of vegetation community, with many bog areas grading into fen, blanket mire into valley mire, and so on. Likewise it is not uncommon for some mire communities to occur *only* within a larger mosaic of wet heath or grassland habitats. Therefore, sites which do not "fit" the broad categories are not necessarily poor examples of species-rich communities, and may be as important for wildlife as more "typical" habitats.

National Vegetation Classification (NVC) categories have been listed below in order to help with the identification of individual bog, fen and flush communities, but it should be noted that when the NVC was being compiled even fewer mire habitat samples were taken from the Island than grassland ones. The NVC should therefore be used as a guide in this context rather than a direct key to the value of a given habitat. This is especially true of upland areas, where a closely-related mixture of habitats may occur even within a small area. Because successful protection of upland biodiversity relies on inclusion of a wide range of closely-related habitat features, upland ASSI selection is treated specifically in Chapter 4.7: Upland habitats.

In the case of very rare bog, fen and flush communities, particularly those which support rare and/or protected species, **all** examples will qualify for selection as ASSIs provided that they are of sufficient size and fulfil the minimum criteria. In most cases, however, candidate sites will be selected to represent the best good examples of each mire type and variant. They will be considered to be "good examples" if they not only fulfil all the minimum requirements but also one or more of the Priority Sites Criteria listed in Part 3.

It should always be borne in mind that the distinction between bog, fen and flush vegetation communities can be very subtle, based on small differences in water source, peat depth, aspect, grazing levels, nutrient enrichment, seasonal drying and a host of other factors. To add to the ecological complexity, both bogs and fens often form part of a mosaic of wet, acid grassland and heath habitats, the whole of which supports an ecology which requires all the separate habitat elements in order to thrive. The delicate balance required in order to maintain bog habitats in particular has lead to a widely-recognised category of "modified bog", which encompasses habitats which result from drying out, scrub-encroachment, over-grazing or nutrient enrichment of established bogs. Despite losing some of their characteristic bog species, modified bogs may also be of high value for wildlife. With this in mind, **the assessment process should aim to protect the full range of Manx bog and fen biodiversity by recognising good examples of varied mire/heath/grassland mosaic habitats as well as the best large areas of a single mire type.**

Types of mire

Two main factors govern the classification of mire types: the source of water and nutrients – which governs the distinction between bogs, fens and flushes as described above - and the depth and type of soil medium. Although it is possible for mires to form in waterlogged mineral soils with no peat present, the majority of bogs, fens and flushes on the Isle of Man are associated with peat deposits. These result from a gradual build-up of dead vegetation – *Sphagnum* mosses in particular - wherever conditions are too waterlogged to allow it to decompose away. This build-up of organic matter can result in a body of peat several metres in depth.

Places where peat is known to be accumulating are known as "active mires" or "active bogs". Any of the types of mire listed below may be either inactive or active regarding the build-up of peat; in practice however this can be difficult to tell. In some cases one site will have some areas of active peat deposition, and others where the peat layer is no longer being added to, perhaps because of heavy selective grazing, or because the mire in that area is starting to dry out. In general, bogs are most likely to be active, whilst fens and flushes may or may not create a build-up of peat.

Examples of mire types on the Isle of Man include basin mires, where peat has developed within a waterlogged depression in the surrounding land; valley mires, where sloping ground is kept waterlogged by springs, seepages and overflows, often at the base of hills or along either side of mountain streams and rivers; and blanket mires, which can cover substantial areas of mountain top and hillside, and receive most of their water from rainfall alone. Blanket mire includes the familiar "blanket bog" that covers wet hill-land throughout the uplands of the British Isles. Whilst convenient for the purposes of ecological survey, the three main types of mire are not always very distinct from each other in the field. For example, blanket mire often grades into slightly more nutrient-rich valley mire on the lower slopes of hills and alongside streams and rivers. This is particularly the case on the Isle of Man, where some habitat categories are actually very closely associated with each other and probably best lumped together for convenience.

Site selection criteria for mire habitats on the Isle of Man have been grouped as follows:

Bog
Mires which receive all or nearly all of their nutrient input from rainwater alone.
Lowland "raised bogs" are very rare; "blanket bog" is the commonest type of mire on the Island and throughout the British Isles. Blanket bog usually occurs on deep peat in the uplands, and is here taken to include the category of "modified bog" .

Valley mires - fens associated with groundwater or surface water flow from springs, river heads, and
flushes - seepages and overflows on hillsides, sloping river and stream valleys and valley floors.

Basin mires
Areas of fen which form where water is "ponded" or trapped in depressions in the surrounding land. Basin mires can cover a large area, but on the Isle of Man they are mostly limited to shallow scrapes and ponds which have filled up with vegetation and now have waterlogged soil but no standing water.

Fen meadows
Waterlogged meadows which are subject to grazing and/or hay cutting. These are often treated as marshy grassland, but they are strictly mires and their vegetation and ecology reflect this. Although rare, they represent one of the most diverse mire habitats on the Isle of Man. Fen meadows are a remnant of a type of farmland which would once have been more common; unlike most mire communities, they are directly dependent on farming methods. This kind of pasture is now thought to be one of the fastest-disappearing wildlife habitats in the British Isles.

These Manx mire types, and the National Vegetation Classification (NVC) categories they most closely resemble, are listed in detail below.

4.4.1 Bog

Description and Distribution

Bogs are mires that support vegetation that is usually peat-forming and which receive mineral nutrients principally from rainwater, with little or no surface flow or groundwater input. This is referred to as ombrotrophic (rain-fed) mire. The vegetation of bogs which have not been modified (e.g. by surface drying and aeration or heavy grazing) is dominated by acid-loving plant species such as bog-mosses *Sphagnum* spp., cotton-grass *Eriophorum* spp. and cross-leaved heath *Erica tetralix*. The water-table on these types of bogs is usually at or just below the surface. The term "bog", like "mire", is a broad category, usually split into two main types, namely raised bog and blanket bog, both of which are capable of a lot of variability. Raised and blanket bogs have broadly similar ecosystems, although some plant and invertebrate species are clearly more specialist than others.

Raised bogs are a rare habitat type both on the Isle of Man and throughout the British Isles. They generally form on flat lowland sites, where the accumulated dead mosses and other organic matter have built up to above the original ground level, forming a characteristic "dome" of waterlogged peat. In the 1994 Ecological Habitat Survey, only one small area of raised bog was identified on the Island. However,

it is possible that small localised patches of raised bog may also occur on more or less flat ground within larger areas of Manx bog or fen, resulting in small pockets of unusual invertebrate or vegetation communities.

Blanket bog is not confined to areas of poor drainage but rather can cloak whole landscapes, even developing on slopes of up to 30°. The period over which blanket peat has been accumulating and the depth it can attain are very variable and not necessarily related. UK studies indicate that most blanket peat development began 5000-6000 years ago, but the range extends from 9000 - 1500 years ago. There is evidence to suggest that some areas of blanket bog began to form following clearance of the original forest cover by early man, but the relative significance of this activity and changing climate on the historical and contemporary extent of the resource has yet to be determined either for the Isle of Man or elsewhere in the British Isles. There is no agreed minimum depth of peat which can support blanket bog vegetation. Throughout the British Isles as a whole, peat depth is very variable, with an average of 0.5-3 m being fairly typical but depths in excess of 5m not unusual. The majority of bogs on the Island are associated with peat deposits of between 0.5 and 3.0 metres.

Throughout their range, blanket bogs support a very wide range of terrestrial and aquatic plants, vertebrates and invertebrates. Some of these are widespread and common, such as heather *Calluna vulgaris*, cross-leaved heath *Erica tetralix*, deer grass *Trichophorum cespitosum*, and cotton grass *Eriophorum* species. Some are much more local, such as the UK BAP species pillwort *Pilularia globulifera*, a protected plant on the Isle of Man. Some are of international interest, for example Eurasian golden plover *Pluvialis apricaria,* which is an infrequent visitor to upland bog and modified bog on the Island, and a rare breeder. One striking feature of very nutrient-poor bogs is the presence of carnivorous plants, which supplement the low nutrients available in the bog with ingenious ways of catching and digesting insects. These species are too specialised to thrive on richer habitats, and depend on mire habitats for their survival.

The presence, extent and type of surface patterning is an important feature of blanket bogs, often exerting a strong influence on the abundance and diversity of plants and animals present. Patterning can range from a relatively smooth surface, with the only irregularities being those created by vegetation features (eg hare's-tail cotton-grass *Eriophorum vaginatum* tussocks and *Sphagnum* moss hummocks) to the extreme patterning associated with suites of bog pools and the intervening ridges. Whilst not as dramatically varied as bogs elsewhere in the British Isles, the full range of patterns of Manx bogs should be represented by the ASSI selection process, in order to reflect the full range of biodiversity involved.

In addition to supporting a diverse ecosystem, blanket bogs fulfil an important role as repositories of archaeological and palaeoecological material and have functional values as agricultural rough grazing, sporting estate and water catchments. In the context of climate change the role of blanket bogs as a carbon store is also now considered significant.

Blanket bog is one of the most extensive semi-natural habitats in the UK and ranges from Devon in the south to Shetland in the north. As with the rest of the British Isles, blanket bog is by far the commonest type of mire on the Isle of Man, covering substantial areas of the uplands; however, despite its regional abundance, blanket bog is very restricted globally, and is one of the habitats listed in the EC Habitats Directive as internationally threatened. For this reason, countries within the British Isles are considered to have a special responsibility for the conservation of these distinctive and ecologically fragile areas.

The bog habitat category also includes **modified bog** vegetation that essentially resembles wet or dry dwarf shrub heath but occurs on deep acid peat which would have once supported peat-forming vegetation. Modified bog includes impoverished vegetation dominated by purple moor-grass *Molinia caerulea* or hare's-tail cotton-grass *Eriophorum vaginatum*. Although there is no agreed minimum depth of peat that can support ombrotrophic vegetation, unmodified bog can be identified floristically by the presence of characteristic species such as cotton-grass *Eriophorum* spp. and peat-forming *Sphagnum* mosses – a feature that tends to be absent or much-reduced once a bog has been modified. Wet modified bog is rare on the Isle of Man, being mostly confined to the Ballaugh Curragh, but dry modified bog is fairly frequent; on the Island it usually takes the form of wet heather or purple moor-grass dominated moorland, modified by farming activities or changes in hydrology, but with some bog species remaining.

The extensive nature of both unmodified and modified blanket bog is such that other mire habitats frequently occur in close association with it. It is therefore very variable and may include localised areas of fen habitat wherever the "blanket" is interrupted by surface water flow, seepage and springlines. Such localised variations in the strict definition of a bog are usually included within the same category as blanket bog to avoid confusion with more clearly differentiated types of fen. In the Manx uplands blanket bog can thus encompass some areas classed as 'intermediate bog' (i.e. sharing features of both raised and blanket bog) together with examples of spring, flush and poor fen, a range of oligotrophic (nutrient poor) water bodies whose catchment is largely or entirely blanket bog, and those relatively small areas of heath and grassland which occur on better drained slopes and by the many streams and rivers which drain areas dominated by blanket bog. Not only are all such areas in hydrological connection with the surrounding peat mass, they frequently contribute to the overall habitat requirements of the peatland fauna. This inextricable mosaic of upland habitats is thought to require a more comprehensive approach to site selection than more clearly-defined lowland habitats, hence the selection of blanket bog ASSIs is covered specifically in Chapter 4.7: Upland habitats.

Status of bogs

The total extent of blanket peat in the UK amounts to just under 1.5 million ha. There is no agreed figure for the extent of blanket bog vegetation. In terms of national cover of blanket peat soil (in the main >0.5 m deep) England supports some 215,000 ha, Scotland approximately 1,060,000 ha, and Wales has around 70,000 ha. Northern Ireland has approximately 140,000 ha of blanket bog vegetation. Significant proportions of peat soil, probably in excess of 10%, no longer support blanket bog vegetation (for example because it has been modified by agricultural activities, or subjected to commercial peat extraction).

Comprehensive data for changes to the total UK resource are lacking, but studies in Scotland (where most of the resource lies and where it accounts for some 13% of the land area) suggest a 21% reduction in the extent of blanket mire between the 1940s and the 1980s. The greatest single cause of this reduction (51%) is afforestation, and substantial losses to forestry are reported from Wales. Further losses of extent and condition can be attributed to drainage and heavy grazing, peat cutting and atmospheric pollution, resulting in significant habitat change in, for example, mid and south Wales and the Pennines.

Within the Isle of Man, bogs are rarely dug out for peat, but may lose some of their diversity due to farming activities or, occasionally, development such as pipeline construction. The 1994 Ecological Habitat Survey report identified a total of just 0.36ha of true raised bog, 105.72ha of blanket bog, 26.08ha of wet modified bog, and 67.36ha of dry modified bog. It is not known how much previously-unmodified blanket bog has since been modified, but the process is plainly still under way on the Island due to the need to utilise farmland to the best ability. The introduction in 2002 of the Manx Agri-environment Scheme may contribute to reducing the rate of modification of otherwise undisturbed upland bogs.

Classification of bogs

Bearing in mind the comments above regarding the use of the National Vegetation Classification (NVC), bogs on the Island may be classified broadly as outlined in **Table 4.4a:**

Table 4.4a: Broad categories of bog on the Isle of Man

Type and Description	Species rich?	Closest NVC categories	Rarities present?	Protected species present?
Bog pools	yes	M1 *Sphagnum auriculatum* bog pool community. No Island NVC sample.	Highly likely to support rare invertebrates	Protected birds of prey such as hen harrier and peregrine may use as feeding territory; also a possibility of lapwing.
Cotton-grass bog	yes	M17 *Scirpus cespitosus-Eriophorum vaginatum* blanket mire One Island NVC sample M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire (restricted to highest upland areas) No Island NVC sample	May support rare plants and/or invertebrates	Protected birds of prey such as hen harrier and peregrine may use as feeding territory; also a possibility of lapwing.
Cross-leaved heath bog (sometimes modified bog)	yes	M18 *Erica tetralix-Sphagnum papillosum* raised and blanket mire No Island NVC sample	May support rare invertebrates and/or plants	Protected birds of prey such as hen harrier and peregrine may use as feeding territory; also a possibility of lapwing. A likely habitat for cranberry *Vaccinium oxycoccus* and rare sedges such as white sedge *Carex curta*.

Minimum selection criteria for bogs

Raised bog
Any unmodified examples of raised bog will qualify for selection if they are over 0.25ha in total extent; Examples of smaller extent will be considered if they form a significant element of a larger area of related habitats that fits at least one of the priority sites criteria as listed in **Part 3**.

Blanket bog
Blanket bog is confined to the uplands; selection of blanket bog will therefore be covered entirely under the specific upland site selection process in Chapter 4.7.

Wet modified bog
Examples of wet modified bog over 1ha in extent will qualify for selection;
Examples of a smaller extent will be considered as a part of a larger mosaic of related habitats, and/or where they fulfil at least one of the Priority Sites Criteria listed in Part 3.

Dry modified bog
Dry modified bog will usually be selected only as part of a larger mosaic of related habitats; this may include heathland and upland sites (See Chapters 4.3 and 4.7 respectively).

4.4.2 Valley mires and flushes

Description and Distribution

A distinctive, complex habitat on the Isle of Man, often associated with blanket bog areas, but also frequently grading into swamp and open water, grassland or heath. Valley mire is naturally marginal to other habitats, but it can also represent the only remaining semi-natural vegetation within improved farmland, especially in or adjacent to upland areas where all the surrounding habitats have been modified or improved. Flushes may occupy quite large areas, particularly at the head of rivers, but usually they are small, appearing as characteristic "bright green patches" on hillsides and valleys. Even small flushes can house unusual or very local invertebrate and plant populations. Valley mires and flushes on the Isle of Man are usually on peat soils, with a neutral to acid chemistry, and hence often have similar species to bogs.

Classification

Bearing in mind the comments above regarding the use of the National Vegetation Classification (NVC), valley mires and flushes on the Island may be classified broadly as outlined in **Table 4.4b:**

Table 4.4b: Broad categories of valley mires and flushes on the Isle of Man

Type and Description	Species rich?	Closest NVC categories	Rarities present?	Protected species present?
Sedge-dominated mires	Not always botanically rich	M4 *Carex rostrata-Sphagnum recurvum* mire No Island NVC sample M6 *Carex echinata-Sphagnum recurvum/auriculatum* mire One Island NVC sample	May support rare plants and/or invertebrates	Protected birds of prey such as hen harrier and peregrine may use as feeding territory; also a possibility of lapwing. A likely habitat for rare sedges such as white sedge *Carex curta*.
Cross-leaved heath wet heathland (also, see **Chapter 4.3 Lowland heathland**)	yes	M16 *Erica tetralix-Sphagnum compactum* wet heath No Island NVC sample	May support rare invertebrates and/or plants	Protected birds of prey such as hen harrier and peregrine may use as feeding territory; also a possibility of lapwing. A likely habitat for cranberry *Vaccinium oxycoccus* and rare sedges such as white sedge *Carex curta*.
Purple moor-grass pastures	sometimes	M25 *Molinia caerulea-Potentilla erecta* mire 1 Island NVC sample	May support rare invertebrates and/or plants	Protected plants such as orchids are highly likely to be present.
Bog pondweed flushes	Not always	M29 *Hypericum elodes-Potamogeton polygonifolius* soakaway	May support rare invertebrates and/or plants	A possible habitat for Pillwort *Pilularia globulifera* and other unusual plants.

Valley mire and flush status

In the UK the majority of fens as a whole are notified as SSSI/ASSIs and many are notified as Wetlands of International Importance under the Ramsar Convention and as SPAs under the EC Birds Directive. Several of the larger fens are managed as NNRs by EN and CCW, and as reserves of the RSPB and County Wildlife Trusts. Several types of fen are listed in the Habitats Directive including transition mire, poor and rich fen, alkaline fens (rich-fen not found on the Isle of Man). A number of fens have been proposed as SACs under the EC Habitats Directive for these types.

Fens as a whole are now a Priority Habitat in the UK Biodiversity Action Plan; small flushes and patches of valley mire which fall within active upland blanket bog areas would also be covered under the Priority Habitat: Blanket Bog. Within the Isle of Man true valley mire is very scattered and often limited in extent, totalling only 14.56ha in the 1994 Ecological Habitat Survey Report. Flushes, which include some extensive areas eg. at the head of the Blaber River, amount to 455.24ha, although it should be noted that much of this occurs on one or two large sites; the rest is very scattered.

Minimum selection criteria for valley mires and flushes

- **All** examples of valley mires and flushes greater than 2ha will qualify for selection;

- Sites which have a mosaic of habitats in which valley mires and/or flushes feature as a proportion of the overall vegetation will qualify for selection if their total extent is greater than 2ha and they fit at least one of the Priority Sites Criteria as listed in Part 3.

- Flushes which occur in association with saltmarsh, cliff or other coastal habitats will be covered by the relevant coastal habitat criteria.

- The importance of valley mires that occur within upland areas has been taken into account in the upland site selection process. Valley mires and flushes that lie within upland areas will therefore be selected by the specific upland site selection process detailed in Chapter 4.7: Upland habitats.

4.4.3 Basin mires

Description and Distribution

Basin mires are a form of fen which develops when water is "ponded up" within a depression in the ground. This may be a natural topographical feature, such as a kettle hole or pingo, or a man-made depression such as an ancient quarry working or abandoned peat-digging. In either case, the vegetation depends on the water chemistry involved. Manx groundwater is generally acidic in nature, hence basin mire vegetation is likely to be similar to bog and acid flush vegetation in nature.

Basin mires are not usually large in extent; the 1994 Ecological Habitat Survey Report noted that several basin mires had been seen during survey work around the Island, but all of them had been too small to map. In spite of this, basin mires may support diverse vegetation and unusual or local invertebrate species, often extending the biodiversity of a larger bog, fen, heath or marshy grassland site.

Classification

Basin mires generally fall within similar NVC categories to valley mires, flushes and bog pools; see Tables 4.4a and 4.4b.

Basin mire status

Basin mires of more than a few hectares in extent are not particularly common anywhere in the British Isles, and calcareous basin mires (not found on the Island) are especially rare. Within the Isle of Man they occur in both the uplands and lowlands, but mostly the uplands, within larger areas of wet semi-natural habitat. Basin mires with good examples of fen habitat are covered under the UK Biodiversity Action Plan Priority Habitat: Fens. Smaller basin mires within upland active blanket bog areas are covered under the UK BAP Priority Habitat: Blanket Bogs.

Minimum selection criteria for basin mires

- Basin mires occurring in upland areas are covered under the Upland site selection process detailed in Chapter 4.7;

- Other basin mires will generally qualify for ASSI selection only where they form part of a larger mosaic of habitats which fulfils at least one of the Priority Sites Criteria listed in Section 3.2. However, exceptional examples of basin mire, e.g. those which fulfil one or more of the Priority Sites Criteria in their own right, will be considered on their own merit, with priority given to those which support very rare or local plant or invertebrate communities.

4.4.4 Fen meadows

Description and Distribution

Unlike most mire habitats, fen meadows are usually part of enclosed farmland, and have been produced by management (grazing, mowing and/or burning). Cessation of management usually results in taller herb and woody species invading and taking over, usually following a gradual succession to curragh. Fen meadows are usually dominated by purple moor-grass *Molinia caerulea*, rushes *Juncus spp*. and sedges *Carex spp.*, and include the category now generally known as "Rhos pasture", or Purple moor-grass pasture, which is often very diverse and which has suffered a severe rate of loss throughout the British Isles in recent years.

Manx fen meadows have a neutral to acid peat soil, and often contain a wider range of plants than the bogs and valley mires which they otherwise resemble. True flood-plain fens such as those typical of lowland England do not occur on the Island, but some river valleys are wide enough to encompass narrow fen meadows – enclosed valley mire - which may be at least partly dependent on flooding for their water source.

The main types of fen meadow that occur on the Island are **purple moor-grass and rush pastures**. Purple moor grass and rush pastures occur on poorly drained, usually acidic soils in lowland areas of high rainfall in western Europe. In the UK, they are found in south-west England, particularly in Devon, southern Wales, south-west Scotland, perhaps extending as far north as northern Argyll, and in Northern Ireland, especially Fermanagh. Elsewhere in Europe they are particularly characteristic of the oceanic and sub-oceanic regions of the western seaboard, from Portugal to the Low Countries, extending eastward into central Europe. Their vegetation, which has a distinct character, consists of various species-rich types of fen meadow and rush pasture. Purple moor-grass *Molinia caerulea*, and rushes, especially sharp-flowered rush *Juncus acutiflorus*, are usually abundant. Just as the best examples of lowland heath contain a wide range of plant communities, so the same is true for this habitat: the characteristic plant communities often occur in a mosaic with one another, together with patches of wet heath, dry grassland, swamp and scrub.

Key species associated with purple moor grass and rush pastures include: whorled caraway *Carum verticillatum*, marsh hawk's beard *Crepis paludosa*, greater butterfly orchid *Platanthera chlorantha*, curlew *Numenius arquata*, snipe *Gallinago gallinago*, and barn owl *Tyto alba*.

Classification

Fen meadows on the Island may be classified broadly as outlined in **Table 4.4c:**

Table 4.4c: Broad categories of fen meadow on the Isle of Man

Type and Description	Species rich?	Closest NVC categories	Rarities present?	Protected species present?
Rush pastures	sometimes	M23 *Juncus effusus/ acutiflorus – Galium palustre* rush pastures 1 Island NVC sample. Possibly also M27c *Filipendula ulmaria-Angelica sylvestris* mire, *Juncus effusus-Holcus lanatus* sub-community No Island NVC sample	May support rare invertebrates and/or plants	Protected plants such as orchids may be present.
Purple moor-grass pastures	sometimes	M25 *Molinia caerulea-Potentilla erecta* mire 1 Island NVC sample	May support rare invertebrates and/or plants	Protected plants such as orchids are highly likely to be present.

Fen meadow status

Fen meadows are one of the few mire habitats which can profitably be improved for agricultural purposes, usually through drainage, liming and fertilizing. In times of increasing pressure for farmers, this has led to a sharp reduction in the overall area of fen meadow in the British Isles, as previously low-input fields are brought into more intensive use. This is true of the Isle of Man as elsewhere. Purple moor grass and rush pastures – the main types of fen meadows on the Island - are a special priority for nature conservation because they are highly susceptible to agricultural modification and reclamation throughout their range. In Devon and Cornwall, where the habitat is known as Culm Grassland, only 8% of that present in 1900 remains, with a staggering 62% of sites and 48% of the total area being lost between 1984 and 1991. In Northern Ireland, between 1990 and 1993, the rate of loss of fen meadow was reckoned to be 3.3% per annum. Fragmentation and isolation of stands have been common.

The total area of this habitat in the Isle of Man is hard to ascertain, as much of it is likely to have been included in the Marshy grassland Phase 1 habitat category. However, as this whole category amounts to only 1096ha or 1.94% of the Island, some of which may already have been modified or destroyed, the total area of fen meadow is not likely to be great.

Because of the high rate of loss, purple moor-grass and rush pastures are now a Priority Habitat in the UK Biodiversity Action Plan, and several key sites have been designated SSSIs and/or SACs in recent years. In Wales it is estimated that there is now about 24,000 ha of lowland purple moor-grass and rush pasture. In south west England 530 purple moor grass and rush pastures sites are known to survive on the Culm Measures, covering 3,981 ha, 400 sites on Dartmoor covering 1,000 ha with a further 90 sites covering about 300 ha on the Blackdowns. In Northern Ireland it was estimated that there was about 24,600 ha in 1993. No area estimates are available for Scotland, but the total extent is thought likely to be in the region of 2,000 ha. Thus it is probable that the total extent of the habitat in the UK is now about 56,000 ha. This is thought to be considerably more than survives in the rest of Europe, with the possible exception of the Republic of Ireland. Countries in the British Isles therefore have a responsibility for the conservation of this habitat, which is in danger of ecological extinction if the current rate of loss continues.

Minimum selection criteria for fen meadows

- **All** good examples of fen meadows over 1ha in extent will qualify for selection;

- Smaller areas of fen meadow may qualify for selection if they fulfil at least one of the Priority Sites Criteria listed in Part 3, with priority given to sites which form part of a larger mosaic of interrelated habitats.

- Fen meadows may also fall within upland areas; these will be covered under the upland site selection process detailed in Chapter 4.7.

Wet pasture at Glen Rushen ASSI; the furry appearance is due to the presence of whorled caraway *Carum verticillatum* leaves.

4.5 Open water and swamp

Description

The size of the Isle of Man and the absence of extensive chalk or limestone areas naturally limits the range of open water bodies present compared with adjacent countries. For example, there are no large lowland river systems, lakes are few and mostly limited to man-made reservoirs, and marl water bodies and chalk streams are absent altogether. Instead, the most typical watercourses are small, soft-water streams in the uplands, which often reach the sea via dramatic waterfalls and deep coastal glens.

Flooded quarry workings and other industry-related man-made water bodies are rare on the Island. Standing water is most often found in reservoirs, or in dubs (shallow farm ponds) on farmland, most of which are concentrated in the north of the Island (Allen, 1984). Another farmland feature which forms a significant habitat in parts of the Island is the presence of drainage ditch systems, some of which have a well-established aquatic flora and fauna resulting from decades of continuous management. Whilst not natural watercourses, some ditch systems do connect with rivers, and most are designed to have a slight flow in order to carry excess water away. The ecology of well-established drainage ditches is therefore intermediate between that of ponds and streams (although species of fast-flowing upland streams are likely to be absent).

Despite the high proportion of coastline, there are few examples of salt or brackish standing water bodies on the Island, due to the lack of suitable topography. Those that there are – such as the seasonally-wet dune slacks on the Ayres National Nature Reserve – tend to support rare and local plants and invertebrates, and to have a high level of importance for coastal wading birds. Such brackish pools will be covered in Chapter 4.6: Coastal habitats, along with strictly tidal areas such as river estuary saltmarsh.

A distinctive ecological feature of all open water on the Island is the tendency for water levels to fluctuate, often sharply, following changes in the weather. For example, small ponds and dubs may dry out in summer, but remain sufficiently flooded for the rest of the year to enable aquatic plants and animals to survive from year to year (see Samson, 2002). Their ecology is adapted to this situation. Likewise, some upland streams with small, steep catchment areas may dry to a trickle in warm summer months, but fill up to a powerful torrent after one night of heavy rain. This has necessitated flood protection measures in many parts of the Island. For these reasons, both permanent and seasonal open water features are covered by the Criteria, and those watercourses which retain the most natural structure will be considered a priority for protection.

Aquatic habitats are one type of site for which buffer zones may be required in order to carry out effective species conservation, even where the biodiversity of the buffer zone itself is low. This is because of the disproportionate vulnerability of wetland habitats to runoff, spray drift and other "edge effects", which can quickly damage the entire ecology of a site once they affect the water. Buffer zones can also protect standing water from bank erosion by grazing livestock, and may be important habitats in their own right, e.g. rank grassland and scrub that offer cover for frogs and a feeding area for birds and semi-aquatic invertebrates. No cultivation, spraying or fertilizer applications should be carried out in a buffer strip. It may also be necessary to exclude livestock, at least for certain periods, in order to protect the banks and water quality.

This chapter covers all freshwater features, including submerged, floating and emergent (swamp) vegetation communities. Rivers and streams are both covered here, but it should be noted that in the uplands, most watercourses will be selected as part of an overall upland area, using the Upland habitats criteria in Chapter 4.7.

Assessing open water and swamp

All of the Priority Sites Criteria listed in Part 3 of this document apply to the selection of open water and swamp sites. However, the special nature of freshwater ecology – its motability and its susceptibility to very quick changes in chemistry, clarity and flow rates – means that the following criteria should be given special consideration when assessing an open water site:

Naturalness, representativeness and water quality
Water bodies are one category of habitat where **man-made sites** may offer good substitutes for natural pools and lakes. This is particularly true of sites where the water quality is good (see below) and has been allow to develop over a long period of time – e.g. old, flooded quarries, which may in exceptional cases support submerged, floating or swamp vegetation communities very similar to those found on natural lakes (NCC 1989, *Ch6*). In view of this, although naturalness is still a very desirable feature, both semi-natural and man-made sites will be considered for selection.

Whether subject to human influence or not, the **flow rate** of watercourses is an important factor when assessing the naturalness and representativeness of a site, because the ecology of the watercourse will be adapted to the prevailing speed of water flow, in particular the available oxygen levels and the need to secure a stronghold. The level of human modification – especially flood relief measures and other control structures – is therefore an important consideration when assessing the naturalness and representativeness of rivers and streams. Because most water bodies on the Island are not large, other questions of water movement, such as wind and wave effects on lake shoreline vegetation, will not normally apply, although reservoirs with very hard, wave-swept edges are clearly less well-suited to the formation of emergent vegetation fringes than those with softer margins.

Position within a larger mosaic of habitats can indicate the naturalness of an open water site – see *Position in ecological unit*, below.

Although different shapes and sizes of water body may look very distinctive, from an ecological perspective the **chemical quality** of the water itself is often the more important factor, because this tends to determine the range of animals and plants which can live there; it may also indicate the degree of human modification currently affecting the site. The need to assess the water quality of a site using chemical analysis varies according to circumstances; in most cases the classification of the habitat will be obvious from the diversity of species present. Water analysis is more helpful in assessing the condition of an existing open water habitat, particularly where there appears to be a problem, for example with escalating algal growth or sudden fish deaths. The results of water quality testing can help with comparing similar watercourses for selection.

Where chemical analysis is to be carried out, the first consideration is usually trophic status – i.e. how nutrient-enriched the water is. Water with plenty of available plant nutrients (particularly nitrogen and phosphorus) is classed as eutrophic, whilst a mesotrophic water body has only moderate nutrient levels, and oligotrophic water is relatively nutrient-poor. Water which contains a high level of dissolved substances such as tannins, but little available plant nutrients, is referred to as dystrophic, and is usually associated with peatland areas where the water is acidic and dark-stained. All these categories are naturally associated with a particular ecology, and all may contain rarities in certain cases; a change in trophic status can therefore result in considerable damage to an open water ecosystem, whilst a stable level of nutrient input is usually associated with a more natural and representative site.

The **water quality** of a river, pond or lake can be affected by a variety of factors, both man-induced and naturally occurring. Some of the most important considerations are:

Biological oxygen demand (BOD) – a high BOD is a sign that water is highly nutrient-enriched, leading to excessive algal and/or bacterial activity and a corresponding increase in the demand for oxygen. The effects on organisms which need high levels of dissolved oxygen can be severe, with extreme cases – such as those caused by sudden milk or silage spills – leading to mass fish kills (DEFRA, 2000). An unhealthily high BOD may be due to an ongoing situation, or may relate to a single event. In either case the biodiversity of the water body is likely to be adversely affected.

pH (acidity/alkalinity)
The pH of a water body has a direct effect on important aspects of water chemistry such as the balance of calcium in the water. A higher pH is usually taken to indicate a higher trophic status, i.e. eutrophic, rather than mesotrophic or oligotrophic water. With the exception of sites in the vicinity of Castletown, where limestone is the underlying rock, most Manx water is relatively acidic, soft water (with low levels of dissolved calcium and magnesium salts). The ecology of Manx rivers and streams reflects this and is adapted to soft water conditions. In the case of bog pools, a steady, very acidic pH of 4.5 or less is vital

in order to support the few, specially-adapted species that can survive in the extreme conditions. An increase in alkalinity, for example due to run-off from nearby building works, can threaten the special interest of such sites, not least because increased pH is often associated with increased nutrient levels. However, it should be noted that in the case of lakes and ponds which naturally have a lot of plant and algal growth in summer, the water can vary considerably in pH – becoming more alkaline when vegetation growth is at its strongest.

Plant nutrients
The plant nutrients most often tested for are ammonia, nitrates and phosphates, although a range of other chemical tests – eg. for potassium levels and sulphates – may also be useful in assessing the condition of a water body. Healthy eutrophic ponds, lakes and rivers have relatively high levels of plant nutrients and support a high diversity of plants and animals as a result; however, artificial sources of nutrients such as phosphates and ammonia can far exceed healthy levels. Ammonia, nitrates and nitrites are all potentially dangerous to fish at high levels, and are associated with a high BOD. Phosphates are of particular concern because high phosphate levels result in greatly accelerated algal growth, creating a soaring oxygen demand and decreased water clarity and light penetration. This situation can be difficult to remedy.

Conductivity
The electrical conductivity of soft water such as that naturally found in Manx rivers and streams is naturally very low. Inputs such as farm or domestic sewage can hugely increase the conductivity by introducing a high concentration of sodium and other ions. Whilst a good indication that something is amiss with otherwise clean, soft-water streams, conductivity is a less useful test in salt or brackish water, as these water-bodies already have a high conductivity due to the natural salt load of the water.

Undesirable readings on any of the above tests will be considered **negative** points when considering a site for selection, except where the problem is plainly short-term and/or a satisfactory solution is possible. The same applies to more obvious sources of water quality problem, such as oil pollution, mine water contamination or discarded agrochemical containers.

Diversity
In general, well-lit, nutrient-rich, base-rich eutrophic waters are capable of sustaining the greatest diversity of aquatic life, whereas only a very limited range of species can survive in very acidic or dystrophic pools. However, bog pools and dystrophic standing water may support vulnerable rarities such as unusual dragonflies, so the desirability of species richness at any given site needs to be tempered with consideration of how rare both the habitat and species are.

Many animals which inhabit open water require a mixture of feeding areas and cover, and semi-aquatic species are adapted to using more than one habitat in order to complete their life-cycle. Hence a range of adjacent vegetation types is a very desirable feature, e.g. proximity to related habitats such as fen meadows and mires.

Position in ecological unit
The majority of natural watercourses exist within a wider ecological context of upland or lowland wetland situations, hence position within an ecological unit should be one of the prime considerations when assessing two otherwise similar watercourses. Likewise, the biodiversity of ponds and dubs and particularly bog pools may depend to a great extent on the nature and quality of the surrounding habitat. This affects not just the species present (see Diversity, above) but also potential water quality issues such as whether or not the water is shaded, whether grazing stock have access, and whether the nutrient status is being affected by fertilizer runoff.

Open water and swamp types

For the purpose of these Criteria, areas of open water and swamp on the Isle of Man have been grouped broadly as follows:

Still water and swamp: Natural pools, ponds, lakes and seasonally-flooded areas, man-made ponds and dubs, reservoirs and other man-made water-bodies. These are the commonest sites for **swamp** vegetation, which usually occurs around the shallower margins of still water. Swamp may also occur as a habitat on its own, with no open water visible. This is especially true of shallow water bodies, which can fill up with extensive stands of pure swamp such as bottle sedge *Carex rostrata* or common reed *Phragmites australis*. **Brackish pools** and **dune slacks** also occur on the Island; these are covered in Chapter **4.6: coastal habitats.**

Ditch systems: These consist of linked, man-made ditches, occasionally incorporating minor natural watercourses. On the Isle of Man, ditch systems usually result from a desire to drain farmland (Allen, 1984), either on an ongoing or seasonal basis. They may be strategically placed or, more commonly, randomly associated within a particular area. Well-established ditch systems may support a good range of aquatic plant and invertebrates, and may be particularly important for semi-aquatic species.

Flowing water: Rivers and streams, both lowland and upland. Some swamp may form alongside the margins of slower-flowing rivers, but it is usually restricted to areas where there is a "bay" or widening out of the main watercourse. Note: river estuary saltmarsh is covered in Chapter **4.6: Coastal habitats**.

These Manx open water and swamp types, and the National Vegetation Classification (NVC) categories they most closely resemble, are each treated separately in detail below.

4.5.1 Still water and swamp

Description and Distribution

The main types of still water bodies on the Island are:

Bog pools, which occur in both upland and lowland habitats. Those which occur in the uplands are covered by the Upland Habitats criteria described in **Chapter 4.7**. Those which occur in lowlands are usually confined to the wetter parts of curragh and fen sites. They are amongst the smallest open water bodies on the Island, usually occurring as a collection of small pools and troughs within a larger site.

Bog pools may be too dark and dystrophic to support any vegetation other than *Sphagnum* mosses; however, lowland examples frequently support a mat of floating vegetation (usually dominated by bogbean *Menyanthes trifoliata*) and a fringe of emergent sedges and rushes. Bog pools – including very dystrophic examples – are known to support a small but significant range of rare and local invertebrate species.

Ponds and dubs (shallow field ponds, some of which may dry out in summer) are scattered throughout the Island's farmland, with the majority concentrated in the north. Where ponds and dubs occur within a large semi-natural area – and particularly if several occur in close proximity – their overall biodiversity and value for wildlife is likely to be greatest (q.v. Samson, 2002). Collections of ponds are also more likely to contain rare plants and invertebrates than isolated sites. The beetle fauna has received some study and the resulting species lists can be used to compare site quality. Unlike bog pools, ponds and dubs often occur in the absence of associated semi-natural habitat, surrounded by improved farmland. This can limit their value for wildlife, but even completely isolated examples may still support a good range of aquatic and emergent species. Shallow dubs within improved farmland may also have a special role to play in supporting farmland birds such as lapwing, curlew and snipe.

Lakes and reservoirs are rare on the Isle of Man, and most are the result of human activities. Natural lakes, such as Lough Cranstal (a relic of an ancient, much larger area of open water in the north of the

Island), are also affected by human activities due to the proximity of improved farmland and managed drainage systems. Despite the scarcity of large semi-natural water bodies, the Island's few larger open water sites still support a range of associated vegetation, along with significant populations of both breeding and visiting waterfowl.

Most ponds, dubs and larger water bodies are likely to fall within the broad category of eutrophic standing water, i.e. water bodies with high levels of plant nutrients such as nitrates, calcium salts and phosphates. However, some are more mesotrophic in nature, with species characteristic of less nutrient-rich waters.

Classification of still water and swamp habitats

Still water and swamp habitats on the Island may be classified broadly as outlined in Table 4.5.a

A flowing stream and pools at Glen Rushen ASSI, with whorled caraway *Carum verticillatum* and bog pondweed *Potamogeton polygonifolius*.

Table 4.5.a: Broad categories of still water and swamp habitats on the Isle of Man

Type and Description	Species rich?	Closest NVC categories (after Rodwell, 1992[4])	Rarities present?	Protected species present?
Bog pools These are rare, scattered and tend to be very limited in extent; typical sizes range from 0.01ha to 0.1ha. Most are confined to upland bog areas and will be covered by the criteria for Upland habitats; some occur in the lowlands, where they represent a rare and vulnerable habitat.	Not usually; it is not in the nature of very acid, dystrophic water bodies to support a wide diversity of species.	A14 – *Myriophyllum alterniflorum* (alternate water-milfoil) community A24 – *Juncus bulbosus* (bulbous rush) aquatic community (no NVC samples mapped as ubiquitous throughout north west Britain)	This community may occasionally contain unusual sedges, mosses or liverworts; may also support rare dragonflies and other specialised invertebrates.	Sometimes. White sedge *Carex curta* is known sometimes to occur on the edges of bog pools; Pillwort *Pilularia globulifera* also prefers shallow acidic waters.
Ponds, dub and lakes Most ponds, dubs and larger water bodies are likely to fall within the broad category of **eutrophic** standing water, i.e. water bodies with high levels of plant nutrients such as nitrates, calcium salts and phosphates. However, some are more **mesotrophic** in nature, with low levels of calcium salts and species characteristic of more acid, less nutrient-rich waters.	Variable, according to degree of nutrient enrichment and modification. May be very species rich in good examples.	A2 – *Lemna minor* (common duckweed) community A7 *Nymphaea alba* (native white water-lily) community A8 – *Nuphar lutea* (yellow water-lily) community A9 – *Potamogeton natans* (floating pondweed) community A10 – *Polygonum amphibium* (amphibious bistort, now named *Persicaria amphibia*) community A11 – *Potamogeton pectinatus-Myriophyllum spicatum* (fennel pondweed and spiked water-milfoil) community A12 – *Potamogeton pectinatus* (fennel pondweed) aquatic community A15 *Elodea canadensis* (Canadian waterweed) community A16 *Callitriche stagnalis* (common water-starwort) community A19 *Ranunculus aquatilis* (common water crowfoot) community (all these communities are fairly widespread throughout the British Isles, hence NVC samples were not mapped)	Often. Although not always species-rich, this is a relatively scarce habitat on the Island, and may contain unusual stoneworts, pondweeds and invertebrates.	Fennel pondweed *Potamogeton pectinatus* is itself a protected plant on the Island.

Bottle sedge swamp Usually found in association with bogbean (e.g. in the Curragh) and water horsetail (e.g. around the edges of larger water bodies). This kind of swamp is typical of nutrient-poor, acid waters on peat soils, and may grade into bog pools.	Not very; although this is one of the more diverse acidic swamp vegetation communities, the habitat is not usually capable of supporting a high degree of species richness.	S9 – *Carex rostrata* (bottle sedge) swamp, especially the *Menyanthes trifoliata-Equisetum fluviatile* sub-community. No Island sample in NVC maps. S10 – *Equisetum fluviatile* (water horsetail) swamp, *Carex rostrata* sub-community also see below. No Island NVC samples.	Often forms a good habitat for unusual aquatic invertebrates; some rare plants may also occur.	
Water horsetail swamp May occur as dense stands of horsetail (e.g. at the edge of lakes) or smaller mats of mixed vegetation with similar species to bottle sedge swamp.	Not usually.	S10 *Equisetum fluviatile* (water horsetail) swamp No Island NVC sample.		
Tussock-sedge swamp A distinctive mix of large sedge tussocks and emergent vegetation in between; can provide a unique habitat for invertebrates. Very rare on the Island.	Moderately species-rich	S3 *Carex paniculata* (greater tussock-sedge) sedge swamp No Island NVC sample	May support rare invertebrates and unusual emergent plant species	
Spike-rush swamp Typically forms a fringing zone around larger lakes and reservoirs.	No.	S19 *Eleocharis palustris* (common spike-rush) swamp	May form part of a larger habitat for unusual invertebrates.	
Reedmace/bulrush swamp This species is characteristic of broad pond and river margins, where it forms dense stands (although rarely on the scale of bulrush swamp in the English lowlands). In the absence of reedbeds this forms a valuable bird habitat.	Variable; may be a single-species only stand of bulrush	S12 *Typha latifolia* (greater reedmace) swamp	May support unusual invertebrates and birds.	May attract protected bird species including rare visiting waterfowl.

Common club-rush swamp A tall and distinctive vegetation forming a sheltered water margin habitat; may have similar associated plants to bottle sedge swamp (see above). May occur in bays and sheltered stretches of river margins. A **rare** habitat on the Island.	Often species-poor, but may contain a range of submerged and floating species amongst the rushes.	S8 - *Scirpus lacustris ssp. lacustris* (common club-rush, now known as *Schoenoplectus lacustris*) swamp One Island NVC sample.	A number of unusual plants may be present, as this is a rare type of vegetation on the Isle of Man. Unusual invertebrates may also be present in this habitat for at least part of their life-cycle.	Yellow water-lily, white sedge and common bladderwort may all occur within this vegetation type, but very rarely do so on the Island; Common club-rush is itself a protected species. May form part of the favoured habitat for shy protected water birds such as the water rail and bittern.
Greater pond-sedge swamp Typical of lowland English lake and canal margins; at the north end of its usual range here, with **only one** occurrence (Loch Cranstal)		S6 - *Carex riparia* (greater pond-sedge) swamp No Island NVC sample		
Bur-reed swamp This distinctive plant is at the northern edge of its main range here. It rarely forms large stands, tending to occur in zones along the edge of slower-moving rivers and ditches, and around the edges of sheltered ponds.	Some stands may be moderately diverse due to the presence of emergent species amongst the bur-reed	S14 *Sparganium erectum* (branched bur-reed) swamp No Island NVC samples.		
Reed swamp **Rare** on the Island, and never forming the huge areas of "monoculture" habitat found in England. May occur in brackish habitats, e.g. alongside muddy tidal reaches of rivers.		S4 - *Phragmites australis* (common reed) swamp One Island NVC sample.		May attract protected bird species including rare visiting waterfowl.
Sea-clubrush swamp Typical of more or less still, brackish or salt water alongside estuaries, lagoons and the deeper areas of saltmarshes.	This is very much a halophyte (salt-loving) community, and is therefore covered in **Chapter 4.6 - Coastal Habitats**, in the section on Saltmarsh.			

Status of still water

Naturally-occurring water bodies with unmodified fauna and vegetation are rare throughout the British Isles, chiefly because of their strong associations with human activities – notably farming, fishing and water supply. The more natural and unspoilt water bodies have therefore received the highest levels of recognition, with regionally restricted features (e.g. turloughs and Mediterranean temporary ponds) included as Priority habitats in Annex 1 of the EC Habitats Directive. A range of oligotrophic lakes, natural dystrophic lakes and ponds, and natural eutrophic lakes – all of which are vulnerable to loss of biodiversity due to pollution and nutrient enrichment - are also listed as Annex 1 habitats. The UK Biodiversity Action Plan recognises both eutrophic and mesotrophic lakes as Priority Habitats, along with reedbeds.

The DAFF Phase 1 Habitat Survey recorded an average size of water body on the Island of just 0.273ha, with a maximum of 25.4ha and a total area of 105ha (which indicates the rarity of large bodies of open water) and just 19ha of true swamp (Sayle *et al*, 1995). Whilst there are over three hundred standing water bodies recorded, many are much smaller than the mean average size, often as small as 0.003ha; many more were too small to be included in the survey. Such ponds and dubs are rarely found in association with other wetland habitats and tend to be vulnerable to drying, pollution, stock poaching and other ecological "edge effects". Many therefore have a limited biodiversity; for those that are species-rich, a **buffer zone** is usually vital for effective conservation of both the aquatic and emergent species.

Whilst the majority of distinctive British open water types do not occur on the Isle of Man, and many of the water bodies present are low in diversity, the small number of diverse lakes, ponds and dubs which are present contain some of the rarest Manx plant and invertebrate species, several of which are protected under the Wildlife Act 1990 (see Samson, 2002). The Manx Wildlife Sites Handbook criteria for selection of Wildlife Sites therefore includes all open water or wetland that has rich marginal, inundation or aquatic vegetation communities (dominated by native species) and/or is of particular value for invertebrates, birds, fish or bats (excepting sites that are severely and irreversibly degraded). It also includes all areas of swamp greater than 0.5ha in extent, or 0.25ha when in mosaic or juxtaposition with other semi-natural habitats, and dominated by one or more of a list of typical native swamp species (Keehan/MWT, 1999).

The Isle of Man is signatory to the Ramsar Convention, which requires Member States to promote "wise use of wetlands" and to protect sites which fulfil the criteria for Ramsar Site status. These criteria refer to wetlands as a whole rather than individual habitat types. They contain several points of relevance to open water, including:

Criterion 1: A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.

Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.

Criterion 3: A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.

Criterion 4: A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.

It is likely that the majority of sites which are considered for Ramsar Site selection on the Isle of Man will contain at least an element of still water habitat.

Minimum selection criteria for still water habitats

Note: The majority of still water habitats will require a buffer zone of at least 5m from the water's edge to enable effective conservation measures.

Bog pools

- Upland bog pools will be selected as part of larger upland sites – see **Chapter 4.7 Upland Habitats.**

- All lowland sites with a single or several pools totalling 0.5ha or more (including any buffer zone) of bog pools will be considered for selection where the pools in question form part of a larger area of related semi-natural habitat;

- Semi-natural areas with a collection of bog pools totalling less than 0.5ha (including any buffer zone) will be considered for selection where the pools in question fulfil at least one of the Priority Site Criteria listed in Part 3.

Ponds and dubs

- An individual lowland pond/dub will be considered for selection where it fulfils one or more of the Priority Site Criteria listed in Part 3, *and* forms part of a larger area of related semi-natural habitat;

- Series and/or groups of lowland ponds will be considered for selection where they collectively fulfil at least one of the Priority Sites Criteria listed in Part 3. This includes groups of ponds which are situated within improved farmland.

- In all cases, priority will be given to sites which have a good structural diversity and/or a good range of both submerged and emergent plant species, including the swamp categories listed in Table 4.5.a.

Individual, isolated ponds and dubs will not usually be considered for ASSI selection except on species criteria, and upland ponds and dubs of interest will be selected as part of larger upland sites – see **Chapter 4.7 Upland Habitats.** Criteria for selection of brackish pools will be covered in **Chapter 4.6: Coastal habitats.**

Lakes and reservoirs

- Lakes and reservoirs will be considered for ASSI selection where they fulfil at least one of the Priority Site Criteria listed in Part 3 *and* have a high structural diversity including more than one of the swamp categories described in Table 4.5.a (above).

- Priority will be given to lakes and reservoirs which occur in association with other wetland habitats such as streams, curragh, and mire.

4.5.2 Ditch systems

Description and Distribution

When unspoilt by pollution or excessive nutrient enrichment, man-made drainage ditches can provide a collection of interrelated habitats capable of supporting a wide range of plants and animals typical of both stagnant and slow-flowing open water. Those which are managed sparingly, but on a regular basis, generally provide the best opportunities for emergent vegetation; more undisturbed ditches may offer better opportunities for semi-aquatic invertebrates (NCC, 1989 Ch6:5). In some cases they may provide the only source of continuous wetland habitat for native species which would otherwise have no place in a modern farmed landscape; for this reason they may contain both plant and invertebrate rarities.

There is rarely enough space in managed ditches to allow the formation of swamp except where the ditches have become choked with vegetation through lack of maintenance, or where small "bays" occur along the main course. However, ditches often provide good habitat for submerged and emergent plants, and they are particularly well-suited to those species which thrive in a mixed, "semi-aquatic" environment, e.g. insects such as dragonflies which rely on the adjacent terrestrial habitats for feeding territory.

The Isle of Man does not have a tradition of flood-meadow and levels management on a par with lowland England and Wales, but there are some areas of farmland, notably the Ballaugh Curragh, in which the wetland environment has a long history of water level control via ditches and sluices (MNH, 1998). These habitats complement the adjacent mire and scrub, extending the possibilities for native wildlife. The lack of an overall plan of management until relatively recently, and the varying nature of the land use and ownership over the years, do not detract from the value of the Ballaugh Curragh drainage ditches for wildlife; indeed, these factors have probably contributed to the ecological diversity of the system over a long period of time.

Classification of ditch systems

Drainage systems may or may not reflect an overall drainage scheme for an area; they may simply result from the efforts of several landowners working individually to control water levels on their land. They fall broadly into two types: those on peat soils, and those on mineral soils, which tend to have less acidic waters and a higher overall nutrient status. There are no established classification methods for species-rich ditch systems, which tend to fall into similar categories to ponds and streams, based on the quality of water involved. Ditches on the Isle of Man may contain any of the pond and swamp vegetation communities listed in Table 4.5.a above, with the exception of those which prefer large areas of open water.

Ditch system status

Lowland ditch systems have long been recognised as a potential haven for aquatic species, but have only been fully taken into account in national designations relatively recently. The series of Welsh and English SSSIs which includes the Gwent Levels (Rhumney and Peterstone) and the Somerset Levels aims to encompass the best examples of ditch system habitats, along with the adjacent wet grassland and mire habitats. On the Isle of Man, the central parts of the Ballaugh Curragh, which includes some ancient ditch and sluice systems of archaeological as well as ecological interest, has been protected by the Curragh Acquisition Act (1963) and subsequent transfers of ownership to the Manx Museum. The Manx Wildlife Trust also manages parts of the Curragh land, some of which contain associated ditches and drains.

Certain of the Ramsar Site criteria (see *Status of still water*, above) may apply to ditch systems within wetland areas, as does the overall requirement for Ramsar Convention members to practice wise use of wetlands.

Species-rich ditch systems are vulnerable to agricultural intensification, wholesale heavy mechanical clearance, and pollution from adjacent developments - hence good examples of thriving ditch system ecology are rare. Unfortunately, the interconnected nature of ditch systems means that the introduction

of foreign aquatic plants or invertebrates can soon affect the species composition of quite a large area; for this reason it is important to safeguard species-rich ditch systems from thoughtless introductions, which can be difficult or impossible to reverse. Pollution incidents can likewise affect ditch systems very drastically. The *Code of Good Agricultural Practice for the Protection of Water* is aimed at preventing damaging pollution events that could otherwise find their way into ditch systems with catastrophic effects on the ecology.

Minimum selection criteria for ditch systems

Note: The majority of ditch habitats will require a buffer zone of at least 5m from the water's edge to enable effective conservation measures.

Only well-established systems of drainage ditches with a diverse ecology will be considered for selection.

- The best example of a lowland ditch system on peat soils will be considered for selection, as will the best example of drainage ditches on mineral soil; both examples should fulfil at least one of the Priority Site Criteria listed in Part 3.
- When choosing the best example of each type of ditch system, special priority should be given to those systems which are known to support rare species that wholly or partly rely on drainage ditches for their survival on the Island.

4.5.3 Flowing water

Description and Distribution

The short catchments and steep terrain of the Isle of Man have resulted in many small rivers and streams, the majority of which fall into upland or upland margin categories by British standards. Few get a chance to develop to more than two or three metres in width, and there are no extensive lowland river systems with accompanying high levels of sediment and nutrient build-up. However, the low-lying parts of the Island do support small, relatively eutrophic rivers with a range of associated marginal habitats, and there are some examples of rivers that follow a full course of upland, marginal, lowland and estuarine habitats before entering the sea. The more ecologically diverse rivers and streams on the Island all occur in close association with related habitats such as moorland, glens, wooded valleys and unimproved farmland.

The dynamic nature of river systems has led to a long history of efforts to control their natural fluctuations and changes in course, in particular to avoid flooding of farmland and settlements, but also to alter meandering watercourses to a more convenient and controllable structure. Few rivers are unmodified by man, either by direct means or as a result of exacerbated erosion due to human factors upstream. This is the case on the Isle of Man as elsewhere in the British Isles – although effects of sediment loading and other features of large lowland river systems are obviously less marked here. If possible at least one representative watercourse should be selected which shows a natural progression from fast upland stream to a slower, more level, lowland river as it enters the sea, in order to ensure that all types of ecological niche are covered by the designation.

Classification of flowing water

Flowing water habitats on the Island fall broadly into upland and lowland rivers and streams, with the majority likely to be wholly or partly covered by the Upland habitats criteria described in Chapter 4.7. Lowland stretches of rivers such as the Sulby and the Silverburn may be affected by human intervention and enrichment from farmland runoff, but not to the extent of heavily nutrient-enriched English lowland river systems. Bays and slower-flowing stretches of Manx rivers may therefore support a variety of the swamp and emergent vegetation communities described in Table 4.5a above, such as common reed *Phragmites australis* and greater reedmace *Typha latifolia*, as well as submerged aquatics such as common water crowfoot *Ranunculus aquatilis*.

Flowing water status

The importance of unspoilt high-quality watercourses on the Island for sport fishing and water supply is

reflected in a range of protective measures. Game fisheries are protected by a variety of laws and bylaws, both from pollution incidents and from the activities of poachers. *The Code of Good Agricultural Practice for the protection of water* is aimed at protecting watercourses from polluting agricultural practices. Whilst upland and smaller streams are frequent on the Island, relatively unmodified stretches of semi-natural lowland rivers are rare, and this is reflected in the Manx Wildlife Sites Handbook, which recommends that all natural watercourses which exhibit no obvious artificial modification to bed and water level and have a high proportion of semi-natural habitat on both banks should be considered for selection as a Wildlife Site (Keehan/MWT, 1999).

In the wider context, *Water courses of plain to montane levels with the* Ranunculion fluitantis *and* Callitricho-Batrachion *vegetation* are now an EC Habitats Directive Annex 1 habitat for which the UK has a special responsibility. Manx rivers have some affinities with Subtype 3 of this river category, which relates to less nutrient-rich rivers in the north and west of Britain, often on upland margins.

Certain of the Ramsar Site criteria (see *Status of still water*, above) may apply to rivers and streams including estuarine reaches; as does the overall requirement for Ramsar Convention members to practice wise use of wetlands.

Minimum selection criteria for flowing water

Note: The majority of flowing water habitats will require a buffer zone of at least 5m from the water's edge to enable effective conservation measures.

Please note that river estuary saltmarsh will be covered in **Chapter 4.6: Coastal habitats**, and upland watercourses will generally be selected according to the Upland habitats criteria in **Chapter 4.7**.

- The best example of a natural and unmodified river from source to sea should be selected along with its catchment of tributaries;

- Shorter sections of lowland river which fulfil at least one of the Priority Site Criteria listed in Part 3 will be considered for selection where they possess a good range of structural diversity and good examples of at least two of the vegetation communities described in Table 4.5a above and/or other key habitats such as semi-natural broadleaved woodland cover and valley mire;

- In all cases, priority will be given to watercourses which occur in association with other semi-natural habitats such as wet grassland, wet woodland and scrub, and valley mire.

Fast-flowing water at Dhoon Glen ASSI creates high humidity, encouraging lots of fern growth.

4.6 Coastal habitats

Description

Defining exactly what is coastal and what is inland is not always straightforward. In general, coastal habitats may be referred to as either "maritime", "sub-maritime" or "para-maritime":

- Strictly **maritime** habitats are strongly affected by salt spray and exposure to strong winds and high humidity. It is rare for such habitats to occur at more than a narrow field's width from the shore;
- **Sub-maritime** habitats may continue for one or two fields' distance from the shore, and have less extreme conditions. Both maritime and sub-maritime habitats attract a distinctive range of flora and fauna, including some specialised plants and animals which only occur on the coast;
- **Para-maritime** areas are affected by the climate of the sea (i.e. high humidity, relatively small temperature range and exposure to strong winds) but not by the high soil salinity and extreme conditions that occur near the shore. In this sense, much of the Isle of Man could be said to have para-maritime conditions.

For the sake of clarity, this chapter covers strictly **maritime** habitats only, i.e. those which occur on rocks, sands, mud and cliffs between astronomical low tide level and points inland which are regularly within range of salt spray (Ratcliffe, 1977). Sub-maritime habitats all have strong associations with inland habitat types, and will therefore be covered in the relevant chapter – e.g. the Coastal grassland section of Chapter 4.2: Lowland grasslands, and the Dry scrub section of Chapter 4.1: Woodland.

This chapter may need to be considered in tandem with the separate document entitled *Guidelines for the selection of Marine Nature Reserves in the Isle of Man*, which covers sub-tidal marine communities, some of which relate closely to the intertidal habitats described below.

Assessing coastal habitats

All of the points on the Checklist of Priority Sites Criteria listed in **Part 3** are relevant to coastal sites - with the possible exception of points relating to Management History, as there will be some coastal habitats which have never received any management intervention. In all cases, a key consideration will be whether the coastline is generally soft – and hence liable to shift and change both in structure and actual location – or hard, with a relatively constant substrate. In addition to this, the following criteria are of particular importance when assessing coastal sites:

Size

One reason that coastal habitats have all been covered within the same chapter is the transitional nature of the terrain involved: habitats on the coast usually fall into zones, which grade into each other and represent an interrelated series, often in a state of continual development. Site assessments should therefore take into account the need to include all of the habitats that make up a particular coastal ecosystem, rather than just one or two features. This ensures not only that the full biodiversity of the coastline in question will be protected, but also that some of the processes are safeguarded – such as dune system development – for which adjacent habitats are needed in order to accommodate species which are naturally advancing or retreating as the coastal profile develops. This requirement tends to favour larger sites, and the largest examples of particular habitats.

The positive effects of size apply to species populations as well as habitat extent. The presence of breeding seabird colonies and other localised species of interest means that coastal sites are more likely to be chosen if they support the largest and/or most thriving communities of a particular species. The need for this is increased by the restricted nature of some coastal locations (see Location, below). However, it should be borne in mind that steep and/or vertical cliff habitats are unlikely to register a high area on orthographic maps, hence area is not the primary attribute for selection of cliff coasts (NCC, 1989).

Location
Although the Isle of Man is well-endowed with coastline, some coastal habitats are naturally restricted, and for certain features there is very little choice of good sites suitable for ASSI designation. The location of a coastal site is therefore a crucial consideration. There are several reasons for this:

- **Geology**. Most of the Island has a Manx slate bedrock with neutral to acid soils; the small, localised limestone features have a different ecology to the rest of the Island's coastline and as such they do not offer much choice in terms of site comparison for selection;
- **Aspect**. Most sloping or steep coastal sites are one-sided in nature, i.e. the zoning and ecology of the habitats present depends on their position in relation to the sea, which is usually only along one side of the site. The species present will therefore be those which are suited to the aspect, whether it is a cool north-facing cliff or a low south-facing limestone shelf. South-facing cliffs are rare on the Isle of Man; their sunny aspect appears to have a positive effect on the species diversity of both plant and invertebrate communities of coastal species (Lamb, 1999; Boyce & Fowles, 1989).
- **Exposure.** Very exposed coastal habitats are associated with more specialised plants and animals that can survive the harsh conditions and benefit from the lack of competition. More sheltered sites, particularly those on which a good level of drift material and soil has built up, may support robust weedy species typical of ruderal vegetation inland. Both these types need to be recognised as important;
- **Animal behaviour patterns.** Location affects fauna just as much as flora, either because of animal behaviour patterns – eg. preferred seal pupping beaches – or for the same aspect- and exposure-related reasons that influence plant communities;
- **Coastal development**. Location does not just relate to existing features; it is also important for the future development of habitats where these are drifting or transitory in nature. For example, sand dunes and saltmarsh are both vulnerable to loss from coastal "squeeze", man-made damage and modification on sites where there is no adjacent area onto which the habitat can shift if the coastline in question is retreating or accreting. The availability of adjacent habitats is therefore a positive factor in selecting a good example of a developing coastal ecosystem (NCC 1989). This includes adjacent inland habitat types such as unimproved grassland and scrub.

Diversity
Site selection should aim to include not just the full diversity of habitats and species on a site, but also the full range of transitional, zonal and successional habitat types. This is particularly important on soft coastlines, where dunes, slopes and soft cliffs exist as a continually developing system, with an ecology that is adapted to the shifting substrate.

Rarity, fragility and vulnerability
The restricted and specialised nature of some coastal communities makes them vulnerable to modification and damage. This is partly due to the difficult conditions on exposed coastal sites, where recolonisation may be slow. It is also due to the relatively restricted availability of suitable adjacent habitats for beleaguered species to move onto if conditions become inhospitable.

Whilst capable of withstanding very tough conditions, plant communities which are adapted to harsh environments are often by their nature very fragile when it comes to physical damage from vehicle access or heavy trampling. Rarity, fragility and vulnerability of coastal habitats should therefore be given special attention when comparing sites for selection, and unspoilt sites with especially rare or fragile species and habitats should be given priority where possible.

Coastal habitat types

For the purpose of these Criteria, coastal habitats on the Isle of Man have been grouped as follows:

Intertidal
Strandlines and shingle
Dunes
Saltmarsh
Brackish pools
Sea cliffs, caves and slopes

Elements of these habitats, and, where applicable, the National Vegetation Classification (NVC) categories they most closely resemble, are listed in detail on in sections 4.6.1-4.6.5 below.

4.6.1 Intertidal habitats

Intertidal habitats on the Isle of Man are currently assessed using the UK document *Guidelines for selection of biological ASSIs: Intertidal habitats and saline lagoons* (JNCC), in conjunction with local knowledge.

4.6.2 Strandlines and shingle

Description and Distribution

Strandlines, where the tide deposits loose pebbles, litter and organic material, may occur on any shore where there is space for deposits to build up on a regular basis. Whilst obviously a very mobile and changeable habitat, strandlines nevertheless have a distinctive ecology that includes characteristic annual vegetation, invertebrate communities and consequent opportunities for feeding birds. **Shingle** is broadly and simply defined as sediment particles that are larger than sand or gravel and smaller than boulders. This definition encompasses a wide range of particle sizes and mixtures, and may be differentiated still further where wind and wave action sculpts the loose sediments into permanent or semi-permanent structures such as beaches, spits and banks.

The likelihood that strandline and shingle structures will form a suitable home for flora and fauna depends greatly on the exact size and mix of particles involved, the degree of tidal exposure, and the stability of the shingle. For example, a very exposed area of shingle with large pebbles and few finer particles, which is regularly shifted about by fierce tidal action, is unlikely to support any vegetation at all, and very few invertebrates. However, an area of relatively stable shingle with some smaller particles amongst the pebbles will offer a growing medium to the small number of plant species that can stand the extreme conditions – which include drought, heavy salt load, and strong winds.

The Isle of Man has a great variety of different types of beach throughout its coastline, encompassing several distinctive strandline and shingle habitats within a small area (Lamb, 1999). Shingle and strandlines therefore represent a significant element of Manx coastal ecology, with vegetated shingle being a particularly valuable habitat due to its relative rarity. At their most diverse, vegetated shingle structures can support a very distinctive range of plants and an abundance of birds and invertebrates. Shingle beaches also provide good haul-out and pupping areas for seals.

The designation of the Ayres National Nature Reserve, which contains the largest area of shingle on the Island, was partly in recognition of the importance of this habitat for wildlife. Other areas of shingle occur on beaches along the east coast of the Island, such as Laxey beach, and on the south coast, notably Sandwick shore. Strandlines occur all round the Island, but tend to build up more in places where flat or gently sloping beaches face the prevailing currents, particularly the south and south west coasts.

Worldwide, shingle is home to rare plants and invertebrates, significant populations of breeding birds, and many seal territories, notably grey seals, which utilise both vegetated and non-vegetated shingle beaches as haul-out and pupping areas. Grey seals *Halichoerus grypus* are among the rarest seals in the world: around 40% of the global population of grey seals live and breed around the coasts of the British Isles and Isle of Man, which therefore have a collective global conservation responsibility for this species (see www.jncc.gov.uk, 2005). Several other protected species on the Isle of Man rely on beaches, notably little tern *Sterna albifrons*, which nest on shingle at the Ayres, and plants such as oysterplant *Mertensia maritima*; both of which are protected under the Wildlife Act 1990. Strandlines around the Island on both sandy and shingle shores also support a range of feeding birds, notably chough *Pyrrhocorax pyrrhocorax*, particularly in winter, and turnstone *Arenaria interpres* and a roosting site for other beach feeders at high tide. Plants of note include Isle of Man cabbage *Coincya monensis ssp monensis* and grass-leaved orache *Atriplex littoralis*, both protected under Schedule 7 of the Wildlife Act 1990.

Classification of strandlines and shingle

Vegetation of strandlines and shingle around the Island may be classified broadly as outlined in **Table 4.6.b**. Both **annual** vegetation of strandlines, which may occur on both shingle and sandy beaches, and **perennial** vegetation of shingle banks, are important for wildlife conservation. However, it should be noted that annual strandline vegetation is commoner worldwide than perennial vegetation of shingle banks, which is very restricted, with few extensive examples even within the British Isles (www.jncc.gov.uk, 2005).

Strandline and shingle status

The 1995 Isle of Man Ecological Habitat Survey mentions just four sites around the Island's coast where strandline vegetation was found during the Phase 1 Habitat Survey. 876ha of coastal habitats were mapped in total during this Survey, of which only 43ha is mapped as shingle/cobbles (Sayle *et al*, 1995). It is not recorded which of these shingle patches had any vegetation present, and it is likely that some areas described as strandline vegetation were on shingle structures with perennial as well as annual plants present. The Terrestrial Survey of the Coast of the Isle of Man (Lamb, 1999) goes into more detail, listing "shingle above the high tide mark" as a major habitat element on 25 of the 58 coastal sections surveyed. However, the shingle found rarely supported any permanent plant or invertebrate communities due to the very exposed nature of the shore. A rough estimate based on surveys of key sites suggests that less than a quarter of the shingle mapped supports any kind of vegetation, making vegetated shingle one of the rarest habitats on the Island (BDIS). Good examples of strandline communities are slightly more frequent, but not abundant due to the very exposed, rocky nature of many Manx beaches and the practice of clearing strandline depositions from popular beaches in the holiday season. The importance of both strandlines and shingle is reflected in the Manx Wildlife Sites Handbook, which recommends Wildlife Site status for well-vegetated strandlines and shingle beaches with good invertebrate and bird populations (Keehan, 1999).

Worldwide, vegetated shingle is a category which has received a lot of conservation concern. Although shingle beaches are very familiar to visitors of British coastal resorts, vegetated shingle is in fact an internationally scarce and important habitat, restricted to the coasts of Britain, Ireland, North-west Europe, Japan, and New Zealand, and never in great abundance in any of these areas. There is known to be around 4,000 ha of stable or semi-stable vegetated shingle around the coast of the UK, which is widely distributed (often restricted to small patches isolated from other shingle areas) and which exhibits a wide range of variation. There are only a few extensive examples of perennial vegetation of stony banks in Europe, and the UK hosts a significant part of the European resource of this habitat. In recognition of its restricted range and conservation importance, Coastal Vegetated Shingle is listed as a UK Biodiversity Action Plan Priority Habitat, whilst both Annual vegetation of drift lines and Perennial vegetation of stony banks are listed as Annex 1 habitats under the EU Habitats Directive. Full details of these and related habitats and species can be found at www.jncc.gov.uk.

Minimum selection criteria for strandlines and shingle

Strandlines will not constitute reason for ASSI selection on their own except where associated with perennial vegetation of shingle banks (see below) and/or on the grounds of species criteria. However:

- the presence of 100m or more of unpolluted strandline with associated vegetation and/or bird or invertebrate populations is likely to fulfil the Priority Site Criteria for Naturalness and Representativeness and favourable Ecological Position, as described in Part 3, for a coastal site with one or more other habitat features. Good examples of strandline communities will therefore be a positive factor in the selection of larger coastal sites.

Bare shingle will not constitute reason for ASSI selection as a habitat on its own, but should be included within the boundary of designated coastal sites wherever it occurs adjacent to other selected habitats e.g. dunes or vegetated shingle.

Vegetated shingle, whether sandy in nature or not, will qualify for selection where:

- The shingle supports a range of species associated with any of the NVC categories described in Table 4.6b, and the total extent is greater than 0.2ha*, or

- The total area of vegetated shingle as described above is greater than 0.05ha* and the area fulfils at least one of the Priority Site Criteria listed in Part 3, with priority given to sites which are known to support populations of rare plants and/or animals.

*Because of the naturally narrow nature of most vegetated shingle habitats, it may be convenient to think of shingle in terms of length of site as well as total area:
0.2ha = 1km of 2m width shingle, 0.5km of 4m width shingle, 250m of 8m width shingle
0.05ha = 250m of 2m width shingle, 125m of 4m width shingle, 60m of 8m width shingle etc.

Blackthorn *Prunus spinosa* , usually a substantial shrub, has an almost prostrate form when growing on the harsh environment of bare shingle

Table 4.6b: Broad categories of strandlines and shingle habitats on the Isle of Man

Type and Description	Species rich?	Closest NVC categories (See Rodwell, 1992[5])	Rarities present?	Protected species present?
Sandy strandline Consists of seaweed, driftwood and litter deposits, rapidly-changing according to tides and often greatly increased by storm events. Vegetation is likely to be limited to salt-tolerant, weedy annual species. This type of strandline may be important in the formation of embryo dunes (see 4.6.3 below)	Not usually rich in plant species, but can support rich terrestrial and marine invertebrate communities	None, but sand couch foredune vegetation SD4 (see 4.6.3, below, and Table 4.6.c) may occur in association with sandy strandlines.	May form part of breeding and/or feeding territory for rare birds (see right)	Grass-leaved orache *Atriplex littoralis;* oysterplant *Mertensia maritima.* A range of birds may feed along strandlines, including chough *Pyrrhocorax pyrrhocorax*, starling *Sturnus vulgaris*, and turnstone *Arenaria interpres*.
Sandy shingle A mixed substrate, with smaller sand and gravel –sized particles caught between larger pebbles, providing a potential growing medium for perennial as well as annual plants. This type of strandline may also be important in the formation of embryo dunes (see 4.6.3 below)	May be species-rich, especially where perennial vegetation is established	SD3: *Matricaria maritima – Galium aparine* (sea mayweed/cleavers) strandline community No Island NVC sample SD4: (sand couch foredune – see above and Table 4.6.c) SD19: *Phleum arenarium – Tortula ruralis* (sand timothy grass and moss) dune annual community – also occurs in disturbed areas of sand dunes (see Table 4.6.c below) No Island NVC sample	Sea holly *Eryngium maritimum*	Oysterplant (as above); Sea wormwood *Seriphidium maritimum*; Grass-leaved orache *Atriplex littoralis*; Hare's-foot clover *Trifolium arvense*; Isle of Man cabbage *Coincya monensis subsp monensis*; viper's bugloss *Echium vulgare*. A range of birds may feed occasionally on vegetated sandy shingle. Some birds such as little tern *Sterna albifrons* and ringed plover *Charadrius hiaticula* may nest on sandy shingle.

Shingle Sharply-drained, large pebbles with limited, mostly annual vegetation. May build into sloping banks, the inland side of which can develop perennial vegetation and associated invertebrate communities. The ability of this vegetation to trap sand high up the shore may play a part in dune formation, especially in an island setting.	Not usually	SD1: *Rumex crispus-Glaucium flavum* (curled dock/yellow horned poppy) shingle community No Island NVC sample SD2: *Honckenya peploides – Cakile maritima* (sea sandwort/sea rocket) strandline community 2 Island NVC samples	Yes; several rare plants (see right) and invertebrates may occur on this habitat; also some unusual/locally distributed plants such as Sea kale *Crambe maritima.*	Oysterplant *Mertensia maritima*; NB this species is also nationally scarce in the British Isles. Terns *Sterna* spp. may nest on shingle areas.
Bare shingle This consists of pebbles and cobbles only, often within the most exposed tidal ranges.	No	Not applicable; no vegetation present	May form part of breeding and/or feeding territory for rare birds (see right)	May be used for haul out or pupping area by Schedule 5 protected Grey seal *Halichoerus grypus*; breeding terns *Sterna* spp.

Sea sandwort *Honckenya peploides*, growing on shingle at the Ayres ASSI and National Nature Reserve

4.6.3 Dunes

Description and Distribution

Coastal sand dunes develop where there are onshore prevailing winds and a sufficient supply of sand, coupled with a large enough area of beach, to allow sand deposits to build up and dry out between high tides (Ratcliffe, 1977). A small number of highly specialised grasses, principally marram grass, lyme grass and sand couch, can colonise the shifting sand and develop a vegetation community which both stabilises the developing dunes and helps further build-up by trapping more sand.

Sand dune vegetation forms a number of zones in relation to the time elapsed since the sand was deposited, the degree of stability which it has attained, and the local hydrological conditions:

- **Embryonic and mobile dunes** occur mainly on the seaward side of a dune system where sand deposition is occurring and occasionally further inland in blow-outs. They support very few plant species, the most characteristic being marram grass *Ammophila arenaria*.
- **Semi-fixed dunes** occur where the rate of sand accretion has slowed but the surface is still predominantly bare sand; marram is still common but there is an increasing number of other species.
- **Fixed dune** grassland forms largely closed swards where accretion is no longer significant, the surface is stabilised and some soil development has taken place. Calcareous fixed dunes support a particularly wide range of plant species. On dunes which have become acidified by leaching or **de-calcified**, acid dune grassland or dune heaths develop.
- **Dune heaths** are usually dominated by ling *Calluna vulgaris* and bell heather *Erica cinerea*.
- **Dune slack** vegetation occurs in wet depressions between dune ridges; it is often characterised by creeping willow *Salix repens* and mosses.

Fixed dunes and well-developed dune grassland and heath are potentially very species-rich, attracting warmth-loving insects as well as birds and a wide range of grassland and heathland plants. Dune habitats are further diversified by the presence of dune slacks. All these habitats are slow to recover from damage, and are hence vulnerable to human disturbance and modification, particularly heavy vehicle access, fires, and disturbance of ground-nesting birds. Once "reclaimed" for agriculture or development a dune is lost for good, and changes in coastal defences or adjacent land use can alter the whole dune system by affecting local sand deposition patterns. For these reasons, much UK duneland has been lost or damaged, and a high proportion of the remaining habitat is protected under UK and/or EU legislation.

Dunes can form in a variety of places, always in exposed conditions. Because of the need for a large area of more or less flat, open land, dunes occur predominantly around the north coast of the Isle of Man, where hindshore dunes form on large, open areas of coast (e.g. the Ayres). Elsewhere, the coastline is either too steep and rocky to allow dune formation, or the areas of sand build-up are on beaches adjacent to built-up areas such as Peel and Port Erin.

Classification of dunes

Vegetation of dunes around the Island may be classified broadly as outlined in **Table 4.6.c**.

Dune status

The Isle of Man has one large area of dunes across the north coast, with more open dunes concentrated in the northwest (eg. Blue Point) and dune heath most prevalent in the central to northeast Ayres and Point of Ayre. Elsewhere, only tiny patches of sand deposits occur, none of which show the range of dune development found on the north and northwest coasts. Dune heath (54% of coastal habitats overall) is by far the most extensive dune type, with dune scrub and dune slack the rarest. Although they make up a high proportion of the total area of coastal habitat on the Island, dune habitats are rare overall, with even dune heath making up just 0.55% of the Island total, or 1.89% or the semi-natural habitat total. The rarity and vulnerability of dune habitats is recognised in the Manx Wildlife Sites Handbook: all areas of dune except severely degraded examples are recommended as eligible for Wildlife Site selection (Keehan, 1999).

Dune habitats are treated as threatened habitats throughout the British Isles, with Coastal Sand Dunes listed as a UK Biodiversity Action Plan Priority Habitat. At the European level, a range of dune types are listed in Annex 1 of the EC Habitats Directive, including Embryonic Shifting Dunes, Dunes with *Salix repens ssp. argentea* (Salicion arenariae), Shifting dunes along the shoreline with *Ammophila arenaria* (`white dunes`), Fixed dunes with herbaceous vegetation (`grey dunes`)(a priority habitat) and Atlantic decalcified fixed dunes (Calluno-Ulicetea) (also a priority habitat). Humid dune slacks are also listed, with a note to the effect that this habitat is more frequent in the UK than elsewhere, hence the UK has a special responsibility for its conservation (www.jncc.gov.uk, 2005).

Minimum selection criteria for dunes

- The largest examples of each of the following dune types will qualify for selection:

  - Mobile foredune and "white" or "yellow" dune with:
marram grass *Ammophila arenaria;*
lyme grass *Leymus arenaria* and
Sand couch *Elytrigia juncea*;

  - Semi-fixed "grey" dunes;
  - Fixed dune grassland;
  - Dune heath.

- Any dune system greater than 2ha in extent which fulfils at least one of the Priority Sites Criteria listed in Part 3 will qualify for selection, with priority given to sites with good naturalness and representativeness (i.e. those sites with least disturbance, modification and damage).

- Selected areas of dunes should be included with as much adjacent semi-natural coastal habitat as possible, including bare and vegetated shingle banks, strandline and coastal scrub.

- When selecting dune systems, special consideration should be given to the landward boundary, which should encompass sufficient land to allow the dune system to develop onto suitable adjacent habitat where applicable.

Hare's-foot clover *Trifolium arvense*, a protected species, growing on semi-fixed dune at Ramsey Mooragh Shore ASSI

Table 4.6c: Broad categories of dune habitats on the Isle of Man

Type and Description	Species rich?	Closest NVC categories (See Rodwell, 1992[5])	Rarities present?	Protected species present?
Mobile foredune *and* ***yellow dune*** Mobile foredune consists of shifting sand on the seaward side of a dune system, behind which larger and progressively more stable dunes can build up. Sandy strandlines (see 4.6.2 above) may lie adjacent to this habitat, and strandline vegetation can play a part in the formation of embryo dunes. Yellow dune is slightly less mobile, and generally supports a loose mat of plant growth of one or two species such as marram grass or lyme grass. A few specialised invertebrates and a very limited number of plants can survive in these habitats, which are subject to constant change and abrupt re-grading following strong winds and storm events.	No	SD4: *Elymus farctus ssp boreali-atlanticus* (sand couch – now called *Elytrigia juncea ssp boreoatlanticus*) foredune One Island NVC sample SD5: *Leymus arenarius* (Lyme grass) mobile dune community No Island NVC sample SD6: *Ammophila arenaria* (marram grass) mobile dune community No Island NVC sample	May form part of breeding and/or feeding territory for rare birds (see right)	Not usually, although some bird species such as little tern *Sterna albifrons* may utilise foredunes as nesting areas.
Fixed and semi-fixed dune Semi-fixed dunes are often referred to as grey dune, and are usually well-vegetated, with more varied vegetation than yellow dunes. This vegetation becomes progressively more consolidated inland, until it grades into fixed dune grassland and/or heath. Dune scrub may also occur, although it is rare on the Island due to the small areas of dune involved.	May be species-rich in both plant and invertebrate communities	SD7 *Ammophila arenaria – Festuca rubra* (marram grass and red fescue) semi-fixed dune community 2 Island NVC samples SD8 *Festuca rubra – Galium verum* (red fescue and lady's bedstraw) fixed dune grassland One Island NVC sample SD10 *Carex arenaria* (sand sedge) dune community No Island NVC sample SD12 *Carex arenaria – Festuca ovina –*	Rare and/or locally distributed plants and invertebrates are a possibility	A range of orchid species grow on developed dunes, including Twayblade *Listera ovata,* Autumn lady's tresses *Spiranthes spiralis*, Pyramidal orchid *Anacamptis pyramidalis* and early marsh orchid *Dactylorhiza incarnata*. Larvae of the scarce crimson and gold moth *Pyrausta sanguinalis* feed on thyme in this habitat.

		Agrostis capillaris (sand sedge, sheep's fescue and common bent grass) dune grassland Disturbed areas of fixed dunes may have SD19: *Phleum arenarium – Tortula ruralis* (sand timothy grass and moss) dune annual community No Island NVC sample		
Dune slacks Damp depressions and hollows in between dune ridges may have a high water table for all or part of the year, allowing marshy vegetation to survive. The degree of brackishness of dune slacks depends on the proximity to the sea and level of exposure to salt spray deposition; in general they are classed as freshwater, with truly salt slacks classed as types of saltmarsh even when on sand rather than mud (see Table 4.6.d). Dune slacks on the Island are rare (restricted to the Ayres) and usually small (under 1ha).		SD15 *Salix repens – calliergon cuspidatum* (creeping willow and moss) dune slack community SD16 *Salix repens – Holcus lanatus* (creeping willow and Yorkshire fog) dune-slack community One Island NVC sample Sand sedge (SD10 – see above) may also occur around dune slacks SD17 *Potentilla anserina – Carex nigra* (silverweed and common sedge) dune-slack community No Island NVC sample	Dune slacks may support very locally distributed invertebrate populations.	Orchids may thrive in dune slacks, notably Northern marsh orchid *Dactylorhiza purpurea*. Wintering waders such as curlew *Numenius arquata* and lapwing *Vanellus vanellus* may be attracted to dune slacks as feeding areas.

4.6.4 Saltmarsh

Description and Distribution

Saltmarsh is a habitat composed of species that can withstand high salinities and regular flooding from the tide. It forms in areas with fine sediments and usually some protection from the worst onslaught of the storm waves. On the Isle of Man it is found fringing tidal rivers and in coastal bays with some protection from the waves.

It can incorporate a number of zones of different vegetation. Seaward there is often a pioneer community which must be tolerant of extended periods of submergence in saltwater and washing by wave and tide. Higher up the beach the communities are more terrestrial in character. These can form a succession through which sediments are gained to the land, or a zonation that is more static but protects the higher areas from erosion by the sea, the roots of the vegetation binding the sediments together and the shoots breaking the force of the waves. This range of communities can be shortened by erosion from the sea, or due to 'coastal squeeze', in which the landward boundary of a saltmarsh is curtailed by a bank or sea wall whilst the marsh moves up against it with a rise in sea level or due to sediment movements.

Saltmarsh communities vary geographically and with local physical conditions (tidal range, salinity of the water and sediment type). Moving northwards in the British Isles, there is a steady decline in the numbers of saltmarsh plant species and particle size tends to increase in a northerly and westerly direction, affecting soil aeration, drainage and nutrient status, with a greater number of species growing on finer soils (Ratcliffe 1977). Northern saltmarshes, such as those found in the Isle of Man, therefore tend to be botanically poorer than those in the south of England.

Saltmarshes often form part of a larger system of coastal habitats, which can be of importance for birds and invertebrates. Associations with brackish habitats, in marshes or creeks, or with terrestrial habitats such as woodlands, can allow a higher diversity of species to live there. Such areas can form localised features that are important or rare in the British Isles. For instance, there are very few places in Britain where a gradual transition from saltmarsh to woodland can be seen (Ratcliffe 1977). On the island, Port Cornaa has a saltmarsh which is botanically poor, yet the proximity of other habitats such as woodland, has benefited the wildlife and Boyce and Fowles (1989) recorded a very good list of invertebrates in this habitat mosaic.

There are areas of coast, mostly too exposed and not silty enough for saltmarsh habitat to form, where saltmarsh species may be found as either strandline vegetation or on salt-sprayed cliffs. Such sites do not fall within this section. For instance, sea arrowgrass is found on salt-sprayed grasslands. It is therefore not a good indicator of the habitat, whereas saltmarsh rush is more specific in its habitat requirements.

Good stretches of saltmarsh vegetation can be found around the fringes of the Irish Sea, with some extensive areas in north-west England and south-west Scotland. However, the Isle of Man has very little area that could be termed 'estuary', where there would be sufficient shelter for fine sediments to fall and saltmarsh to form over an area of significant size. Saltmarsh grows best on fine sediments, but most of the coastal Manx sediment is too coarse. Derbyhaven has a fairly large area of mud but almost no saltmarsh vegetation. Those areas having an estuarine environment have been subject to development and drainage to form the port areas of Douglas, Castletown, Peel and Ramsey. In these areas saltmarsh may have been found in the past but only Ramsey retains this habitat, along the banks of the Sulby River. However, there are other small areas elsewhere on the island in estuaries and sheltered bays.

The Isle of Man Ecological Habitat Survey Phase 1 report recorded only 6.72 ha of saltmarsh in total. There are four main areas: Ramsey, Port Cornaa, Langness and Poyllvaaish with small patches of saltmarsh species also present elsewhere. Langness is the largest site.

Saltmarsh sites on the Isle of Man

Langness has the largest patch of saltmarsh on the island, 3.44 ha (phase 1), around Poyll Breinn, the stinking pool. It is considered the best example of saltmarsh on the island (Gubbay 2000) and was grazed (at least parts of it) formally (phase 1 report). The phase 1 survey also shows a tiny patch further south (0.04 ha), another close to the golf course hotel (0.04 ha) and 7 small patches on St. Michael's Island totalling 0.21 ha. All of these are within the Langness, Sandwick and Derbyhaven ASSI, designated on 19th October 2000. It was listed as a Site of Marine Nature Conservation Importance by the Manx Wildlife Trust (Gubbay 2000). The site includes celery-leaved buttercup *Ranunculus sceleratus*, chestnut sedge *Blysmus rufus*, grass-leaved orache *Atriplex littoralis*, sea club-rush *Scirpus maritimus*, sea lavender *Limonium vulgare*, parsley water dropwort *Oenanthe lachenalii* and cord grass *Spartina anglica*.

Visits by Luff and by Boyce and Fowles have produced invertebrate lists. Boyce and Fowles (1989) found the weevil *Polydrosus pulchellus* ab. *insquamosus,* a nationally notable (Category Nb) species, and of a rare form previously found in Devon, Kent and Gloucestershire. This site is the northernmost recorded locality of the centipede *Schendyla peyerimhoffi*. The saltmarsh and adjoining wrack beds and pools are an important feeding ground and roost for ducks and waders. In the winter wigeon, teal, shelduck, curlew and golden plover are common and in summer lapwing nest here. Redshank were previously recorded nesting but have not returned in recent years.

Port Cornaa has a small saltmarsh of 0.72 ha (phase 1) lying behind the high shingle bar, astride the river. This saltmarsh is listed as a Site of Marine Nature Conservation Importance in the Isle of Man by Gubbay (2000). Formerly grazed, it has also often been flooded by fresh water when the river has been dammed for safe bathing (Garrad 1972). The river Cornaa runs through it and it is backed by marshy grassland, with woodland close behind and an area of alder carr linked to the marsh. The saltmarsh drains through a creek system, leaving open mud at low tide. Some erosion has been noted by Spencer (pers. comm.) recently and some minor bank works may have been done to prevent the river from eroding the southern marsh.

Areas are dominated by either red fescue *Festuca rubra* or creeping bent *Agrostis stolonifera* with abundant sea arrowgrass *Triglochin maritimum* and sea plantain *Plantago maritima*. Sea rush *Juncus maritimus* is locally abundant and saltmarsh rush *Juncus gerardii* locally frequent. Glasswort *Salicornia europaea* agg. has also been recorded (Allen 1984). Parsley water-dropwort *Oenanthe lachenalii* is recorded, and two uncommon sedges, distant sedge C*arex distans* and false fox-sedge *C. obtrubae*. The area to the east of the river is more complex and supports an abundance of sea rush, saltmarsh rush and rock samphire. A water crowfoot *Ranunculus trichophyllus* characteristic of brackish water has been recorded here, considered very local by Allen (1984).

Boyce and Fowles (1989) considered this area to be of considerable invertebrate interest, due to the close proximity of saltmarsh, pasture, river shingle and woodland, forming a mosaic of habitats, each perhaps small but adding greatly to the value of the others by their close proximity. A high species abundance should result. The saltmarsh, though low in plant diversity, had a significant invertebrate interest, the sheltered conditions and shallow silt and gravel channels providing habitat for ground-active species. Two ground beetles found here are scarce saltmarsh species with a restricted distribution in the British Isles: *Aepus marinus* (nationally notable Nb, widespread but local in the British Isles in intertidal habitats) and *Bembideon maritimum* (Nb in Hyman 1986, but not included in the revision of Parsons 1992).

At **Ramsey**, saltmarsh is stretched along both sides of the tidal Sulby River, including the largest area, at Poyll Dhooie, which used to be grazed. The alteration of the river mouth may have affected the distribution and extent of saltmarsh significantly. At Poyll Dhooie a tip created in the 1940s resulted in the loss of some of the saltmarsh (Spencer pers. comm.). Despite this, the area as a whole remains the second largest area of saltmarsh on the island. Most of the areas are dominated by red fescue. At the White Bridge reed swamp of *Phragmites australis* merges with the red fescue saltmarsh, the reeds continuing upstream in fresher water, lining the banks, as typical of an upper estuary situation. Sea aster *Aster tripolium,* grass-leaved orache *Atriplex littoralis* and long-spiked glasswort *Salicornia dolichostachya* are all recorded. There is an area with brackish pools fringed with saltmarsh rush *Juncus gerardii*. Here rabbits graze the sea arrowgrass *Triglochin maritima* and creeping bent *Agrostis stolonifera*.

Poyllvaaish has scattered areas of ungrazed saltmarsh on carboniferous limestone mixed with strandline vegetation, shingle and scattered saltmarsh plants. It is dominated by red fescue *Festuca rubra,* with locally abundant common saltmarsh grass *Puccinellia maritima*. Sea aster *Aster tripolium*, glasswort *Salicornia europaea* agg. and sea purslane *Halimione portaculoides* (very local, Allen 1984) are found here (phase 1). The oyster plant *Mertensia maritima* (very rare; Allen 1984) was once recorded here c. 1866 but crushed by a passing cart and not seen since. To the south, one patch of the rare reflexed sea meadow grass *Puccinellia distans* was recorded in Allen (1984) by Poyllvaaish Farmhouse, and celery-leaved buttercup *Ranunculus sceleratus* on the shore between this site and Ronaldsway.

Classification of saltmarsh

Saltmarsh on the Island may be classified broadly as outlined in **Table 4.6.d**.

Saltmarsh grows on fine sediments which settle out in sheltered areas of salty or brackish water. Because the sediment type, slope and level of brackishness are important, the changing physical nature of a site can affect the saltmarsh growing on it. On the Island, saltmarshes grow in three physiographic situations, estuarine (Sulby River), lagoonal (Cornaa), and beach plain (Langness and Pooilvaaish).

Rodwell (2000) identified four saltmarsh NVC communities on the Isle of Man, of which two fall within the Atlantic Salt Meadows protected in Europe under the Habitats Directive. From the extreme lower end of the transition of communities comes the common eel grass *Zostera marina* which is sometimes washed up on Manx beaches around the island (Allen 1984; Rodwell 2000). *Zostera* beds (Rodwell's NVC SM1 community) are known to grow off St. Michael's Island / Langness and are likely to be found elsewhere by diving survey. However *Z. marina* is mainly found on sites constantly submerged by the sea (and some lagoons elsewhere), from just above the spring low water mark, down to 4m below. On the Isle of Man it is not recorded as a continuing seaward extension of saltmarshes and is likely to form separate, sub-littoral stands which may be best considered under the criteria for Marine Nature Reserves.

In the lower marsh SM13c *Puccinellietum maritimae, Limonium vulgaris - Armeria maritima* sub-community is characterised by Rodwell as having *Puccinellia maritima* as a constant constituent. In the mid-upper marsh red fescue saltmarsh SM16 *Juncetum gerardi* is characterised by the constants *Festuca rubra*, *Plantago maritima* and *Glaux maritima*. Higher still, the upper marsh community SM24 *Atriplici - Elymetum pycnanthi* has been identified, but this is invariably dominated by sea couch *Elytrigia atherica* (form. *Elymus pycnanthus*) though this has not been recorded on the Island.

A third characterisation of saltmarshes lies in their management. Grazed marshes form a different structure to the rank ungrazed marshes, resulting in a different invertebrate community and frequently different birds. Continuing traditional management may be important to the retention of some of the wildlife interest; a change in management can result in the development of a different community. Port Cornaa, Langness and Poyll Dhooie were formerly grazed but none of the sites were grazed when the phase 1 report was written.

Lesser sea-spurrey *Spergularia marina* on saltmarsh at Langness ASSI

Table 4.6.d: Broad categories of saltmarsh on the Isle of Man

Type and Description	Species rich?	Closest NVC categories (See Rodwell, 1992[5])	Rarities present?	Protected species present?
Sea-clubrush swamp Typical of more or less still, brackish or salt water alongside estuaries, lagoons and the deeper areas of saltmarshes. Uncommon.	No.	S21 - *Scirpus maritimus* (sea club-rush, now known as *Bolboschoenus maritimus*) swamp No Island NVC sample	Provides good bird cover, so may attract nesting or passing rarities.	
Lower saltmarsh. This vegetation generally colonises the muddier, wetter parts of saltmarshes, and is regularly covered at medium to high tide. It often forms important feeding sites for wading birds.	Not rich in plant species; may however support a diverse invertebrate population and associated feeding waders.	SM8 Annual *Salicornia* (glasswort) saltmarsh community No Island NVC sample SM9 *Suaeda maritima* (annual sea-blite) saltmarsh community No Island NVC sample SM10 Transitional low-marsh vegetation with *Puccinellia maritima* (common saltmarsh-grass), annual *Salicornia* (glasswort) species and *Suaeda maritima* (annual sea-blite). No Island NVC sample. SM13 *Puccinellia maritima* (common saltmarsh-grass) community, esp. 13c *Limonium vulgaris - Armeria maritima* (Sea lavender – thrift) sub-community One Island NVC sample. SM14 *Halimione portulacoides* (sea-purslane) saltmarsh community No Island NVC sample SM15 *Juncus maritimus – Triglochin maritimum* (saltmarsh rush – sea arrowgrass) saltmarsh No Island NVC sample	Yes; several lower saltmarsh plant species are rare or uncommon on the Island, e.g. the more unusual *Salicornia* glasswort species.	Protected plants may include *Halimione portulacoides*, *Eleocharis uniglumis* slender spike-rush, *Limonium vulgare* common sea-lavender, *Seriphidium maritimum* sea wormwood, *Oenanthe lachenalii* parsley water-dropwort. Protected bird species that may feed on lower saltmarsh include curlew *Numenius arquata* and shelduck *Tadorna tadorna*.

Middle saltmarsh. These usually resemble muddy, more or less closed grasslands, often dominated by red fescue growing as a flattened mat, or by tufts of saltmarsh rush. Can be grazed, although no middle saltmarsh on the Island is currently grazed.	Yes; may support a range of plants, invertebrates and associated bird life.	SM16 *Festuca rubra* (red fescue) saltmarsh community One Island NVC sample SM18 *Juncus maritimus* (saltmarsh rush) saltmarsh No Island NVC sample SM19 *Blysmus rufus* (saltmarsh flat-sedge) community No Island NVC sample	Yes; several unusual species occur in mid-range saltmarsh; *Blysmus rufus* is itself a rarity on the Island, and rare invertebrates and feeding birds are also a possibility.	Protected plants may include *Halimione portulacoides*, *Oenanthe lachenalii* (parsley water-dropwort), and *Seriphidium maritimum* (sea wormwood). Protected bird species that may feed on middle saltmarsh include geese and shelduck.
Upper saltmarsh. This tends to have a grassy cover, suitable for grazing – although there is no grazed saltmarsh on the Isle of Man, and grazed sites are becoming rarer throughout the UK. This is not a well-developed habitat on the Island, and upper saltmarsh species may occur only as a fringe amongst rocks and built-up areas on the landward edge of the marsh.	May be species-rich, but is not usually extensive enough on the Island to develop its full potential. Presence of wet hollows and pools can increase the diversity.	SM24 *Elymus pycnanthus* (sea couch) saltmarsh community One Island NVC sample – but note, *E. pycnanthus* (now re-named *Elytrigia atherica*) does not appear to have been recorded on the Island! In other respects the habitat does match this common NVC community. SM28 *Elymus repens* (common couch) saltmarsh community No Island NVC sample. Note: *E. repens* has been renamed *Elytrigia repens*.	Yes; some unusual plant species may occur, especially where pools are present - notably coastal sedges such as *Carex otrubae* false fox-sedge, *C. extensa* long-bracted sedge, and *C. distans* distant sedge and *Puccinellia distans*. Reflexed saltmarsh grass	Protected plants may include *Oenanthe lachenalii* (parsley water-dropwort), *Atriplex littoralis* (grass-leaved orache) and *Seriphidium maritimum* (sea wormwood). Protected bird species that may feed on lower saltmarsh include lapwing *Vanellus vanellus*, ringed plover *Charadrius hiaticula*, and starlings *Sturnus vulgaris*.

Saltmarsh status

Wider context
Saltmarshes are a priority habitat for conservation in the EU (Annex 1 of the Habitats Directive: Atlantic salt meadows considered by the JNCC to be equivalent to SM10 to 20) and as a result, form parts of a number of Special Areas of Conservation in the UK. They are also listed as a priority habitat in the UK, resulting in the provision of a habitat action plan. There are more than 29,000 ha of saltmarsh in the UK (Saltmarsh Database, JNCC website 2003). About 80% of British saltmarsh is designated as SSSI (50% in north-west Scotland). In Northern Ireland 5 of 7 estuaries with saltmarsh are ASSI. Through the habitat action plan the UK aims to create 100 ha per year to maintain the total area (about 100 ha per year are lost) plus a further 40 ha per year to replace the 600 ha lost between 1992 and 1998.

Regionally (Colwyn Bay to Stranraer, and Isle of Man), Manx saltmarshes are tiny compared with the extensive saltmarshes of Lancashire, Cheshire and Cumbria. Less than 1% of the Manx coast is saltmarsh but this is 46% in Lancashire, 45% in Cheshire and 30% in Cumbria (Barne et al. 1996). A notable feature is the high proportion of mid to upper marsh communities remaining, whereas elsewhere in Britain many have been drained and improved for agriculture or developed. Most of the region's saltmarsh is concentrated in the Dee and Ribble Estuaries, Morecambe Bay and inner Solway Firth and much of it is grazed, grassy turf.

The plant species diversity is lower than that for south-east England. The typical zonation (Barne et al. 1996) is from a *Spartina* pioneer community to a low-mid marsh with a *Puccinellia maritima* community and red fescue saltmarsh (*Juncetum gerardii* community) in the mid to upper marsh. Sea purslane *Halimione portulacoides* saltmarsh is less widespread than on the south and east coasts due to grazing. The driftline is dominated by either couch *Elymus repens* or sea couch *Elymus pycnanthus* saltmarsh. At the Solway there is a change from western to Scottish-type marshes, with upper marsh transitions to grassland and brackish fen, and several species reach or approach the northern limits of their west coast distributions here: sea purslane, sea wormwood *Artemisia maritima*, sea lavender *Limonium vulgaris*, lax-flowered sea lavender *Limonium humile*, sea couch, hard-grass *Parapholis strigosa* and strawberry clover *Trifolium fragiferum*.

Invasion by cord grass *Spartina anglica* has caused concerns at some sites in the UK. This species (a polyploid hybrid arising in southern England) has been planted in the UK to make use of its success in binding sediment and thereby stabilising it. It naturally appeared on the Isle of Man in the mid-1970s but appears to have spread little (Allen 1984 in Barne et al. 1996) and was not found at Langness in 2004-2005 (Spencer, pers. comm.). This occurs at only a few sites possibly because the saltmarshes overlie rock with relatively little mud (Barne et al. 1996).

Manx saltmarshes are not considered to be of international importance because they are extremely small and have relatively low diversity. However, they are of importance to wildlife conservation in the Manx context, as they are highly restricted, form a distinctive habitat with a very different biota to other habitats on the island, they could be lost very easily through a change in land use, whether drainage, development or coastal protection works, or as a result of physical changes in the environment, such as a rise in sea level squeezing the marsh against harder inland boundaries which can prevent its inland advance and restrict its continued effect of coastal protection and land claim.

Sea milkwort *Glaux maritima*, growing on saltmarsh at Fort Island, Langness ASSI

Minimum selection criteria for saltmarsh

Saltmarsh quality should be assessed by size, species richness and the presence of rare species. When comparing sites, those showing the full range of saltmarsh communities or a transition or mosaic between saltmarsh and other habitats, such as woodland or grassland, should be considered a priority for conservation. Grazing can modify the plant communities, so management must be considered in comparisons.

1. Include all areas of significant size, i.e. above 0.1 ha (total area to include separate patches on sites with discontinuous patches of saltmarsh);

2. Include smaller sites with populations of rare species (eg. plants found at three sites or less on the island) or community types not represented in larger sites. Every saltmarsh sub-community should be represented, preferably by the best example.

3. Include smaller sites where they form a transition to or mosaic with other eligible habitats or sites adjacent to eligible habitats.

Boundaries

Saltmarshes form a habitat which lies on the boundary of the sea and the land. Some constituent communities are essentially marine or sediment pioneers, whereas others are really terrestrial. These constituent parts shift with the sediments on which they depend, which may move seaward or landward depending on the local erosion or accretion of sediments. Site boundaries should reflect this by using a variable lower boundary such as the astronomical low tide line and an upper boundary high enough to take in all of the present saltmarsh habitat and allow for an expected rise in sea level.

4.6.5 Brackish pools

Description and distribution

Whilst some ponds which lie in close proximity to the coast may have a slightly brackish ecology (due to sea spray periodically reaching the water), true brackish pools are extremely rare on the Isle of Man. They represent the Island's only representative of an internationally rare habitat, **saline lagoons**. Saline lagoons are essentially bodies, natural or artificial, of salt water partially separated from the adjacent sea. They retain a proportion of their seawater at low tide and may develop as brackish, full saline or hyper-saline (i.e. saltier than sea water) water bodies. The largest lagoon in the UK is in excess of 800 ha (Loch of Stenness) although the rest are much smaller and some may be less than 0.1ha (UK BAP, UK Marine SACs Project, 2005).

Saline lagoons sometimes contain invertebrates rarely found elsewhere, and also provide important habitat for waterfowl, waders and seabirds. The flora and invertebrate fauna present can be divided into three main components: those that are essentially freshwater in origin, those that are marine/brackish species and those that are more specialist lagoonal species. On the Isle of Man, species typical of saline lagoons may colonise brackish pools, forming small populations of plants and animals that are rare or absent from anywhere else on the Island. As with larger saline lagoons, the species composition of brackish pools depends a great deal on the type of saline input and the stability of the environment. On the Island, brackish pools take several forms:

- Depressions in dune systems may permanently or seasonally fill with brackish water, forming **dune slacks** – for details of these and related dune habitats, see Section 4.6.3, above.

- Small, isolated, brackish pools notably occur amongst the limestone and volcanic rock formations at Scarlett, on the Island's south coast. They receive salt water from spray and high tide events, resulting in variable salinity depending on levels of salt and rainwater input, and rates of evaporation. They represent some of the most base-rich water bodies on the Island, with the closest ecology to saline lagoons in the UK. They support a characteristic charophyte, or stonewort, flora along with macro-algae such as

Enteromorpha sp., and pondweeds typical of eutrophic, relatively base rich water, such as fennel pondweed *Potamogeton pectinatus*, an uncommon, protected species on the Island.

- Small brackish "trapped" rockpools also occur at places such as Peel Castle old quarry, where a natural or man-made "sill" of rock traps a mix of sea- and rainwater, allowing only periodic salt water inputs at high tide and during storms. The salinity of such pools may vary sharply, with evaporated pools in hot, sunny weather reaching hypersaline concentrations. Such environments are very harsh, and only highly specialised fish and invertebrates are known to survive their demanding fluctuations in conditions.

- Cliff-top ponds may receive small inputs of sea water during storm event, and often remain slightly brackish in nature throughout the year, at least following inputs of high sea-spray and low rainfall. They are less likely to support specialised rare species than true saline lagoons, but may still support unusual plants such as brackish water-crowfoot *Ranunculus baudotii*.

In each of the above cases, the level of salinity in the pool will be heavily influenced by rainfall levels; even specially-adapted flora and fauna may struggle to survive during extended periods of high evaporation and low rainfall.

Classification of brackish pools

Brackish pools on the Island are too small and fragmented to match the usual vegetation community classifications for saline lagoons, but they may show clear characteristics of open water NVC types such as A11 – *Potamogeton pectinatus-Myriophyllum spicatum* (fennel pondweed and spiked water-milfoil) community and A21 – *Ranunculus baudotii* (brackish water-crowfoot) community. Saltmarsh plants such as saltmarsh rush *Juncus gerardii* and sea arrow-grass *Triglochin maritimum* may also occur in and around shallow brackish pools.

Status of brackish pools

True brackish lagoons are only known to occur at two places on the Island, at Scarlett Point and behind Peel Castle. They amount to scarcely 0.05ha – too small an area to be covered by the DAFF Phase 1 Habitat Survey. Only those at Scarlett support a diverse vegetation community; the pool at Peel Castle is notable for the presence of sticklebacks, which are generally able to survive brackish conditions. Other instances of small brackish pools - such as regularly "trapped" rock-pools and ponds near the edge of cliff-tops - are thought to amount to less than 1ha in total, comprising many small examples around the rockier parts of the Island's coastline. Keehan (1999) states that "*all saline lagoons (as defined by Barne J.H.* et al, *1996)"* should be considered for selection as Manx Wildlife Sites.

In the European context, coastal lagoons of any size are a very rare habitat type, associated with rare plant and invertebrate species. For this reason Coastal lagoons are a Priority Annex 1 Habitat under the EU Habitats Directive, and Saline lagoons are a UK Biodiversity Action Plan Priority Habitat. Most of the saline lagoons covered by SAC or SSSI designations are greater than 1ha; however, some of the same ecological issues (and rarities) are also associated with smaller brackish pools.

Unless they occur in very inaccessible locations, brackish pools are vulnerable to a range of threats due to human activity. Their vulnerability is heightened by the fact that their very nature does not allow for regular flushing and replacement of water; thus, any water-borne contaminants may become dangerously concentrated as water evaporates between inputs of rainfall or sea-water, threatening the survival of any plants and animals present. This is further complicated by the tendency of lagoons to accumulate very fine bottom sediments. Certain introduced contaminants, such as phosphorus and organic material, will bind to, or be stored within, fine sediments such as mud more than other substrata such as sand or rock, potentially heightening both the severity and longevity of pollution incidents (UK Marine SACs project, 2005).

Other potential problems for brackish pool species include increased turbidity, which can stir up fine sediments and choke or inhibit delicate species, and oil pollution and any associated dispersant chemicals, both of which can jeopardize brackish water invertebrates by affecting the oxygen availability and surface tension properties of the pool. In all these cases, it may be difficult for brackish pools to recover quickly from contamination, due the factors mentioned above. The precautionary approach to impact

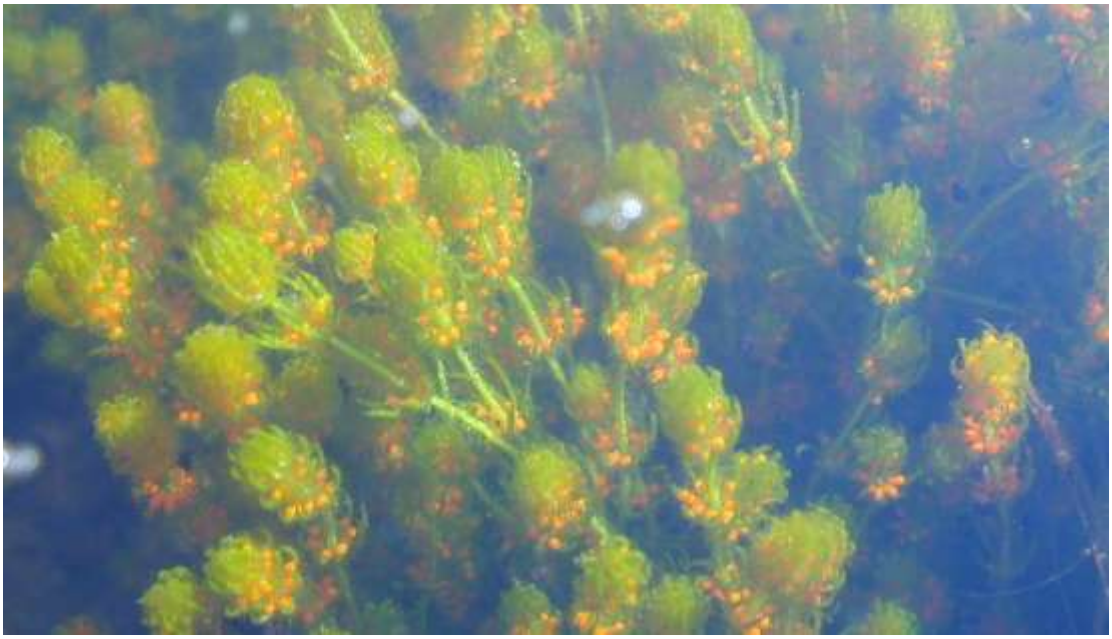
assessment is therefore thought to be especially important where water quality in brackish pools is thought likely to be under threat (UK Marine SACs project, 2005).

Minimum criteria for selection

- Boundaries for wider coastal ASSIs should be drawn so as to include any brackish pools along with at least 5m of buffer zone around each pool (or its known widest extent, if fluctuating), along with the immediate sources of both salt and freshwater input – e.g. adjacent beaches, on the seaward side, and freshwater creeks and/or springlines on the landward side.

- All examples of permanent brackish pools, including sites where the pools fluctuate in size either seasonally or occasionally, should be considered for ASSI selection where they fulfill at least one of the Priority Site Criteria listed in Part 3; pools will normally be included within larger coastal sites, but where this is not appropriate it is recommended that brackish pool ASSIs should cover at least 0.25ha including the pools, even where vegetation around the pools is of low species diversity;

particular priority should be given to sites which support any of the following:
- native fish populations;
- specialist brackish water invertebrates;
- plants which are not known to occur at more than three sites on the Island



Stonewort *Chara vulgaris* growing in brackish pools on the Island's south coast

4.6.6 Sea cliffs, caves and slopes

Description and Distribution

The interface between land and sea is a harsh environment for both plants and animals: maritime cliffs, caves and slopes are exposed to the full might of the sea and the weather, and present many challenges as a habitat. The biggest challenge for most plants is simply that of getting a roothold, as hard cliffs may have few suitable crevices in which to take root, whereas soft cliffs may crumble so quickly that few plants can grow to maturity before the substrate shifts and collapses against the oncoming tide and weather. Other challenges for plants and animals include finding enough food and water, coping with salinity, and surviving storm events.

Despite the challenges, there are advantages for species which can make a home on the most exposed parts of the coast: frosts are rare so close to the sea, there is often little competition from other species, and the range of potential predators is also relatively limited. Thus, seabird colonies thrive on steep and rugged cliffs, and some of the rarest and most competition-sensitive native plants in the British Isles are restricted to cliff tops and crevices (Ratcliffe, 1977). The lack of grazing by large herbivores is also an advantage to cliff-top plants: for example, rare, relict, native oak woodland on the Island is thought to be restricted to inaccessible locations, away from livestock and direct human influence (Garrad, 1972).

Coastal slopes

The softer and more weathered coastline around the Island supports **coastal slope** vegetation, which benefits from the accumulation of soil-forming material on the relatively gentle gradient of the slope compared with cliffs. Heavy inputs of salt from sea-spray, coupled with guano deposits from sea-birds, can lead to relatively base- and nutrient-rich soils on coastal slopes. Ruderal vegetation often results, which may grow up into coastal scrub if left undisturbed. At its most well-developed, coastal scrub may support a wide range of plants, invertebrates and breeding birds see **Chapter 4.1: Woodland and scrub** for a more detailed treatment of this habitat. The mild temperatures and high humidity next to the sea can result in woodland ground flora species thriving on coastal slopes even where there is no tree or shrub cover – notably bluebells *Hyacinthoides non-scriptus* and common dog's-violet *Viola riviniana*, both of which thrive on coastal "brooghs" either amongst bracken cover or rough grassland. Such areas are important for the conservation of Dark green fritillary butterflies, which rely on violets as larval food-plants.

Where coastal slopes are grazed, the resulting grassland is likely to resemble sub-maritime, coastal grassland as described in **Chapter 4.2: Lowland grasslands**, with species typical of both neutral grassland and cliff-tops. A colourful, short, herb-rich turf can result which is of value to invertebrates, particularly on south-facing slopes which offer warm, sunny habitats for moths, butterflies and other flying insects.

Cliffs

The Phase 1 habitat definition of hard and soft maritime cliffs is that they have less than 10% vegetation cover. As such, they are both essentially bare rock habitats, where fauna is at least as important a point of scientific interest as flora. In most other respects, however, hard and soft coastlines vary sharply in the ecosystems they support. The question of whether a stretch of cliff has a predominantly hard or soft substrate is therefore a key point to consider at the start of an assessment.

Soft coastlines change readily in response to physical processes, forming beaches, dunes, soft cliffs or unstable coastal slopes, and hence a mosaic of interrelated and interdependent habitats. **Soft cliffs** on the Island generally consist of muddy and sandy sedimentary rocks, and are subject to continual erosion, particularly on the northwest of the coast, where the effects of the prevailing wind and currents are strongest. Lamb (1999) identified several parts of the coast which were eroding, in some cases quite rapidly, notably at Kirk Michael, Glen Wyllin and Ballaugh Shore (The Cronk). However, he also notes that *"the eroding cliffs are of British if not European importance for their geomorphological exposures and are also important for a number of rare and scarce invertebrates (see Boyce and Fowles, 1989, and JNCC 1996)."* For coastal plants and animals, the instability of a soft coastline is partly offset by its ability to absorb some of the stresses of wind and wave pressure and provide an easy substrate for burrowing and taking root. Hard coasts tend to have a more stable substrate, with simple zones of animal and plant communities dictated largely by proximity to the sea.

Hard cliffs around the Island consist of Manx slate, with localised stretches of red sandstone cliff (at Peel) and limestone (at Castletown). None of these is as hard as the hardest type of cliff found in the British Isles, and nearly all have some cracks, fissures and broken up surfaces which may support plant as well as animal life. Most cliffs around the Island are less than 20m in height; however, some hard Manx cliffs are amongst the taller cliffs in the British Isles, reaching over 300m in south west of the Island - for comparison, the tallest UK cliff faces are 430m (granite, St Kilda), with the tall, Old Red Sandstone cliffs at Foula and Orkney reaching around 370m and 335m respectively (Ratcliffe, 1977). Collapse of hard cliffs occurs less often than collapse of soft cliffs, but can be quite catastrophic and sudden, resulting in abrupt loss of marginal habitat. Examples of this may be seen along the far south-west coast of the Island.

Hard cliffs around the Island support some of the Island's most significant seabird colonies, including guillemot, razorbill, black guillemot, fulmar and puffin. These are notably concentrated in the south west and north east of the Island, but may occur at scattered hard cliff sites elsewhere. Raven, peregrine and chough also benefit from hard cliffs (including suitable caves and disused mine adits) both for safe, inaccessible breeding sites and for hunting territory. Near-vertical cliff faces offer an undisturbed, ungrazed refuge for plants as well as animals. Whilst birds are a visible and much-recorded cliff-dwelling group, the inaccessibility of cliffs means that other groups are less well known; for example, a full lichen survey has not been carried out on Manx cliffs, and non-flying invertebrates are under-recorded.

Caves

Unlike most soft cliffs, hard cliffs may offer an additional element of habitat: caves. Whilst the surging tidal currents in sea-caves scour the rocks and make for a harsh and inhospitable environment, caves can also offer an element of stability in an otherwise turbulent coastline. For example, the roof space of large sea caves may offer an unusually mild and frost-free, sheltered area for roosting birds or bats, or for sensitive ferns such as maidenhair fern *Adiantum capillis-veneris*. The pebble beaches at the back of some caves also offer good pupping sites for grey seal *Halichoerus grypus*, as they are sheltered, easily-guarded, and relatively safe from predators.

Whilst coastal slopes can often be surveyed on foot with care, there is great difficulty involved in surveying many cliff habitats and caves, some of which are simply too dangerous to explore without specialised equipment. This is especially the case where they lie underwater or within the intertidal zone (see also: Section 4.6.1: Intertidal habitats). Cliffs and caves, and particularly their marine fauna, are consequently an under-recorded habitat on the Island.

The chough *Pyrrhocorax pyrrhocorax*, a familiar coastal protected species which breeds on inaccessible sea cliffs, has been immortalised on the Island's stamps and a coin

Coastal flushes and springs

Freshwater elements such as streams, flushes and seepage lines on and adjacent to cliff faces may not be large enough to qualify for ASSI selection on their own, but are a valuable element of habitat diversity on cliffs, often with associated plant and invertebrate communities. Tufa forms on some of the Island's western cliffs where freshwater flushes and seepages deposit a lime-rich crust on cliffs. This is colonised by mosses and small plants such as brookweed *Samolus valerandi.* Other flushed cliff faces support colonies of royal fern *Osmunda regalis* and hemp agrimony, *Eupatorium cannabinum*. Locally, small reed beds may become established on the soft cliffs, where the cliff vegetation merges with wet coastal grassland. These offer a sheltered habitat for birds such as sedge warblers, which have a limited range of available habitats on the Island.

Classification of sea cliffs, caves and slopes

Vegetation on sea cliffs and slopes may be classified broadly as outlined in **Table 4.6.e**.

Table 4.6.e: Broad categories of maritime cliff vegetation on the Isle of Man

Type and Description	Species rich?	Closest NVC categories (See Rodwell, 1992[5])	Rarities present?	Protected species present?
Hard cliff rock crevices	Not usually, but may support rarities (see right); some communities of annual plants (e.g. MC5) are relatively species-rich	MC1 – *Crithmum maritimum-Spergularia rupicola* (rock samphire/ rock sea-spurrey) maritime rock-crevice community No Island NVC sample MC5 – *Armeria maritima-Cerastium diffusum ssp diffusum* (thrift/ sea mouse-ear) maritime therophyte (annuals) community No Island NVC sample	Provides good bird cover, so may attract nesting or passing rarities; some rare and specialised invertebrates may occur (currently an under-recorded group), including the Pod lover moth *Hadena perplexa capsophila*, whose larvae feed on sea and bladder campions.	Rock sea lavender *Limonium binervosum agg*. may occur; Schedule 1 birds may nest and/or feed in hard cliff crevices, including chough *Pyrrhocorax pyrrhocorax*, raven and peregrine; Schedule 5 animals may occur, including grey moths, whose larvae which feed on sea campion.
Sea bird colonies These areas of cliff attract numbers of breeding sea-birds, which affect the vegetation and invertebrate communities in turn; e.g. colonies of burrowers such as puffin and Manx shearwater are associated with NVC type MC7, whereas steep cliffs of breeding guillemots and gulls are commonly associated with type MC6.	No, but may attract rare birds and/or specialised invertebrates	MC6 – *Atriplex prostrata-Beta vulgaris ssp maritima* (common orache/sea beet) sea-bird cliff community One Island NVC sample MC7 *Stellaria media-Rumex acetosa* (chickweed/sorrel) sea-bird cliff community Not mapped in NVC (too scattered).	Rare breeding birds may occur (see right)	Schedule 1 protected birds including chough, peregrine, Manx shearwater and shag – also, see below sand martins on soft cliffs).
Soft cliffs The upper landward edge of soft cliffs may slump to form friable, shifting coastal slopes, with a distinct "undercliff", usually vertical, on the seaward side. Undercliffs and other vertical, soft cliffs formed when soft coastlines collapse can be valuable for insects such as mining bees, and	No.	Soft coastlines are often too friable and unstable to support an established vegetation cover; however, scattered plants may get a roothold, forming loose communities of species commonly found on either strandlines and shingle or foredunes (see Sections 4.6.2 and 4.6.3, above)	Soft cliffs can support a specialised invertebrate fauna where the conditions are suitable. Sites that are not eroding too quickly, and allow vegetation to form, or have freshwater influence, have the greatest potential. Sand martins favour soft	Sand martins nest here in colonies; protected plants such as oysterplant *Mertensia maritima* and Viper's bugloss *Echium vulgare* may occur at the base of soft, sandy cliffs, especially where they meet the strandline. Lizards may occupy sunny slopes.

may offer suitable nesting cliffs for sand martins. The base of soft cliffs may also support unusual vegetated strandline plants such as oysterplant and purple fumitory.			cliffs for nesting. Scattered rare ephemeral plant species such as purple ramping-fumitory *Fumaria purpurea* may occur.	
Cliff top vegetation	This kind of vegetation, where it does not fall into the Sea bird colonies category (above), generally forms grassland and/or scrub, and has been treated as Coastal scrub or Coastal grassland; see **Chapter 4.1 – Woodland and scrub**, and **Chapter 4.2 – Lowland grasslands**.			

Sea ivory *Ramalina siliquosa* (centre of picture) is well-known, but most coastal rock face lichens are likely to be under-recorded on the Island

Status of sea cliffs, caves and slopes

The Terrestrial Survey of the Coast of the Isle of Man (Lamb, 1999) was carried out in a series of 58 coastal sections of approximately equal length. The survey revealed the rugged nature of the Island's coastline, with hard maritime cliffs a major component of several stretches, mostly around the east and south-west edges of the Island, and a minor component of 22 sections. Soft cliff was less common, recorded in seven sections, as a major component in each case, in the northwest and northeast of the Island. Lamb (1999) also noted that soft cliffs were exclusively a maritime habitat, whilst hard cliffs could be found inland, e.g. in ravines or quarries. The small section of limestone rock in the Castletown area has the rarest cliff and slope types on the Island, but supports a disproportionately high proportion of the Island's cliff and rock crevice plant biodiversity (BDIS). In addition to cliff and slope, 34 sections of the Survey had boulders and/or rocks above the high tide mark, both from soft and hard rock types.

The value of cliffs and slopes for fauna in particular is recognised in the **Manx Wildlife Sites** Handbook (Keehan, 1999), which states that all stretches of maritime soft cliff that are shown to be of high invertebrate value, and all stretches of maritime hard cliff that support important colonies of seabirds, should be considered for selection as Wildlife Sites.

The **UK** supports a significant proportion of EU sea cliff vegetation (www.jncc.gov.uk). *Maritime Cliff and Slopes* is a UK BAP Priority Habitat, and a high proportion of the hard cliff coast in England has been notified as SSSIs - in areas such as the south-west of England almost the whole cliff-lined coast has been notified. Notification of soft cliffs has been less extensive, but areas such as north-west Norfolk and the Isle of Wight have a high proportion of their soft cliffs notified. In Wales approximately half of the total maritime cliff resource has been notified as SSSIs, but as yet only a small proportion has been notified as ASSIs in Northern Ireland (**www.Ukbap.org.uk**).

In the **European context**, *'Vegetated sea cliffs of the Atlantic and Baltic coasts'* is listed in Annex 1 of the EC Habitats Directive. Under this Directive, nine lengths of coastline in the UK have been nominated as candidate Special Areas of Conservation (SAC) for their cliff features (two of which include substantial representation of soft cliffs). The importance of cliffs for seabirds has also been recognised: under the EC Birds Directive, 38 Special Protection Areas (SPA) in the UK have been designated which include cliff sites - these comprise 30 sites in Scotland, 5 in Wales, 2 in England, and 1 in Northern Ireland.

Whilst cliffs often provide habitats which are unusually free from direct human influence, cliff and slope communities still face a number of **threats**, including:

- *Erosion*. High rates of erosion do not imply a loss of the cliff resource, either in geological or biological terms. Cliff face communities are able to retreat with the cliff line, and erosion is vital for constantly renewing geological exposures and recycling the botanical succession on soft cliffs. However, cliff-top vegetation may be destroyed where it is squeezed between a receding cliff face and cultivated land (UK BAP) and the rate of erosion of a soft cliff can affect the ability of a diverse invertebrate fauna to form.

- *Built development*. Built development near the edge of cliffs can prevent cliff-top biological communities from retreating in response to cliff erosion, subjecting them to a form of 'coastal squeeze'. Developments may also result in decreased habitat naturalness and representativeness, either from the need for enhanced coastal protection, or from increased littering and introduction of new species (see below), e .g. from newly adjacent gardens.

- *Coastal protection*. Coastal protection systems are still relatively limited on the Island, but may play a stronger part in coastal defences in the future. Attempts to protect property from the effects of erosion can result in cliff faces being re-profiled and/or sown with hardy grasses of little value for nature conservation. All such works have the effect of stabilising the cliff face, resulting in geological exposures being obscured, bare soil and early pioneer stages becoming overgrown, and wet flushes drying out.

- *Agriculture.* In traditional low-intensity grazing systems, livestock are grazed on cliffs and slopes, maintaining the open maritime grassland vegetation. Intensification of agriculture can lead to maritime grassland on more level terrain being ploughed out, while that on sloping ground may be abandoned and, where not maintained by exposure, is frequently overgrown by scrub. Localised eutrophication can be caused by fertiliser run-off from arable land above and this encourages coarse, vigorous 'weed' species at

the expense of the maritime species. Agricultural land drains discharging on the cliff face may cause local acceleration of erosion.

- *Introduced species*. Predators, such as cats and rats, can have a significant impact on populations of cliff or burrow nesting seabirds, particularly on isolated sites such as the Calf and small islets. Other introductions include feral goats and stray sheep; these are not thought to cause much damage to coastal vegetation communities in general, but their presence as nimble grazers could affect the survival success of rare cliff crevice plants.

The spread of certain alien, invasive plants, especially members of the flowering plant family Aizoaceae such as the hottentot fig *Carpobrotus edulis*, can have a devastating impact on indigenous maritime plant communities (UK BAP). This species has yet to colonize Manx coastlines as it has in Cornwall and elsewhere in the British Isles, but the Atlas 2000 (BSBI, 2000) shows it to have been recorded in five of the 10km squares that cover the coastline. Its emergence as an invasive species should not therefore be ruled out as a future problem. Other species which may invade cliff and slope vegetation and displace native species *en masse* include Montbretia *Crocosmia x crocosmiiflora*, cotoneaster *Cotoneaster spp.*, Spanish bluebell *Hyacinthoides hispanicus* (and its hybrid with the native bluebell) and Japanese knotweed *Fallopia japonica* (which prefers disturbed areas).

Minimum criteria for selection

Selection on species grounds

The importance of maritime cliffs for breeding birds means that some cliff sites are likely to fit the criteria for selection on bird criteria alone - see **Chapter 4.9: Fauna**. As a priority, the best site for any species of conservation concern should be put forward for designation.

Selection on habitat grounds

- The best examples of uninterrupted soft cliff and slope coastline should each be selected from the northwest and northeast Manx coastlines; sites should fulfil at least one of the Priority Site Criteria listed in Part 3, and priority should be given to the sites with the most diverse ecology, in terms of vegetation cover, adjacent habitat types (including intertidal habitats), and fauna.

- Stretches of hard maritime cliff will be considered for selection where they are known to fulfil at least one of the Priority Site Criteria as listed in Part 3. As a minimum, site boundaries should include the shoreline, cliff, and any semi-natural cliff-top vegetation.

- With all cliff, slope and cave assessments, priority should be given to sites which are known to support rare plants and/or animals, in particular those which depend exclusively on highly undisturbed and inaccessible habitats, including at least one example of each of the following:
- core breeding sites for dark green fritillary butterfly;
- good examples of native woodland and scrub on cliffs and slopes;
- key pupping sites for grey and/or common seal;
- cliff crevice communities with good plant diversity, especially rarities;
- cliff and cave communities with good plant diversity, especially ferns;
- known bat roosting caves;
- core breeding sites for Schedule 1 protected birds
- sites on limestone rock, which is the rarest cliff type on the Island, and which supports a high proportion of the Island's cliff and rock crevice plant biodiversity (BDIS);

- Freshwater elements such as streams, flushes and seepage lines on and adjacent to cliff faces should be included within designation boundaries as a valuable element of habitat diversity.

- In all cases, where there is a natural transition between maritime communities and inland grass or heath, the site boundary should be drawn to encompass both interests where practicable.

N.B.: maritime cliffs, caves and slopes are amongst the least well-recorded habitats on the Island, but this should not be allowed to prejudice their selection as ASSIs; where there is a dearth of biological information the precautionary principle should be applied to site selection, with appropriate surveys made a priority pending boundary confirmation and management planning.

4.7 Uplands

Introduction

This chapter concerns the selection of ASSIs which lie wholly or partly above the usual altitude at which fields are enclosed and cultivated. Throughout the British Isles the open, unenclosed nature of upland vegetation is distinctive, a familiar landscape resulting from necessarily extensive farming practices. The resulting mosaic of habitats is widespread in the highest and most exposed parts of the UK, Ireland and the Isle of Man, and in each case represents the largest single category of semi-natural habitat. Paradoxically, this terrain supports some of the rarest and most vulnerable habitats in the world, namely blanket bog and temperate heather moorland – both of which are protected under the EU Habitats Directive. Countries within the British Isles are therefore considered to have a special responsibility for the conservation of these habitats.

Whilst onlookers usually have little difficulty in identifying an upland landscape by appearance, there is no established scientific definition of an upland as opposed to lowland habitat, and deciding on appropriate boundaries for upland ASSIs is notoriously difficult (Ratcliffe, 1977). It has been noted elsewhere that a simple altitude "cut-off point" is not always the best way of defining uplands, and that the distinction between upland and lowland is an arbitrary one (NCC 1989). This is partly due to the varying degrees of latitude and coastal exposure in the British Isles, with some northern sites exhibiting the same vegetation communities at much lower altitudes than their southern counterparts, particularly on exposed coastland. This gradient of variation is recognised as an important feature of habitats in the Atlantic biogeographic region (which includes all of the British Isles), particularly where typically upland and lowland vegetation both lie on a continuous ecological gradient.

Manx uplands occupy an unusual position, being more or less at the northern limit of typical English lowland heathland, and the southern limit of the type of wet, bryophyte-rich moorland commonly found in north-west England and western Scotland (see Rodwell *et al*[2]). In most cases, the transition from lowland to upland vegetation on the Island occurs at around 250m, i.e. lower than the 300m which is commonly used to define the same threshold in England. Whilst this is a useful starting guide for the identification of potential upland ASSIs, it will not be taken as an absolute cut-off point, as many upland habitats grade into adjacent habitats at lower altitudes, and the resultant gradient of ecological characteristics may be an important feature of the site.

Upland habitats on the Isle of Man are almost entirely semi-natural in origin, and contribute greatly to the wild appearance of the Manx landscape, which is often praised for its attractiveness. The uplands are not, however, wilderness in any sense, having received centuries of settlement, mining, quarrying and farming which have shaped the nature and extent of the habitats present. These include a range of mires, acid grasslands, heaths and streams. Native woodland is restricted to natural colonisation of sheltered river valleys and rills, and the more sheltered hillsides where gorse and bracken have been left ungrazed and native scrub has started to colonise it. Elsewhere, the tree cover is limited to plantations, mostly of conifers but with a more recent emphasis on mixed and broadeaved planting. It should be noted that all of the uplands receive some degree of human influence, either from grazing or burning (deliberate or not), walking, forestry, shooting or in some cases direct cultivation. There has also been widespread agricultural improvement, particularly on the lower fringes of the uplands which can provide productive fields if drained and limed.

Description and distribution

European uplands are commonly defined as being either montane or sub-montane. Montane habitats occur at high altitudes, above the natural tree-line. They support low-growing communities of specialised plants and invertebrates which are strongly frost-hardy. Whilst the altitude at which montane vegetation occurs can vary with latitude and degree of exposure, in the central British Isles it is commonly defined as starting at 600m. This altitude only occurs in one place on the Isle of Man, the summit of Snaefell, and the montane limit is borne out by the presence of a tiny community of arctic/alpine vegetation – notably least willow *Salix herbacea* – on the summit. Aside from this, upland habitats on the Island can be said to fall clearly within the sub-montane category.

The fact that this is varied by the presence of small pockets of arctic/alpine plants is of interest in itself, offering the potential for a biological indicator of whether the climate on the Island is changing.

A topographical map of the Isle of Man shows three broad areas of sub-montane upland. The highest land is often referred to as the Northern Uplands. It consists of several high hills including Snaefell at 620m, and a long, hilly ridge culminating in North Barrule at 565m. There is also a Central Uplands, which is linked to the Northern Uplands by a series of low hills. The Southern Uplands are the lowest in altitude, centering upon South Barrule (483m) and extending to the south-west coastline of the Island. They are divided from the central and northern hills by the Central Valley. Other high ground around the Island occurs in association with high cliffs, notably at Maughold Head and Spanish Head. However, neither of these clifftop areas rises to much over 100m, or exhibits typical upland vegetation.

Manx uplands contain most of the biological features which are identified in the UK *Guidelines for Selection of Biological SSSIs* as being of special importance. These being:
Acidophilous dwarf shrub heath and scrub
Acidic and calcicolous grassland
Fern- and bryophyte-rich vegetation
Montane plant communities generally
Blanket bog
Phytogeographical interest
Ornithological features
Other faunal features eg relict assemblages of invertebrates (NCC, 1989)

Of the above, all the habitats mentioned occur within the Manx uplands except extensive montane vegetation and exceptionally species-rich fern and bryophyte communities – although limited elements of both do occur. All the non-habitat-specific features are also known to occur:

- "**Phytogeographical interest**" is a frequent, and important, feature of many uplands in the Atlantic fringes of the British Isles, and refers to the unusual combination of species representing different geographical elements of flora – for example, Southern Atlantic, Mediterranean and Northern Continental – within the same area (Matthews, 1955 *per* NCC, 1989). An example on the Island might be the proximity of hare's-tail cotton-grass *Eriophorum vaginatum* (a boreo-arctic montane species) to cross-leaved heath *Erica tetralix* (a predominantly suboceanic temperate species) and devil's-bit scabious *Succisa pratensis* (a Eurosiberian or North Continental temperate species), all of which commonly occur together in the more species-rich wet heaths on the Manx upland fringes (Preston *et al* 2002).

- **Ornithological features**. The Manx uplands are of importance for birds. Cullen and Williams (*per* MNCT, 1997) identified the importance of the Manx uplands for those upland birds which benefit from open, heathy habitats – notably the hen harrier *Circus cyaneus*. Despite the relative scarcity of woodland and wetland habitats in the Manx uplands, a wide range of typical moorland breeding species has been recorded, including meadow pipit *Anthus pratensis*, wren *Troglodytes troglodytes*, stonechat *Saxicola torquata*, wheatear *Oenanthe oenanthe*, lapwing *Vanellus vanellus*, curlew *Numenius arquata*, short-eared owl *Asio flammeus*, skylark *Alauda arvensis*, raven *Corvus corax*, red grouse *Lagopus lagopus scoticus*, linnet *Carduelis cannabina*, redstart *Phoenicurus phoenicurus* and twite *Carduelis flavirostris* although the last two species have not been recorded breeding for many years. Merlin *Falco columbarius*, peregrine *Falco peregrinus* and reed bunting *Emberiza schoeniclus* are also recorded as rare breeders in this habitat. Upland grassland, including agriculturally improved areas, additionally provides valuable winter feeding areas for the Island's important chough *Pyrrhocorax pyrrhocorax* population, and has the potential to support breeding corncrake *Crex crex*. Cullen and Williams (*per* MNCT, 1997) identify several conservation priorities amongst upland birds: hen harrier, corncrake, merlin, skylark, linnet, reed bunting, peregrine, chough and red grouse. Most of these are known to be of conservation concern either globally (in the case of corncrake) or within the context of the British Isles.

- The presence of **relict faunal features**, in this case invertebrates, is likely but has yet to be fully investigated, the one major study of Manx invertebrates having missed out the uplands (Boyce & Fowles, 1989). However, Luff (*per* MNCT, 1997) identified "at least 76 species" as possible upland ground beetles, of which 11 occur only, or typically, in the uplands. Luff also notes that this is over half the 19

upland species known to occur in northern England. It might be implied from this that the Manx uplands merit further study of this and other invertebrate groups.

Much of the background information on habitats such as mires and watercourses has been detailed elsewhere in the Criteria. The following chapters in particular are of relevance:
4.3 Lowland heathland
4.4 Bogs, fens and flushes
4.5 Open water and swamp
All of the above habitats may occur next to, and in an ecological gradient with, upland habitats. In such cases it is desirable to protect the range of the semi-natural habitat rather than impose an artificial limit on the altitudinal boundaries of the site see (**Recommendations**, at the end of this chapter). The chapters on **Woodland and scrub** and **Lowland grassland** may also have a bearing on upland habitats. Sections **4.7.1 – 4.7.3**, below, therefore concern those elements of Manx habitat which occur solely, or most typically, within the uplands.

Assessing uplands

The UK Guidelines for assessment of complex upland areas

The problem of how to select protected sites from extensive areas of semi-natural habitat with no obvious boundaries has been identified in the UK Guidelines for Selection of Biological ASSIs:

"Uplands tend to be the most difficult cases, with blanket bogs the most problematical of all, because they usually lack conspicuous edge features along which to draw boundaries".
(NCC 1989 p35)

This difficulty applies as much in the Isle of Man as elsewhere in the British Isles. The solution in the UK was to apply a set of guidelines to aid decision-making in areas with poorly-defined boundaries. Subject to considerations of scale within the smaller island context, these guidelines are also applicable to the Manx ASSI selection criteria. They are as follows:

"There are five simple guidelines which help to reach decisions on these complex and extensive habitats, though they also apply more generally to site selection.

- *At least one example must be included of every biotic feature (except recent artefacts) present - habitat and vegetation types and species of plants and animals. While special consideration should be given to inclusion of rare habitats and species, the common and widespread need to be represented in proportion to their relative extent and abundance. The total animal community "pyramid" should be represented, from "top" predators to the bottom of the food chain.*

- *The full complement of abiotic features should also be included, over as complete as possible a range of the variation present in each (e.g. in underlying geology, soil type, slope, aspect, elevation, macro- and micro-topography and hydrological regime). The amount of each site component to be included should be sufficient to ensure the viability of that component or of any other component which is functionally dependent on it. There is usually a correspondence between biotic and abiotic diversity, but this is not always fully understood and sometimes the abiotic features are more readily identified and mapped.*

- *Where the conservation of an important habitat or species depends on the maintenance of a functional relationship with some peripheral habitat or environmental condition, sufficient of the latter must be included to satisfy the needs of the former. Examples are hydrology of adjoining areas and feeding range for some animals.*

- *Juxtapositions between site components should be treated as further components in their own right, in so far as they reflect varied biotic and abiotic interactions. For instance, where plant community X adjoins communities Y and Z at one place but adjoins comunities A and B at another place, the two groups XYZ and XAB should be treated as separate entities and both included within the site boundary.*

- *The total amount and distribution of the ecosystem concerned, as the sum of all the SSSIs representing that particular type, must be sufficient to ensure viability of all component communities and species in case all remaining areas of such habitat outside these SSSIs become subjected to land-use change. This is a matter not only of size but of spacing between sites, to maximise the probability of exchange of mobile species between them. They must also be sufficient to satisfy the national and international conservation needs…."*
(NCC 1989 p35)

Achieving a similar level of protection in the Isle of Man
In 2002, DAFF commissioned research into the selection of protected upland areas, based on computer modelling of the biodiversity resource in the Manx uplands as a whole (Balson, 2002). The objective was to help achieve the aims listed above by providing a scientifically sound basis for the selection of large, upland ASSIs. The research utilised **Marxan**, a piece of software designed to produce theoretical series of sites, dependent on the value attached to key biological features. A large amount of the most up-to-date biological data available was entered into the program, including plant and bird species distribution, protected species locations, data from the DAFF Hill Land Survey and habitat distributions from the DAFF Phase 1 and 2 Habitat Surveys. Elements of the data were assigned a value according to conservation importance – for example, RSPB "red list" birds were given a higher data value than "green list" species, and internationally important habitats and species were also prioritised.

The Marxan program uses optimisation algorithms to give an indication of the "hotspots" that would need to be included in an upland ASSI series if all the biological features mentioned in the guidance (as quoted above) were to be protected. To maximise the usefulness of the project, all hilly areas – including those Southern Upland areas which fall below 250m – were included.

Results of computer modelling of upland "biodiversity hotspots"
The computer modelling approach was partly aimed at providing quantitative confirmation of earlier recommendations made prior to the development of a detailed biological database – in particular, the key uplands which were identified in the report *Nature Conservation on the Isle of Man* (Pritchard 1975). These were:

- Southern Uplands - includes South Barrule and Stony Mountain
- Slieu Ruy Uplands - includes Slieau Ruy heath, grassland and mire, Colden and the upper reaches of the Blaby River
- Bein-y-Phott Uplands - adjacent to the above, including extensive grassland, mire and heath
- Snaefell Uplands - includes the whole of Snaefell and surrounding grassland, and the only arctic-alpine vegetation on the Island
- North Barrule Uplands - contains the largest proportion of high-altitude land on the Island, and supports extensive wet acid upland pasture with heath elements and strict bog plants such as cranberry *Vaccinium oxycoccus*.

The Marxan program is flexible in terms of data input. Hypothetical reserve networks could thus be generated for a range of parameters according to "maximised coverage". Maximised coverage applies a pre-set limit on cost and/or area, and aims to maximise the conservation features possible within the constraints. This "working backwards" approach is useful where it is desirable to protect a minimum proportion of a large complex of habitats which contain a broad distribution of many individual features of conservation importance. The drawback to this approach is that some features may have to be "sacrificed" in order to gain the maximum overall advantage within the constraints applied. However, this can be corrected by adding to the network any omitted sites which are known to have just one or two unique features of high importance rather than a high-scoring overall diversity.

Three Marxan "trials" were run, aimed at selecting either 30%, 41% or 50% in total of the $1km^2$ units that make up the total upland area. These percentages were chosen to reflect the high importance of the uplands in terms of total contribution to semi-natural habitat area on the Island, and their international importance. Depending on the total area of sites eventually selected, the mid-range of 41% would be more or less in line with the overall long-term aim of ASSI protection for 10% of the Island (see **Section 1.4.3 What proportion of the land should be designated?**). A similar list of priority areas for upland conservation on the Isle of Man was produced by each trial, varying only in extent, indicating a clear series of "hotspots". This extends, supports and qualifies the recommendations of ITE 1975. The areas in question are listed in Table 4.7a, and form part of the recommendations of the Balson report:

Table 4.7.a – Manx upland conservation "hotspots"

(Table adapted from Balson, 2002 p37)

1km grid square	Area description
Southern Uplands (including Bradda Coast)	
SC1869, SC1870	West of Bradda West
SC2071, SC2072, SC2073	Eastern portion of Bradda Hill and northeast of Fleshwick
Note: these included the cliff-top coastal heathland of the Bradda Head area. Due to a catastrophic fire in October 2004, much of that area has now lost its important heathland communities. Whilst the vegetation is starting to regenerate at the time of writing (2006), the previous level of heathland diversity may not return for many years, increasing the relative importance of other Southern Upland habitats compared with the original analysis.	
SC2175, SC2176	Portion nearest the coast of the Manx National Heritage site at Eary Cushlin/Glion Moar
SC2376	Glen Rushen, immediateynorthwest of Glen Rushen plantation
SC2378	Doarlish-Cashen, southwest of Arrasey Plantation
SC2475, SC2476	Immediately south (east and west) of Glen Rushen plantation and northwest of Cringle plantation. Includes the Round Table area.
Central Uplands	
SC3184	South of Earyglass, on the lower north slope of Beary Mountain, near Blaber River
SC3182, SC3282, SC3283, SC3284, SC3381, SC3385	Southern slopes of Beary Mountain, also Slieau Ruy summit and northwest slopes, and Lhargee Ruy's western slpes and south of the plantation at Glion Gill
SC3584	North of Colden Plantation and west of Injebreck Plantation
Northern Uplands	
SC3586, SC3484, SC3587, SC3687, SC3787, SC3886, SC3887, SC3888, SC3889, SC3788, SC3990, SC3991, SC4090, SC4089, SC4088, SC4187, SC4186, SC4286, SC4386	A large block surrounding the Sulby reservoir that stretches directly east from the northeastern slopes of Sartfell (southwestern slopes of Slieu Freoghane) to the lower southwestern slopes of Snaefell. This area also stretches northward, taking in the summit of Slieau Managh and surrounding slopes, but not including the summit of Snaefell or its direct northern or southern slopes. However, the northeast slopes of Snaefell are included in this area, as are the top and northern side of the Laxey Valley.
SC3781	A portion of the southwestern slope of Slieau Ree
SC3982, SC4082, SC4083, SC4084	East of Kate's Cottage, west of Conrhenny plantation, and north and south west of Glenroy
SC4289, SC4389	The valley west from Corrany to Cornaa
SC4391	The northwestern slopes of North Barrule (southeast of the Brookdale plantation)
SC4292, SC4192, SC4092	Northeast of the Slieau Managh Plantation, and stretching east to the upper reaches of Glen Auldyn
SC3791, SC3692	The northern half of, and stretching north and west from, the Manx Natural Heritage site at Sulby towards (although not including) Cashtal Lajer (roundhouse).

The above units contain the maximum overall upland biodiversity within a set maximum area of the Island's uplands, according to the values assigned to each species and habitat type (see Balson, 2002 for more details). It may be inferred that, without a representative ASSI from each of these hotspot areas, the full range of Manx upland biodiversity would not be protected by the ASSI system without having to increase the proportion of uplands protected. **To the list should be added any 1km squares for which the overall amount of data is relatively low, but there is known to be a specific and/or unique interest: for example, the arctic-alpine vegetation on the summit of Snaefell.**

The final recommendation of the Balson report relates to the hotspots identified above:

"2 The Island's conservation goals for the uplands would best be met by designating a series of areas corresponding to the "conservation hotspots", opting for the largest sites possible." (Balson, 2002)

Whilst computer modelling does not enable the precise selection of individual site boundaries, it follows that a representative site from each of the unit areas listed above should be included in any series of upland ASSIs which aims to fulfil the same quality of criteria as those used in the UK.

Assessment of upland ASSI quality

All of the points on the Checklist of Priority Sites Criteria listed in **Part 3** are relevant, with the following criteria of especially high importance:

Size

The need to represent topographic, rather than artificially enclosed, units means that most upland areas which are worthy of protection are necessarily large. Where possible, they should include catchments, and all the semi-natural habitats that follow a natural gradient from high to low altitude. In practical terms it may be necessary to draw boundaries along the "hill wall" which separates enclosed from unenclosed land; however, where semi-natural habitats of high conservation importance are contiguous with upland habitats they should be included with upland ASSIs (as is the practice in the UK), as the ecological gradient from higher to lower altitudes represents an important biodiversity resource. It is thus preferable to select a small number of large, complete sites rather than pick out artificially-defined boundaries from parts of larger ecosystems (see NCC, 1989 pp181-188).

It is accepted that the very large designated areas recommended for the UK (upwards of 4,000ha for some upland habitats) are not applicable in the context of the Isle of Man, but the need to consider designating relatively large areas of the most important uplands should still be taken into account when assessing potential ASSIs.

Location

Much of the variation in upland habitats is due to the amount of peat present, and whether it is accumulating, static or diminishing in quantity. This is heavily dependent on the location of the habitats in question, particularly in relation to surface hydrology. Sites where blanket bog is "active", i.e. where peat is actively being formed, are recognised as internationally important. These sites are irreplaceable in terms of their dependence on a particular type of location.

The location of the higher altitude vegetation on the Island is evidently irreplaceable should the current land use change; it is therefore important that the ASSI series covers the summits of important hills. The prospect of climate change makes these important not just for current biodiversity, for which there are no alternative sites, but for the study of changes in the future, as cold-tolerant species at higher altitudes are often sensitive to changing climatic profiles, and may offer an early indication of permanent change.

Diversity

The presence of a full range of successional stages is important for the conservation of species which depend on upland habitats, particularly invertebrates (see English Nature, 2001 p6.11; Ratcliffe, 1977; NCC, 1989). This is related to the importance of structural diversity, which results from a mixed pattern of grazing, burning and unmanaged areas. Thus, areas of unburnt heather are vital for the conservation of slow-growing lower plant groups and overwintering invertebrates, whilst some vascular plants may benefit from the patchy habitats that result from rotational burning. A mixed moorland which exhibits a range of structural stages is therefore preferable to a "monoculture" of burned or very old heather.

Rarity, fragility and vulnerability
The presence of internationally rare Habitats Directive Annex 1 Priority Habitats on the Island's uplands makes them a priority for conservation. In addition, active blanket bog is a rare and locally distributed habitat on the Island in its own right, and vulnerable to a range of threats. ASSI selection should prioritise these habitats, especially those which show a full range of sub-types, successional stages and ecological gradation.

Rare breeding birds and animals, and protected plant species, should also be prioritised, especially those which are solely dependent on the uplands for their continued survival on the Island. The use of the Marxan programme, which utilises a weighted data value approach, has ensured that the conservation "hotspots", listed in Table 4.7a, above, should encompass the majority of rare and vulnerable features in the uplands within a minimum "cost" in terms of area. However, the comment which follows Table 4.7a, regarding the inclusion of any "single interest" sites not included in the table, should be borne in mind when looking at protection of rare upland species.

Ecological position
The boundaries of upland ASSIs should follow natural topographic units wherever possible, especially where wetland is included that depends on catchment hydrology. When selecting watercourses (see **Chapter 4.5 Open water and swamp**) effort should be made to include at least one watercourse from an upland source for its full length, in order to protect the range of ecological variation from upland to lowland. Hill land ASSIs should include contiguous lowland semi-natural habitats wherever possible – particularly heathland, where there may be no clear distinction between upland and lowland vegetation, but a gradually changing community which is dependent on both upland and lowland elements for its continued biodiversity. See **Recommendations**, below.

The Raven *Corvus corax* is a characteristic bird of steep upland and coastal areas

Dominant upland habitat types

Whilst a wide range of minor habitat elements may occur in the uplands, all of which add to their diversity and wildlife value, there are three clearly dominant habitat types: **acid grassland**, **heath**, and **bog**. All three have lowland counterparts, which are detailed in **Chapters 4.2, 4.3 and 4.4** respectively. Those elements which occur solely or typically in the uplands are described below, and summarised in **Table 4.7.b**. **The minimum criteria for selection of each of these habitat types should be used in conjunction with Table 4.7a, above, in order to select a series of upland ASSIs which collectively represent the full range of upland biodiversity on the Island – see Recommendations, below.**

4.7.1 Acid grassland

Description and Distribution

The origins of acid grassland in the hills lie in the clearance of upland woodland prior to the onset of modern patterns of livestock farming. Regular grazing of cleared uplands suppresses the natural tendency towards growth of dwarf shrub heath, resulting in extensive, open grassland of relatively low species diversity (Drewitt & Manley, 1977). As with lowland examples, drier acid grassland in the uplands may be subject to agricultural improvement such as drainage, liming and re-seeding, whilst wetter and more acid areas may still receive basic drainage and control of unwanted species. In both cases the dominance of grasses is maintained by grazing, as acid grassland on the Island tends towards heathland if left unmanaged, and is prone to encroachment from European gorse and bracken. For these reasons the term "unimproved upland acid grassland" is possibly a misnomer, as upland grassland usually represents an agriculturally improved state on sites that would quickly revert to heather and bilberry cover if farming activities were reduced or removed.

Rainfall in the Manx uplands is heavy and frequent, averaging over 1524mm (60 inches) a year in the hills (compared with under 760mm (30 inches) per year in the south of the Island around Port St Mary) (Birch 1960 *per* Allen, 1984). This can result in peaty "mor humus" topsoil with very low levels of nutrients available to plants, and a pH as low as 3.2 (Fullen, Harris & Kear 1999), i.e. almost as acidic as vinegar and hence inhospitable to all but the most specialised plants. Upland pasture on this kind of soil is frequently interspersed with bog and/or heath, with a full spectrum of degrees of variation in between. A complex, interrelated mix of wet and dry acid grassland, bog, flush, wet and dry heathland and stream valleys is thus strongly characteristic of the Manx uplands. Collectively these make up over half of all the semi-natural habitats on the Island, and support a significant number of protected species.

Despite its lower species diversity compared with some lowland grassland types, upland acid grassland complements other upland habitats, and constitutes a vital part of the ecosystem for some upland birds. For this reason, the assessment process should aim to recognise good examples of patchy upland grassland mosaic within areas of varied habitat, rather than pure acid grassland sward with no heath or wetland elements.

Classification of upland acid grasslands

Upland acid grassland on the Island may be classified broadly as outlined in **Table 4.7.b**.

Upland acid grassland status

Acid grassland occurs throughout most of the Isle of Man, making up around 7% of the Island's land use total. This equates to over a quarter of all the semi-natural habitat present, and nearly half of all the grassland (Sayle *et al*, 1995). Whilst this includes lowland as well as upland categories, the majority lies within the uplands, often in extensive tracts intermingled with other habitats such as heath and bog.

Acid grassland in the uplands of the British Isles is generally treated as less of a conservation priority than heath or blanket bog, as it is very widespread and often results from the modification of heath and bog by human activities (i.e. livestock management). There are some British types of upland grassland which exhibit considerable species diversity, and are home to a range of rare and delicate plants. However, these habitats are associated with more base-rich soils than are found on the Island, usually over siliceous bedrock substrates and in very high and/or exposed conditions. These upland grasslands of high

conservation priority do not occur in the Isle of Man.

Despite the relative lack of diversity in upland grassland types, some of the Manx uplands support a relatively species-rich pasture due to the mixture of bog and heath plants present, which remain as a minor element throughout due to a light grazing regime. These more diverse areas may support rarities such as mountain pansy *Viola lutea* and ivy-leaved bellflower *Wahlenbergia hederacea*. The very highest grasslands, which fall within montane grassland categories, are not as diverse but represent a vulnerable and restricted habitat, and the only available sites for the Island's small number of arctic-alpine species, notably least willow *Salix herbacea*. Both the more diverse upland grasslands, and the high-altitude types, should be given priority when considering how much grassland to include within an ASSI .

The Manx Wildlife Sites Handbook states that all examples of unimproved upland acid grassland of 2 or more hectares in extent should be considered for Wildlife Site selection if they occur in association with other semi-natural habitats of Wildlife Site quality.

Minimum selection criteria for upland acid grassland

Upland pasture

U4 - Sheep's fescue/common bent grass/ heath bedstraw *Festuca ovina- Agrostis capillaris-Galium saxatile* grassland - upland examples;
U5 - Mat grass/heath bedstraw *Nardus stricta-Galium saxatile* grassland
U6 - Heath rush/sheep's fescue *Juncus squarrosus-Festuca ovina* grassland.

Upland examples of U4, U5 or U6 grassland or similar communities will qualify for selection if they are over 10ha in total extent and form part of mosaic of semi-natural habitats. Priority should be given to sites with a range of upland grassland types, rather than one NVC category alone.

U20 – Bracken/heath bedstraw *Pteridium aquilinum-Galium saxatile* grassland will not normally qualify for selection unless it forms part of a larger area of eligible upland habitats which would be fragmented or otherwise reduced in value for wildlife without the inclusion of the U20 habitat. However, special consideration should be given to including bracken/heath bedstraw grassland where it lies adjacent to or forms part of an area of regenerating native woodland and scrub and/or territory for birds of conservation concern.

Montane grassland

U16 – Greater woodrush/bilberry *Luzula sylvatica-Vaccinium myrtillus* grassland
Upland examples of U16 grassland or similar communities will **all** qualify for selection where they form part of mosaic of eligible semi-natural habitats. Priority should be given to sites which support rare species.

4.7.2 Upland heathland

Description and Distribution

Heather moorland is a striking and evocative feature of the Manx landscape, forming large areas of attractive purple hillside in early autumn, interspersed with bright, golden-yellow Western gorse *Ulex gallii* – which is so locally distinctive as to be generally known as Manx gorse. Despite the appearance of wildness, this is a man-made landscape, resulting from the clearance of sub-montane woodland and the deliberate maintenance of a low-growing shrub layer suitable for livestock grazing. Traditional upland heath management includes extensive grazing, occasional cutting and rotational burning. Other factors that are known to have affected the development of heathland in the past include accidental fires, and cutting of peat-rich upland turf for fuel and potash (Garrad 1972).

Upland heathland lies between the uppermost enclosed land and the onset of montane vegetation; in both cases there may be a gradient of vegetation types, but for the purposes of this chapter of the Criteria the altitude range is considered to be 250m to 600m. Within this range, heathland usually occurs wherever there is a thin to moderate layer of peat. Very deep peat (over 0.5m) is less common, and is

more likely to be associated with bog habitats, although some more typically heathland species may also occur within bogs. Examples of upland heathland may be found throughout the Island, on the hill-land in both the Southern and Northern Uplands. Due to heavy sheep grazing, the highest peaks (e.g. Snaefell and North Barrule) do not always support the best examples of upland heather heath, as the grazing regime favours grasses over dwarf shrubs. Better examples of upland dwarf shrub heath occur on the slightly lower slopes of Slieu Freoghane, Greeba Mountain, Cronk ny Arrey Laa and South Barrule (BDIS).

The Island's upland heathland vegetation is almost all of the type referred to by ecologists as dwarf shrub heath. It is usually defined as having at least 25% cover of dwarf shrubs, principally heather (or ling) *Calluna vulgaris,* bell heather *Erica cinerea* and Manx gorse *Ulex gallii*. Compared to lowland sites, upland heathland also tends to have a higher proportion of bilberry *Vaccinium myrtillus* – although poorly-managed burning and heavy grazing pressure can produce a similar proportion of bilberry in lowland heaths as well (www.Ukbap.org.uk, 2005). Other typically upland elements include crowberry *Empetrum nigrum*, deergrass *Trichophorum cespitosum*, and a small number of rare or locally-distributed plants such as cranberry *Vaccinium oxycoccus*, cowberry *Vaccinium vitis-idaea*, common cow-wheat *Melampyrum pratense* and fir clubmoss *Huperzia selago*. Of these, cranberry and deergrass are typical of wetter areas, fir clubmoss grows on rocky outcrops and short, exposed turf, and crowberry favours places where it cannot be out-competed by heather. The presence of a varied microtopography and hydrology is thus an important influence on the diversity of species present in an upland area.

Although neither dry nor wet upland heathland is noted for its great botanical diversity, these habitats are both associated with important bird populations. Species of note in the Manx uplands include hen harrier *Circus cyaneus*, curlew *Numenius arquata*, merlin *Falco columbarius* and short-eared owl *Asio flammeus,* whilst breeding golden plover *Pluvialis apricaria* are exceedingly rare. The significance of the uplands for birds relates to seasonal as well as year-round activities, hence upland moorland and grassland may provide winter feeding sites for birds such as chough *Pyrrhocorax pyrrhocorax*, which breed elsewhere in summer. Other fauna of interest in the uplands includes those invertebrates which prefer the habitat provided by dwarf shrub and lower plant cover. The uplands have not been subjected to extensive invertebrate survey; more general surveys, such as the DAFF Phase 1 Habitat Survey, indicate that upland moorland may be of importance for the Island's dragonfly and damselfly population, especially where it occurs in conjunction with upland streams and bog pools.

The usage, and hence the extent and vegetation structure, of upland heath on the Island has clearly varied according to human needs. Garrad, 1972 lists previous hill-land livestock as including both dairy and beef cattle, sheep, goats and pigs, with some collection of elm and other tree leaves for feed as well as dwarf shrubs. Following a gradual change to heavily sheep-dominated grazing, Garrad comments that " *… the vegetation is now monotonous heath with variety only in the wettest areas and the few really steep faces where even the most persistent and agile sheep could find no foothold".* In the same chapter Garrad also states that *"The monotony of the vegetation is largely due to a combination of prolonged over-grazing and repeated burning".* In the decades since these opinions were published, the intensity of farming in the uplands appears to have changed, with some areas receiving less grazing pressure than previously, and some receiving more. Whilst there are still large areas of homogeneous heather, the regularity of heather burning has diminished in some parts of the Island, resulting in localised stands of older heather, taller gorse and occasional emergent tree growth. Marginal "intack" land has been allowed to become part of the adjacent open heath in some areas, and incorporated into improved and cultivated fields in others, as the pattern of need for supplementary hill-land grazing areas has changed. This dynamic pattern of change and adaptation is typical of upland areas in the British Isles as a whole (see Anderson, 2003 Chs 3-5).

Classification of upland heathland

Wet and dry heathland types known to occur in the uplands are listed on **Table 4.7b**; it should however be noted that some of these vegetation types may also occur in exposed conditions at lower altitudes, and/or in gradient with more typically lowland habitat types. Table 4.7b should therefore be considered alongside Tables 4.3a (Broad categories of dry lowland heathland on the Isle of Man) and 4.3b (Broad categories of wet lowland heathland on the Isle of Man), in Chapter **4.3 Lowland heathland**.

Status of upland heathland

Dry upland heathland
The DAFF Phase 1 Habitat Survey does not distinguish between dwarf shrub heath on lowland as opposed to upland areas, hence figures for each category are approximate. What is clear is that overall, dry heathland is a common habitat on the Island, over 90% of which occurs in upland areas. Unlike dry lowland heathland, upland heath tends to occur in large, unenclosed areas rather than small fragments. Site boundaries may not be well-defined unless a clear hill-wall is present, and many other habitats may occur with or adjacent to the heather. The Manx Wildlife Sites Handbook states that all areas of dry dwarf shrub heath greater than 2ha in extent, or occurring in association with other habitats of Wildlife Site quality, will qualify for inclusion as Wildlife Sites.

Dwarf shrub heaths as a whole are recognised as being of international importance because they are largely confined within Europe to the British Isles and the western seaboard of mainland Europe. The importance of heathland is recognised in the UK Biodiversity Action Plan, which lists both Lowland and Upland heathlands as Priority Habitats. The global and regional scarcity of heather moorland has led to its inclusion on Annex 1 of the EU Habitats Directive, under the general headings of *European Dry Heaths*, *Northern Atlantic wet heaths with cross-leaved heath Erica tetralix,* and *Alpine and Boreal heaths*. Both the first two categories, and elements of boreal heath, occur on the Isle of Man. Of these, **European dry heaths** are found in every EU Member State except for Greece, but are only extensive in the western oceanic fringes of Europe. A high proportion of the EU resource of European dry heaths occurs in the UK, although this proportion is not as high as that of the other Annex 1 habitat, Northern Atlantic wet heaths with *Erica tetralix*. Dry heaths in the UK exhibit exceptional diversity in comparison with examples found elsewhere in the EU. (www.JNCC.gov.uk, 2005).

Wet upland heathland
Wet heath is much less common on the Isle of Man than dry heath – around 310ha in total, or approximately one twentieth of the total non-coastal heath on the Island. Unlike dry dwarf shrub heath, which is predominantly upland, around half of the wet heath recorded on the Island lies within small, fragmented and scattered lowland sites (BDIS). Lowland examples are more likely to be species-rich, but upland wet heath is significant for feeding upland waders and the small number of rare, specialised plants which can tolerate exposed, wet, acid conditions. The Manx Wildlife Sites Handbook states that all areas of wet dwarf shrub heath greater than 1ha in extent, or occurring in association with other habitats of Wildlife Site quality, will qualify for inclusion as Wildlife Sites.

Wet heath is extensively developed in western Britain and there are large areas of poor-quality habitat, almost all of which is in upland areas. One exception is **Northern Atlantic wet heaths with *Erica tetralix***, which are an Annex 1 habitat under the EU Habitats Directive. They are restricted to the Atlantic fringe of Europe between Norway and Normandy. A high proportion of the EU resource occurs in the UK, where it is restricted to highly localised sites in parts of southern and central England (JNCC). Small fragments of this habitat type occur on the Isle of Man, usually in conjunction with valley mires and fens. This habitat type is most commonly found on upland margins (BDIS), but may occur on hillsides wherever conditions are suitable.

Wet heath is an important habitat for a range of vascular plant and bryophyte species of an oceanic or Atlantic distribution in Europe, several of which have an important part of their EU and world distribution in the UK. The UK is one of the most important parts of the world for Atlantic bryophytes, and this is the most important habitat for many of these oceanic species of restricted world distribution (www.JNCC.gov.uk, 2005). The location of the Island would suggest that it may contribute to the UK's high proportion of bryophyte-rich wet heath; however, the full extent of bryophyte diversity in wet heaths on the Isle of Man is not well known at present. It is therefore an area which requires further study on both upland and lowland sites.

Upland heathland as a whole
Much of the Island's hill land is owned and leased by the Department of Agriculture, Fisheries and Forestry. Smaller areas are owned and managed by Manx National Heritage; the remainder is privately owned. As with Isle of Man, substantial areas of UK heathland are also publicly owned or managed, for

example by Scottish Office Agriculture, Environment and Fisheries Department (SOAEFD), the National Parks, and Forest Enterprise, and many areas lie in countryside designated as National Park, National Scenic Area (NSA) or Area of Outstanding Natural Beauty (AONB). The status of heather moorland means that the date and conditions under which heather can be burnt are defined by law throughout Ireland, the UK and the Isle of Man. Codes of good practice are published by the relevant Agricultural departments and take into account biodiversity, as well as agricultural and landscape, issues.

Within the UK large tracts of upland heath are notified as SSSIs/ASSIs, including at least 42,000 ha in England, 34,000 ha in Wales, 7,000 ha in Northern Ireland and 152,000 ha in Scotland. The UK Government has put forward areas that it considers qualify as Special Areas of Conservation (SAC) for these habitats. Some areas of upland heath are also classified as Special Protection Areas (SPA) under the EC Birds Directive, including the Bowland Fells and the North Pennines. Upland heathland is also represented within the UK National Nature Reserve (NNR) network.

Threats to upland heathland

The importance of heather moorland throughout the British Isles has led to considerable analysis of the threats posed both to its extent and quality. In general, the reduction in structural diversity and the trend towards acid grassland – both resulting from heavy grazing, sometimes in conjunction with burning – are considered to lead to a deterioration away from favourable conservation status. The UK Biodiversity Action Plan for Upland heathland states:

"There have been considerable losses of heather moorland in recent times. For example, 27% of heather moorland is estimated to have been lost in England and Wales between 1947 and 1980. On the Berwyn mountains in north-east Wales there was a 44% decline in the extent of heather-dominated vegetation between 1946 and 1984, whereas other upland sites in Wales have shown much smaller losses over similar periods. An estimated 18% was lost in Scotland between the 1940s and 1970s and the trend continued throughout the 1980s with a further estimated loss of 5%. Much of this loss is attributed to agricultural land improvements, heavy grazing by sheep (and, in certain areas, red deer and cattle), and afforestation.

It has also been estimated that 440,000 ha of land in the uplands in England and Wales have less than 25% cover of heather (ie grassland containing suppressed dwarf shrubs). There is likely to be further significant loss of heather moorland to acid grassland if current grazing levels and pressures continue. However, the conversion of heathland to acid grassland is not a purely recent phenomenon. On some sites in Wales (and elsewhere in UK) the major decline in heathland cover probably took place in the 19th century or even earlier." (http://www.ukbap.org.uk)

Associated threats to UK upland heathland are then identified as follows:

"Current factors affecting the habitat

- *Although upland heathland is dependent on management of grazing and burning to prevent succession to scrub or woodland, many upland heaths suffer from overgrazing and environmentally damaging burning regimes. Some of the problems caused by these management practices are described below. As well as direct loss of habitat, many areas of upland heathland are characterised by limited structural diversity with few natural transitions from open heath into scrub and woodland. Current management and other factors are continuing to prevent development of these features in most areas. Undergrazing occurs but is generally only of local significance.*

- *Agriculture is the dominant land use in the uplands. Most of the upland heathland resource falls within the Less Favoured Areas (LFAs). Livestock subsidies have led to a substantial increase in stocking rates (especially of sheep) in many upland areas ….. environmental conditions are now also attached to all the main livestock subsidy schemes, although overgrazing is still a problem and losses of upland heathland habitat continue.*

- *High stocking levels of sheep, and to a lesser extent cattle, lead to heavy grazing of heather and other dwarf shrubs. High numbers of red deer Cervus elaphus are a problem in parts of the Scottish Highlands. Inappropriate methods of supplementary feeding and the absence or minimal use of shepherding also contribute to the problem of overgrazing.*

- *Heavy grazing by sheep, cattle or deer can prevent regeneration by native woodland and scrub, notably along upland heathland margins and stream sides where such habitat additions would be likely to enhance biodiversity value.*

- *Difficulties in negotiating agreements with commoners are hampering take-up of agri-environment schemes on common land.*

- *Conversion to grassland occurs through ploughing, reseeding, liming and fertilisation for agricultural purposes, particularly at lower elevations. Drainage and moorland 'gripping' also reduce the interest of wet heath. These factors have become less significant over the past ten years.*

- *Afforestation (mainly by non-native conifers) leads to direct loss of dwarf-shrub habitat, although temporary and permanent areas of heathland are now being created within some existing forests by restructuring after the first rotation.*

- *Poorly managed muirburn (ie large-scale and too frequent in operation) reduces the habitat quality of upland heath by causing a simplification of structure, loss of lower plant assemblages and erosion of peat.*

- *Encroachment by bracken can lead to a loss of biodiversity; this is a significant problem in some upland areas.*

- *Quarries, windfarms, communication masts, access tracks and certain other planning developments can impact directly on wildlife interest.*

- *Acidification, trophospheric ozone and nitrogen enrichment caused by atmospheric deposition can lead to vegetation changes including a reduction in the lichen and bryophyte interest. Nitrogen deposition can increase the likelihood of insect defoliation of upland heathland.*

- *Climate change could potentially lead to changes in vegetation composition and structure, although any increase in temperature may also be accompanied by possible increases in rainfall and wind speeds. The future position is still unclear but one of the dominant heathland species, heather, does have a relatively wide tolerance of temperature and rainfall, providing the overall climate remains oceanic. It is likely that within the time span of this plan other factors, notably high stocking levels, will have by far the greatest impact on upland heathland vegetation and species.*

- *Localised damage and threats from other forms of land use in the uplands, such as military use and recreation, are a concern.*

- *The interaction of two or more of the factors listed above often greatly increases the overall impact on upland heathland vegetation. For example, poorly managed burning followed by heavy grazing will result in the loss of dwarf shrubs more rapidly than would either factor in isolation. It is possible that grazing pressures interact with pollution to influence vegetation change*." (http://www.ukbap.org.uk)

With the exception of Commoners' rights issues and the impact of military use, the above threats have the potential to apply equally to Manx upland heathland. In particular the grazing levels in parts of the uplands have led to the development of extensive acid grassland on areas otherwise suitable for heather moorland (see p11 above, re. Garrad 1972). The risk of this is likely to increase where higher altitudes and more exposed conditions result in low vegetation recovery rates and a consequent high impact of overgrazing.

Minimum selection criteria for upland heathland

It is expected that upland sites will encompass a range of habitats, of which dwarf shrub heath is one element. However, due to its globally restricted status:

- all wet dwarf shrub heath over 4ha in extent, and
- all dry dwarf shrub heath greater than 8ha in extent,

which fulfil at least one of the Priority Site criteria listed in Part 3, will qualify for selection.

Where small sites are selected, priority should be given to those which exhibit the best diversity of structure and which support key populations of location-dependent rare species.
In additon to this:

- Wet dwarf shrub heath should always be included where it occurs in or adjacent to an area selected as an ASSI under other habitat criteria.

4.7.3 Blanket bog

Description and Distribution

The British Isles are uniquely suited to the formation of blanket bog, which "blankets" the less steep areas of hill and mountainsides in the wetter parts of the UK, Ireland and the Isle of Man. The high rainfall and relatively mild, humid conditions allow waterlogged, moss-dominated vegetation to form on undulating ground, building up into layers of peat which remain waterlogged as bog communities develop on top. Bogs where peat is accreting are known as "active".

"'Active' is defined as supporting a significant area of vegetation that is normally peat-forming. Typical species include the important peat-forming species, such as bog-mosses Sphagnum *spp. and cottongrasses* Eriophorum spp*., or purple moor-grass* Molinia caerulea *in certain circumstances, together with heather* Calluna vulgaris *and other ericaceous species. Thus sites, particularly those at higher altitude, characterised by extensive erosion features, may still be classed as 'active' if they otherwise support extensive areas of typical bog vegetation, and especially if the erosion gullies show signs of recolonisation."* (www. JNCC.gov.uk, 2006).

Peat accumulates very slowly under these conditions:

"Blanket bog peat accumulates in response to the very slow rate at which plant material decomposes under conditions of waterlogging. It is not, however, confined to areas of poor drainage but rather can cloak whole landscapes, even developing on slopes of up to 30°. The period over which blanket peat has been accumulating and the depth it can attain are very variable and not necessarily related. Studies indicate that most blanket peat development began 5000-6000 years ago, but the range extends from 9000 - 1500 years ago. There is evidence to suggest that some areas of blanket bog began to form following clearance of the original forest cover by early man, but the relative significance of this activity and changing climate on the historical and contemporary extent of the resource has yet to be determined. Peat depth is also very variable, with an average of 0.5-3 m being fairly typical but depths in excess of 5 m not unusual. There is no agreed minimum depth of peat which can support blanket bog vegetation.". (www.Ukbap.org.uk)

Active blanket bog is rare in the global context, and a Priority Habitat under the EU Habitats Directive. In the EU, **Blanket bogs** are found primarily in the UK and Ireland, but the extent of surviving habitat is now much reduced in Ireland. Blanket bogs are found in the north and west of the UK, extending from Devon in the south to Shetland in the north. *Scirpus – Eriophorum* mire predominates in the west, particularly at lower altitude, while *Calluna – Eriophorum* mire is particularly abundant in the east and at higher altitudes. *Erica – Sphagnum* mire is widely but patchily distributed (www.Ukbap.org.uk). Despite the apparent suitability of the Manx countryside for the formation of blanket bog, past habitat surveys have shown it to be quite limited in extent – in contrast to UK uplands, where it is one of the most extensive semi-natural habitat types. Rather than blanketing whole hillsides and mountain-tops, blanket bog on the Isle of Man usually occurs in patches on the less steep sides of the higher peaks in the Central and Northern hills – for example, Slieu Meayll in the Central Uplands. Smaller areas may be indistinguishable from localised hillside flushes, and true blanket bog, as opposed to flushes, only makes up around one quarter of upland bog on the Island (Sayle *et al*, 1995).

Whilst some groundwater-fed fen vegetation may occur within upland areas, most boggy wetland is reliant on rainfall and poor or impeded drainage to maintain the uniquely acidic and nutrient-poor conditions. The structure and vegetation composition of blanket bog is thus highly dependent on the underlying topography, and the extent to which it allows water to remain in the bog and/or peat to build up (JNCC, 1994). Human activities such as drainage, peat-cutting and burning can affect this process, particularly where smaller areas of blanket bog and flush lie adjacent to burnt and drained heather moorland. An altered or agriculturally improved hillside on deep peat is likely to support dry modified bog, which has some characteristics of blanket bog – for example, abundant cotton-grass Eriophorum spp. - but little in the way of *Sphagnum* mosses and no active peat generation. Such areas are usually dominated by heather *Calluna vulgaris* or cross-leaved heath *Erica tetralix*.

Blanket bog as it occurs in the UK, in very extensive areas, may exhibit a wide range of surface patterning such as series of bog pools and channels, tussocky as opposed to smooth vegetation, rills, flushes and erosion features:

"An important element in defining variation is the relative proportion of pools on the bog surface. In general, the proportion of surface patterning occupied by permanent pools increases to the north and west, although the precise shape and pattern of pools appears to depend on local topography as well as geographical location. Variety within the bog vegetation mirrors this pattern and is also affected by altitude. Similarly, the number of associated habitats and communities, such as springs, flushes, fens and heath, is greater in the milder, wetter and geologically and topographically more complex north and west."
(www. JNCC.gov.uk, 2006).

Blanket bog may also be sub-categorised according to morphology, e.g. saddle mires, watershed mires. The lack of very extensive blanket bog on the Island makes these features fewer and less obvious, but structural diversity of upland bogs is still an important consideration when assessing the diversity of a potential upland ASSI. In particular the presence of bog pools and other wetland features should be considered a priority for site selection.

As in the rest of the British Isles, Manx blanket bogs offer a store of archaeological and palaecological records, including preserved buried human artefacts, foundations of features such as round-houses, and a fossilised pollen record. Blanket bogs as a whole are increasingly recognised as "carbon sinks", which store atmospheric carbon in the preserved peat layer – a function which is lost where peat is removed faster than it can regenerate.

When assessing a potential upland ASSI with blanket bog, the full hydrological catchment on which the bog is dependent should be included within the ASSI boundary. This is especially important where the bog is thought to be active, i.e. where peat is still building up. Other habitats which depend on the same hydrological environment, such as wet heath, bog pools, streams, springs, fens and flushes, are important elements of biological and structural diversity and should always be included.

Classification of blanket bog

Blanket bog types known to occur in the uplands are listed on **Table 4.7b**; it should however be noted that some of these vegetation types may also occur in exposed conditions at lower altitudes, and/or in gradient with more typically lowland habitat types, which frequently occur on upland margins. Table 4.7b should therefore be considered alongside Tables 4.4a (Broad categories of bog on the Isle of Man) and 4.4b (Broad categories of valley mires and flushes on the Isle of Man), in Chapter **4.4 Bogs, fens and flushes**.

Status of blanket bog

Despite the apparent suitability of the climate and terrain, blanket bog is a rare habitat in the Isle of Man, even when modified bog and flushes are taken into account. The DAFF Phase 1 Habitat Survey found just 106ha of true blanket bog, and 455ha of flush and spring. Blanket bog thus makes up 0.64% of the total semi-natural habitat, or 3.41% if flushes are also included (Sayle *et al*, 1995). Dry modified bog makes up around 0.41% of the total semi-natural habitat, although it should be stressed that all three categories are fairly broad, often occur in complex associations with each other, and may be hard to differentiate at times. Likewise, the precise proportion of active bog is difficult to be sure of and unlikely to constitute all of the total recorded area of blanket bog. What is clear is that the habitat is limited on the Island, and tends to be fragmented at least in comparison with similar habitats in the UK and Ireland. The importance of bog in the uplands is recognised in the Manx Wildlife Sites Handbook, which states that the following will qualify for Wildlife Site status:

- *All areas of flush which are greater than 1ha in extent, or are part of a mire complex*
- *All areas of active blanket bog*
- *All areas of dry modified bog, except severely degraded examples*
- *All areas of wet modified bog, except severely degraded examples*
- *All areas of valley mire and basin mire, except severely degraded examples*

The total extent of blanket peat in the UK amounts to just under 1.5 million ha. There is no agreed figure for the extent of blanket bog vegetation. In terms of national cover of blanket peat soil (in the main >0.5 m deep) England supports some 215,000 ha, Scotland approximately 1,060,000 ha, and Wales has around 70,000 ha. Northern Ireland has approximately 140,000 ha of blanket bog vegetation. Significant

proportions of peat soil, probably in excess of 10%, no longer support blanket bog vegetation (www.Ukbap.org.uk). In recognition of the high proportion of the habitat type which occurs in the UK, and the UK's special conservation responsibility, blanket bog is a Biodiversity Action Plan Priority Habitat.

The global scarcity of active blanket bog has led to its inclusion on Annex 1 of the Habitats Directive as a Priority Habitat – with the caveat that the more species-poor, modified and inactive blanket bog that is frequent throughout much of the British uplands is not a priority. Protective measures in the UK include ASSI (Northern Ireland), SSSI, Ramsar Site, Special Area of Conservation and Special Protection Area designations, often for upland areas which include blanket bog as part of a wider mosaic of interrelated upland habitats. A small number are also managed as National Nature Reserves.

For parties to the Ramsar Convention there has been a recent move towards prioritising wet peatland habitats, which are currently under-represented in the the Ramsar Site series.

Threats to blanket bog

The question of climate change, and how it is, and will, impact on this very climate-dependent habitat should be borne in mind whilst considering other threats.

Detailed data on the main threats to blanket bog on the Isle of Man are lacking, although it is clear that agricultural activities have a part to play in restricting the suitability of some hills for blanket bog – especially where hillsides have been subject to drainage and other agricultural improvement. Comprehensive data for changes to the total UK resource are similarly lacking, but studies in Scotland (where most of the resource lies and where it accounts for some 13% of the land area) suggest a 21% reduction in the extent of blanket mire between the 1940s and the 1980s. The greatest single cause of this reduction (51%) is afforestation, and substantial losses to forestry are reported from Wales. Further losses of extent and condition can be attributed to drainage and heavy grazing, peat cutting and atmospheric pollution, resulting in significant habitat change in, for example, mid and south Wales and the Pennines (www.Ukbap.org.uk). As with the other, related, globally-scarce upland habitat, heather moorland, the UK Biodiversity Action Plan lists many potential threats to blanket bog, the majority of which are of relevance on the Island:

"Current factors affecting the habitat

- *The potential threat from climate change could over-ride many of the following factors. However, it is precisely because of the unknown effects climate change could have that it is important that as much of the resource as possible, representing its full biogeographical extent, is brought into, or maintained at, favourable condition. Pollution, from sulphate and nitrate deposition, may also be significant in certain areas, such as the Southern Pennines.*

- *Drainage - extensive tracts of blanket bog have been drained in the past in attempts to improve the quality of the grazing. New drains continue to be dug and old drains cleaned in some areas. Even without maintenance most drains continue to lower the adjacent water table and some initiate erosion.*

- *Heavy grazing (by sheep, red deer, cattle and horses) - especially if accompanied by supplementary feeding, burning, fencing and drainage, has a significant impact on vegetation. This is a particular concern on common land.*

- *Burning - agricultural and sporting management both involve the use of fire to modify moorland vegetation for the benefit of livestock, grouse and deer in particular. Poorly managed and/or accidental fires can be particularly damaging to blanket bog.*

- *Forestry - although new planting may be relatively small scale, some existing plantations are having an impact on the hydrology and species composition of adjacent areas of blanket bog, notably as the trees mature. Aerial application of fertilisers and pesticides can also result in drift on to adjacent bog.*

- *Peat extraction - commercial extraction, though relatively limited in extent (some 2000 ha in Scotland), can have important local effects. Domestic cutting, most of which occurs on common land, is locally extensive (some 50,000 ha in Scotland) and, particularly where mechanical methods are employed, can have a significant impact, especially in Northern Ireland where the distinction between commercial and domestic activity can be difficult to determine.*

- *Agricultural improvement - drainage, fertiliser application and conversion to pasture has occurred frequently in the past and can be of local significance.*

- *Recreation - many popular walking routes, some of which are also used by cyclists and horse-riders, traverse blanket bog areas which are very sensitive to such pressure. The increased use of all-terrain vehicles for recreational, agricultural and sporting activities can also result in local erosion.*

- *Planning developments - wind farms and communication masts, together with their associated infrastructure, are increasingly being proposed on areas of blanket bog, especially those at high altitude. There are also threats from hydro-electric schemes in Scotland.*

- *Erosion - high altitude bogs in particular, especially those in the Pennines and south Wales, are losing habitat through constant erosion of the peat mass. Some of this may be due to natural processes.*

- *Water course liming - where lime is added to lochs, lakes and rivers as a treatment for acidification, there may be detrimental implications for adjacent areas of blanket bog. Sometimes the bogs themselves have had lime applied.*

Minimum selection criteria for blanket bog

- Blanket bog should always be included where it occurs in or adjacent to area selected as ASSIs under other habitat criteria. This includes modified bog and flush.

- It is expected that upland sites will encompass a range of habitats, of which blanket bog is one element. However, due to its globally restricted status, all active blanket bogs over 2ha in extent which fulfil at least one of the Priority Site criteria listed in Part 3 will qualify for selection. Where small sites are selected, priority should be given to those which exhibit the best diversity of structure and morphology, in addition to their biodiversity.

The soft beds of *Sphagnum* moss on a blanket bog can support other plants growing on and through them, such as round-leaved sundew *Drosera rotundifolia* (red plants on bottom left of picture). However, the habitat is delicate: bike tracks such as those shown above may persist for months or even years.

Table 4.7.b: Broad categories of upland habitat on the Isle of Man

Type and Description	Species rich?	Closest National Vegetation Classification (NVC) categories	Rarities present?	Protected species present?
GRASSLANDS				
Montane grassland The tops of high peaks such as North Barrule, Clag Ouyr and Bein y Phott may share some characteristics of montane vegetation communities, but true "arctic/alpine" vegetation occurs only above 600m, i.e. on the summit of Snaefell.	No. High-altitude habitat on the Island is low in species-richness, but represents a locally rare habitat which is very vulnerable to climate change.	U16 - Luzula sylvatica-Vaccinium myrtillus grassland Occasional on wet, peaty mountain tops where grazing is limited, notably Snaefell. No Island NVC samples	The tops of the highest peaks may support montane species which are rare on the Island, notably Cranberry *Vaccinium oxycoccus,* Alpine clubmoss *Diphasiastrum alpinum* and Least willow *Salix herbacea*.	May form part of the territory of protected bird of prey species. Several protected plant species occur on the highest peaks – *see left*.
Upland pasture (Sub-montane grassland) Frequent, generally above 250m. Always grazed - will revert to heathland and bog if left ungrazed.	No, although all types of upland pasture may occur within a diverse heath/grass/bog mosaic which is species-rich overall.	U4 - Festuca ovina- Agrostis capillaris-Galium saxatile grassland One of the commonest grassland types, often covering extensive areas especially on upland fringes. See also Section 3.1. One Island NVC sample. U5 - *Nardus stricta-Galium saxatile* grassland No Island NVC samples U6 - *Juncus squarrosus-Festuca ovina* grassland. Common, especially in the wettest and most exposed areas. No Island NVC samples.	Yes; a range of plant and animal rarities occur throughout the uplands, almost always in habitat mosaics where upland pasture is one element of an interrelated complex of habitats (BDIS).	May form part of the territory of protected bird of prey species; may be used by lapwings *Vanellus vanellus*, although not normally for breeding. May form part of golden plover *Pluvialis apricaria* habitat, and chough *Pyrrhocorax pyrrhocorax* winter feeding areas. Several protected plant species occur on upland pasture, including mountain pansy *Viola lutea*, Stag's-horn clubmoss *Lycopodium clavatum*, Ivy-leaved bellflower *Wahlenbergia hederacea*, Orchid

		U20 - Pteridium aquilinum-Galium saxatile grassland very common: bracken "invaded" areas, often on margins of U5 grassland, eg. next to plantations. One Island NVC sample.		spp., Pale butterwort *Pinguicula lusitanica*, and Common cow-wheat *Melampyrum pratense*.
HEATHLAND				
Dry dwarf shrub heath May be dominated by heather, Manx gorse or bilberry. Often found in conjunction with other habitats such as wet heath, bog, and acid grassland. Marginal dry upland heathland may be subjected to agricultural improvement such as liming and drainage. Heavy grazing, particularly with frequent burning, can reduce the proportion of dwarf shrubs present until the habitat becomes entirely dominated by acid grassland species.	Pure stands of heather are not species-rich; upland margins and more sheltered sites may be relatively species-rich if a mosaic of habitat types is present.	H8a &b *Calluna vulgaris – Ulex gallii* (heather and western or "Manx" gorse) heath Six Island NVC samples, all within the species-poor or *Danthonia decumbens* (heath-moss) sub-communities. H10 *Calluna vulgaris – Erica cinerea* (heather and bell heather) heath One Island NVC sample Especially characteristic of the western margins of the British Isles. H12 Calluna vulgaris – Vaccinium myrtillus (heath and bilberry) heath One Island NVC sample. H18 *Vaccinium myrtillus – Deschampsia flexuosa* (bilberry and wavy hair-grass) heath No Island NVC sample.	Yes, may attract rare birds (see right). Rare invertebrates and lower plants are a possibility on this habitat, but both groups are data-deficient on the Island. Rare plants do not usually occur, but diverse sites may support unusual clubmosses such as fir clubmoss *Huperzia selago* and stag's-horn clubmoss *Lycopodium clavatum.* The best examples may support protected plants (see right) and locally-distributed species such as cowberry *Vaccinnium vitis-idaea*, and crowberry *Empetrum nigrum*.	Yes. Protected bird species are likely, including hen harrier, kestrel, merlin and short-eared owl. May attract feeding chough especially during the winter. Lizards possible. Protected plants may include orchid species, mountain pansy *Viola lutea*, common cow-wheat *Melampyrum pratense*, lesser twayblade *Listera cordata* and stag's-horn clubmoss *Lycopodium clavatum*.

Wet dwarf shrub heath Cross-leaved heath wet heath Both NVC types listed here are a type of mire; other mire types with less heathy characteristics may occur nearby (see below).	May be species-rich, especially compared with dry dwarf shrub heath of limited structural diversity.	M15 *Scirpus cespitosus – Erica tetralix* (deergrass and cross-leaved heath) wet heath No Island NVC sample Especially characteristic of the western margins of the British Isles. May occur with blanket bog. M16 *Erica tetralix-Sphagnum compactum (cross-leaved heath and Sphagnum moss)* wet heath No Island NVC sample	May support rare invertebrates and/or plants	Protected birds of prey such as peregrine, hen harrier and short-eared owl may use as feeding territory, the latter two forming roosts in wet areas of heathland/mire; also a possibility of lapwing. Lizards possible. A likely habitat for cranberry *Vaccinium oxycoccus,* heath-spotted orchid *Dactylorhiza maculata ssp ericetorum* and pale butterwort *Pinguicula lusitanica*.
BLANKET BOG				
Occurs rather sporadically throughout the Manx uplands, usually as a complex of varying vegetation communities amongst wet heath. Some spring-fed fens and flushes may also occur, which are not strictly blanket bog, but the two are treated together here as they are often contiguous and the habitat is ecologically very similar. Bog pools may occur, especially on hill tops, and are usually very small with limited associated vegetation. This is an under-researched habitat on the Island.	Not generally rich in vascular plants, although structurally diverse sites may support unusual species, and the more nutrient-rich sites (e.g. those which occur in conjunction with fens and flushes) may be more diverse than adjacent heath.	M1 *Sphagnum auriculatum* (bog moss) bog pool community. No Island NVC sample. M3 *Eriophorum angustifolium* (common cotton-grass) bog pool community No Island NVC sample M15 *Scirpus cespitosus – Erica tetralix* (deergrass and cross-leaved heath) wet heath – see wet heath, above. M17 *Scirpus cespitosus-Eriophorum vaginatum* blanket mire One Island NVC sample M18 *Erica tetralix-Sphagnum papillosum* raised and blanket mire No Island NVC sample M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire No Island NVC sample	May support rare invertebrates and/or plants, and attract feeding upland birds.	Protected birds of prey such as hen harrier and peregrine may use as feeding territory; also a possibility of lapwing. Lizards possible. A likely habitat for cranberry *Vaccinium oxycoccus,* pale butterwort *Pinguicula lusitanica* and dioecious sedge *Carex dioica,* in addition to Orchid species.

		M25 *Molinia caerulea-Potentilla erecta* mire 1 Island NVC sample; mostly found on upland margins.		
OTHER HABITATS – see relevant chapters 4.1 – 4.5				
Valley mire, basin mire , fens and flushes	Yes, good examples may be relatively species-rich, especially when compared with blanket bog and structurally-poor heath.	These habitats occur sporadically, usually in very small areas, throughout the uplands. They are common to uplands, upland margins and unimproved lowlands. A minor but distinctive feature of upland margins is the presence of small springhead rills which support a vegetation community similar to M35 *Ranunculus omiophyllus – Montia fontana* (round-leaved water crowfoot and blinks) rill No Island NVC samples. See **Chapter 4.4 Bogs, fens and flushes** for details of commonly-distributed mire types that may also occur in upland areas, particularly upland margins.	Yes. May support rare invertebrates, birds and plants – including lower plants such as mosses. More research is needed on the significance of valley mire for invertebrates and lower plants on the Island.	Yes. These habitats may support a range of rare wetland plants, including good populations of orchids. They also attract wetland birds such as Snipe *Gallinago gallinago*, Curlew *Numenius arquata* and Lapwing *Vanellus vanellus*.
Open water	No, due to very low nutrient levels and an often dystrophic status. However, birds and invertebrates of conservation importance may rely on these areas.	Streams, ditches and small pools occur throughout the uplands, which form the catchment for the Island's rivers. See **Chapter 4.5: Open water and swamp** for details of more commonly-distributed open water and swamp types that may also occur in upland areas, particularly upland margins.	Not usually; the fast flow of upland streams militates against emergent vegetation growth. However, upland pools may support rare invertebrates – currently an under-recorded group.	Upland pools may attract waders such as lapwing, curlew and snipe.

Recommendations for selection of upland ASSIs

1. Upland ASSI selection should reflect the extensive nature of the uplands
As in adjacent countries, it is likely that upland ASSIs will make up a high proportion of the total protected area in the Isle of Man.
"The total area of upland (including blanket bogs) will be by far the largest of all habitats in the SSSI series: this is entirely appropriate, and in proportion to the extent of upland in Britain." (NCC 1989, p188)

2. Select a full range of representative upland mosaic areas
The **best example*** should be selected from within each of the "biodiversity hotspots" identified in Table 4.7a, using hydrological catchment, rather than hill-wall or administrative boundaries, as a guide to the extent of the protected area. Site quality assessment should follow the guidelines above (**Assessing uplands**, p3), including the key Priority Site Criteria listed.
*As a general guide, **best examples** will be:

- the most favourable according to the points listed in the Priority Site Criteria in Part 3
- and
- offering the most intact, unmodified and comprehensive inclusion of the hydrological catchment of a peatland, where applicable
- and
- forming a large ecological unit with a good range of associated upland habitats such as wet and dry dwarf shrub heath, bog, mire, rocky outcrops, springs, rills and flushes.
- and/or
- of critical importance for one or more populations of rare or vulnerable species.

3. Include best examples of each individual habitat type in the uplands
Upland areas which are important for the conservation of particular species or habitat sub-types but which are too narrow in overall biodiversity to have been identified as "hotspots" by the Balson, 2002 report should be selected according to the **minimum selection criteria** for each of the habitat types as described in sections **4.7.1 – 4.7.3** above.

4. Integrate with lowland ASSI selection wherever possible
The selection of upland ASSIs should relate to lowland ASSIs as follows:

- Eligible lowland habitats which occur in an ecological gradient with upland habitats – e.g. lowland heath, watercourses and mires – should be included in the boundary of upland ASSIs where they are ecologically contiguous. Thus, although the minimum altitude of 250m is taken as a guideline to the definition of an upland area, ASSI boundaries should not cut off important habitats just in order to create a purely upland site.

- The criteria for selection of flowing water (see Chapter 4.5: Open water and swamp) indicate that at least one river should be selected from source to sea. As the source of most Manx rivers lies in the uplands, this criterion should be borne in mind when selecting upland ASSIs.

4.8 Flora – sites of exceptional importance for plant conservation

Notes:
The species scoring system is based on the rarity/significance of the species, using lists which may themselves be updated at intervals. This avoids having to review the species criteria scoring lists separately. To qualify under plant species criteria the plant in question should normally have been confirmed as present within the 12 months before designation.

For scoring purposes a species may only be included **once**, at its highest-scoring category (e.g. a Schedule 7 Red Data Book species scores 10, not 12).

International significance is denoted by inclusion of naturally resident species which are listed on Appendix I of the Bern Convention and/or Annexes II, IV or V of the EC Habitats and Species Directive.

British Isles significance refers to inclusion of species in the British or Irish Red Data Book as *Extinc*t, *Endangered* or *Vulnerable.*

Plants listed on Schedule 7 of the Wildlife Act 1990 are considered nationally important in the Manx context, in particular those which are known to occur at three sites or fewer. In the case of Schedule 7 species which are listed as a group - e.g. all orchids - the score applies separately to each species present.

Priority sites for plants are those with a score of 10 or higher.

CRITERIA	**SCORE**
International significance	10
British Isles significance	10
Schedule 7 species excluding those present on > 3 sites	2
Schedule 7 species occurring on > 3 sites.	1

Examples:
A site with 5 Schedule 7 plants found within the last 12 months, all of which are known to occur at three or fewer sites, would score **10** and be a **priority site** for ASSI selection;

A site with any British Isles Red Data Book species known to occur within the last 12 months would also score **10** and be a **priority site** for ASSI selection.

A site which harboured three Schedule 7 plants, one of which occurs at more than three sites Island-wide, would score **5** points, and would **not** be considered a priority site for ASSI selection solely on the basis of the plant species present.

4.9 Avifauna – sites of exceptional importance for birds

General

Birds can be used in site assessment in two ways. Firstly, the presence of a particular bird community in a specific habitat can indicate that a site is of high quality and worthy of designation as ASSI. Under the site quality guidelines in 3.2, the naturalness and diversity of a site can be indicated by the presence of a typical assemblage for the habitat. This will include some birds that rarely aggregate in large numbers but may rely on particular habitats to sustain them, eg. merlins on moorlands, or corncrakes in hay fields. It is important that such habitats are maintained in order to sustain such species on the island in the future. The scores for Breeding Bird Assemblages (criteria below) may be used in site comparison. For instance, a woodland with a score of 16, will not qualify for its breeding bird assemblage alone, but will be considered of greater interest for its habitat-specific birds than a site with only a score of 10. In this situation, where more than one of the important habitats is included in a site, the score may be raised by further species of interest in the second habitat, but double scoring is not applicable. The thresholds will not be relevant in this situation.

Secondly, sites may be considered of interest because of their bird interest itself, due to the regular presence of concentrations of a species. Such sites are easy to pick out for colonial breeders but some species tend not to congregate, so areas with the highest densities or linked to other interest should be put forward.

The intention is to protect populations of all of the regularly occurring species on the island within the ASSI series. Common species are likely to be included, by default, within ASSIs designated for other reasons and would not normally provide the only interest of a site. As a priority, the best site for any species of conservation concern, should be put forward for designation.

There may also be sites that are of particular importance because of their scientific value, such as bird observatories and long-term survey areas. A long history of recording at a site can provide very important information on changes in the fauna and in the environment, that may be impossible to detect in other ways. Although not an eligibility criterion in itself, such importance may form a reason for choosing one eligible site over another.

Birds populations can be divided into breeding and non-breeding populations. Some species are sedentary and some migratory at least to some extent. In order to protect a population of birds, it is important to ensure that habitats remain available for feeding birds all year round. Whereas some species move up and down the hills, others cross international borders in the search for a year-round food supply (see below). Also, breeding sites will be required and some species require undisturbed areas where they can roost in relative safety when their feeding areas are unavailable, such as waders during high tide.

The proportion of a population found on a site in a particular season has been accepted as a criterion for assessment. This not only shows that a site is important for the maintenance of the population, due to its holding a significant proportion of it, but is also self-adjusting for rarity, because more sites will become eligible for species with small populations than those that are common and widespread. There is therefore an in-built bias towards the protection of rare species.

International obligations
The Isle of Man has obligations under certain international conventions for the conservation of wildlife. These include the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) and the Agreement on the Conservation of African-Eurasian Migratory Waterbirds made under that convention, the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) and the Convention on Wetlands of International Importance, especially as waterfowl habitat (Ramsar Convention).

Sites that are recognised as internationally important for birds may therefore be eligible for designation as Wetlands of International Importance, for waterfowl under Ramsar, or Areas of Special Conservation Interest, for birds of European conservation concern under Bern. The latter is equivalent to an EU Special Protection Area, as SPAs are accepted as the EU's ASCIs. Such sites should receive legal protection by designation as ASSIs, and the criteria have been written to allow this. Sites of international importance for birds will also be considered as of national importance.

Migratory birds are of particular concern. Some move around a series of sites during the non-breeding season, searching for winter food along a traditional route and frequently relying on particular sites for their survival when moving along the chain of feeding areas. Areas used by significant numbers of wintering and migrating waterfowl must therefore receive protection. In the Isle of Man the numbers of birds at such sites is relatively small in comparison with north-west England, but this is partly because of the lack of suitable habitat on the island, which lacks any large, productive mudflats. However, over a year many birds will pass through the island, stopping to take on food to burn on the next stage of the journey. Manx sites, though holding relatively small numbers of birds at any one time are important in the maintenance of an international network of sites for such species.

Important Bird Areas (IBAs) are sites that support internationally important assemblages of birds. Together they form a coordinated international network of sites, the protection of which relies on cooperation between nations. Sites in the Isle of Man are listed in Pritchard *et al*. (1992). These were selected for their importance in the context of the European Community or globally. Five sites have been recognised: the Isle of Man Sea Cliffs, Calf of Man, The Ayres, Ballaugh Curraghs and The Isle of Man Hills. The sites are recognised on the basis of criteria used by Ramsar, BirdLife International (as the ICBP) and the then Nature Conservancy Council. They were designed to enact requirements under the Ramsar Convention and the EU Birds Directive. Although the Isle of Man has no responsibilities under the Birds Directive, it does have a responsibility to protect sites of international importance for birds. The Birds Directive arose from the Bern Convention to which the island is a party. The listed sites are therefore of a high priority for conservation and will be considered priority areas for designation as ASSI.

Arable fields and highly improved grasslands will not normally be included as feeding and roosting sites, due to their wide availability, unless they are put forward due to particular aspects of their ecology or location which makes them special. Seasonally flooded grasslands, however, can be especially important for birds and would therefore receive consideration, but such areas are not common on the island.

Shy breeding birds such as the curlew *Numenius arquata* (centre of picture) benefit from large protected areas such as the Ballaugh Curragh ASSI and Ramsar Site

Sites of British importance
Regular status assessments of bird populations are made at the British level, such as the list of Birds of Conservation Concern for Britain, including the Isle of Man but excluding Ireland. An accepted level for national importance in Britain is 1% or more of a population.

Sites of Manx importance.
Some species that are common in Britain are rare on the island and at risk of loss as breeding species or are retained only as visitors, having bred previously. Sites of importance for maintaining the presence of species on the island should be protected as ASSI. Sites should be regularly used (see below), based on recent information.

Site information
Where possible site selection should be made on good data, ideally from 5 consecutive years. However, the records do not always allow this. The publication of the new atlas will provide a view of the use made of the island by each species in detail, as a snapshot in time. Some detailed site recording may, however , be necessary to show that the expected bird numbers are seen consistently.

Some species of particular interest in Britain and the Isle of Man, are counted fully at intervals, but not annually, such as seabird colonies and hen harrier nests. Three such counts, which could span a period of thirty years, are acceptable and show the continued use of a site over an extended period. Mean numbers can be compared but sites with high numbers of breeders or with a high productivity of chicks will be favoured over declining sites.

Minimum selection criteria for sites of high importance for birds

1. Sites of British importance: any site holding at least 1% of the population of a species in Britain and the Isle of Man, either for a breeding or non-breeding population.
For breeding sites of rare species it is important that the site is regularly used (see Site Information above) and the site boundary should normally include all the land areas required for the survival of the bird during breeding.

2. Sites of Manx importance for birds of local conservation concern: for any species listed on Schedule 1 of the Wildlife Act or the Red List of Birds of Conservation Concern (for Britain or for Ireland), the best site providing for its needs in each relevant season will qualify.
A site may be rated highly as having the largest proportion of the Manx population on a single site or having the highest density of the species on the island. If a species has populations that rely on separate, regularly used sites in different seasons, the important sites for a particular population may be chosen, rather than simply the best wintering and breeding areas, to ensure the protection of an important population in all seasons.

3. Smaller seabird sites and heronries: for any heron or seabird, except herring gull, if no site has been chosen for this interest under (1) or (2), then the best breeding site with at least 10 breeding pairs regularly seen, should be picked.
This may be justified on the basis of the number of chicks produced on a site each year, or if such data is not available, the number of pairs nesting. This criterion caters for species that aggregate in colonies but not necessarily in large numbers that would exceed the 1% threshold. Seabird populations in the British Isles are of special international importance so this criterion will ensure that the significant sites are eligible.

4. Breeding bird assemblages: sites with a very good range of the birds peculiar to a particular habitat are eligible.
The habitats given below have been chosen because they have a particular bird fauna. These vary in the numbers of species that they support, so for each habitat a list of typical species has been provided, with scores rated by the rarity of the species in Britain (see ratings by British breeding population, Nature Conservancy Council 1989). To assess a site, the scores are summed for each listed species of bird recorded as a probable breeder in a majority of recent years for which information is available.

Species regularly using a site for essential activities may be included, even if the nest is outside of the site. Any site with a score equal to or exceeding the stated threshold is eligible for designation. The species and scores are given in Table 4.9a.

Where substantial areas of more than one of these habitats is included in a site, the site could become eligible if one or more of the thresholds is exceeded, the whole site might then be considered as an ecological unit if applicable (see guidelines on boundaries), or the wider site could be eligible if the score lists are summed for each major habitat and exceed the sums of the thresholds (double counting for a species is allowed).

The Manx thresholds were adapted from the Nature Conservancy Council figures by first summing the scores for Manx species that breed in the relevant habitat on the island, giving a potential maximum (scores of 5 or 6 were not included in this maximum). The thresholds were set at about ½ of this maximum score, and adjusted to a level appropriate to make eligible the best quality sites on the island. An exception was woodland, in which the threshold is set at 2/3 due to the large number of species found in many woods.

If a rare species begins to breed regularly at a site, having an index listed by the NCC under a similar habitat, the score given there may be used to add value to the total for a site. The threshold would not be reassessed unless major changes occur or an overall revision is necessary. Sites with very rare breeders, establishing themselves as regular, will therefore have a particularly high score.

Habitat	**Threshold score**
Lowland damp grasslands	11
Lowland fen without open water	11
Open waters and their margins	22
Upland moorland and grassland with water bodies	18
Upland moorland and grassland without water bodies	16
Scrub (excluding heath)	9
Woodland	18
Hard coastline	21
Soft coastline	21

Upland moorland sites demand a higher threshold score than lowland grassland and fen

Table 4.9a: Criterion 4 scores for habitats

Lowland damp grasslands

Shelduck	2	Curlew	2
Teal	3	Cuckoo	2
Shoveler	4	Whinchat	2
Quail	5	Grasshopper warbler	2
Corncrake	6	Sedge warbler	1
Lapwing	1	Reed bunting	1
Snipe	2		

Lowland fen without open water

Little grebe	2.5	Cuckoo	2
Teal	3	Whinchat	2
Shoveler	4	Grasshopper warbler	2
Water rail	3	Sedge warbler	1
Snipe	2	Reed bunting	1

Open waters and their margins

Little grebe	2.5	Common tern	3
Mute swan	3	Cuckoo	2
Shelduck	2	kingfisher	3
Teal	3	Grey wagtail	2
Shoveler	4	Grasshopper warbler	2
Tufted duck	3	Sedge warbler	1
Water rail	3	Reed bunting	1
Ringed plover	3	Oystercatcher	2
snipe	2	Curlew	2

Upland moorland and grassland with water bodies

Hen harrier	4	Grey wagtail	2
Merlin	4	Whinchat	2
Peregrine	4	Stonechat	2
Red grouse	1	Wheatear	2
Snipe	2	Chough	4
Curlew	2	Raven	3
Short-eared owl	3		

Upland moorland and grassland without water bodies

Hen harrier	4	Short-eared owl	3
Merlin	4	Whinchat	2
Peregrine	4	Stonechat	2
Red grouse	1	Wheatear	2
Snipe	2	Chough	4
Curlew	2	Raven	3

Scrub (excluding heath)

Cuckoo	2	Garden warbler	1
Long-eared owl	3	Blackcap	1
Whinchat	2	Linnet	1
Stonechat	2	Redpoll	1
Grasshopper warbler	2		
Whitethroat	2		

Woodland

Grey heron	3	Chiffchaff	1
Sparrowhawk	2	Goldcrest	1
Woodcock	2	Spotted flycatcher	1
Stock dove	1	Long-tailed tit	1
Cuckoo	2	Coal tit	1
Long-eared owl	3	Treecreeper	1
Redstart	1	Raven	3
Garden warbler	1	Redpoll	1
Blackcap	1		
Wood warbler	2		

Hard coastline (including rocky cliff and associated pebble beach)

Fulmar	1	Black guillemot	2
Manx shearwater	1	Razorbill	1
Cormorant	3	Puffin	1
Shag	2	Rock pipit	2
Peregrine	4	Stonechat	2
Shelduck	2	Wheatear	2
Eider	2	Raven	3
Oystercatcher	2	Chough	4
Ringed plover	3		
Kittiwake	1		
Great black-backed gull	2		
Lesser black-backed gull	2		

Soft coastline (including soft cliff, saltmarsh, sand dune and associated sand or pebble beach)

Fulmar	1	Arctic tern	2
Shelduck	2	Little tern	3
Eider	2	Cuckoo	2
Oystercatcher	2	Sand martin	1
Ringed plover	3	Rock pipit	2
Lapwing	1	Stonechat	2
Snipe	3	Wheatear	2
Curlew	2	Grasshopper warbler	2
Black-headed gull	1	Sedge warbler	1
Great black-backed gull	2	Linnet	1
Lesser black-backed gull	2	Reed bunting	1
Common tern	3		

5. Species rich sites: sites with at least 39 breeding species or 83 species on passage, or wintering, in recent years.

This criterion is especially appropriate for very varied sites with habitat mosaics and for passage/wintering sites, either of which may hold large numbers of species but small populations of each. These thresholds have been produced by reducing the equivalent UK thresholds (Nature Conservancy Council 1989) by the difference in the size of the British and Manx Species Lists for categories A and C (see Manx Ornithological Society and British Ornithologists' Union), i.e. by 55%, because there are fewer species recorded on the Isle of Man. The categories of passage and wintering have been combined because recent information has shown that these cannot be separated in a simple way. The higher passage threshold has been adopted as, at the time of writing, diverse sites in the Isle of Man have greater significance as a passage stop-over than as a site for longer-term over-wintering species. Only highly diverse sites are likely to qualify but these should include the top passage/wintering sites that many small populations may rely on.

4.10 Fauna – sites of exceptional importance for animals

Notes:
The species scoring system is based on the rarity/significance of the species, using lists which may themselves be updated at intervals. This avoids having to review the species criteria scoring lists separately. To qualify, the species should normally have been confirmed as present within 3 years.

For scoring purposes a species may only be included **once**, at its highest-scoring category (e.g. a Schedule 5 Red Data Book species scores 10, not 12).

International significance is denoted by inclusion of naturally resident species which are listed on Appendix II or III of the Bern Convention, Appendix I of the Bonn Convention and/or Annexes II, IV or V of the EC Habitats and Species Directive.

British Isles significance refers to inclusion of species in the British or Irish Red Data Book as *Extinc*t, *Endangered* or *Vulnerable.*

Animals listed on Schedule 5 of the Wildlife Act 1990 are considered nationally important in the Manx context, in particular those which are known to occur at three sites or fewer. In the case of Schedule 5 species which are listed as a group - eg. Vespertilionid bats - the score applies separately to each species present.
Note: Bat roosts will only be considered for designation if this is considered appropriate.

Priority sites for animals are those with a score of 10 or higher.

CRITERIA	**SCORE**
International significance, excluding bats	10
British Isles significance, excluding bats	10
Schedule 5 species, excluding widespread species such as common pipistrelle, common frog and common lizard. Mobile species should spend significant amounts of time at the site*	2
Widespread species on Schedule 5	1

* Significant amounts of time may refer to bat roosts, regular observations of feeding bats, or seal pupping or haul-out areas.

Common frog *Rana temporaria*, a protected species, photographed by a pond in Ballaugh Curragh ASSI

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Abbreviations:
BDIS – Biological Data Information System
BSBI – Botanical Society of the British Isles
BDIS - Biological Data Information System (DAFF internal biological database)
CMS – Centre for Manx Studies
DAFF – Department of Agriculture, Fisheries and Forestry
DEFRA – Department for Environment, Food and Rural Affairs (UK Govt. Department)
DOT – Department of Transport (Manx Government, unless otherwise stated)
HMSO – Her Majesty's Stationery Office (now The Stationery Office)
JNCC – Joint Nature Conservation Committee
MNCT – Manx Nature Conservation Trust – now MWT
MNH – Manx National Heritage (also: Manx Museum, Manx National Trust)
MWT – Manx Wildlife Trust (previously MNCT)
NCC – Nature Conservancy Council (now JNCC)
NVC – National Vegetation Classification (as detailed in Rodwell et al, 1992)
RSPB – Royal Society for the Protection of Birds
UCL – University College, London
UK BAP – UK Biodiversity Action Plan
WWF – World Wildlife Fund

Key websites:
http://www.forestry.gov.uk Forestry Commission – this website includes information on habitats that occur in conjunction with woodland, as well as on Forestry Commission plantations and their management e.g. http://www.forestry.gov.uk/forestry/Lowlandheath

http://www.jncc.gov.uk/Publications/JNCC312/UK_habitat_list.asp - JNCC webpage of habitats listed under Annex 1 of the Habitats Directive, with links to habitat descriptions and selection criteria e.g:
UK Marine Special Areas of Conservation (SACs) Project http://www.ukmarinesac.org.uk/index.htm

www.rspb.org.uk – bird information e.g. www.rspb.org.uk/birds/guide/c/chough/feeding.asp and related habitat information, e.g.
RSPB: Lowland heathland habitat information factsheet
(http://www.rspb.org.uk/Images/Lowland%20Heathland_tcm5-45464.pdf , 2005)

www.Ukbap.org.uk - the website of the UK Biodiversity Action Plan, containing Priority and Broad Habitat descriptions and status accounts, taken from the UK Biodiversity Group Tranche 2 Action Plans - Volume II: Terrestrial and freshwater habitats (December 1998)

January 2008
Compiled and edited: L Moore
Chapter reviews: each chapter has been contributed to and agreed by the Wildlife Committee over the years 2003 – 2007. Dates of Wildlife Committee acceptance of the Criteria are available from DAFF.
Photographs: L Moore, except chough stamp and coin pictures on p99: Isle of Man Post